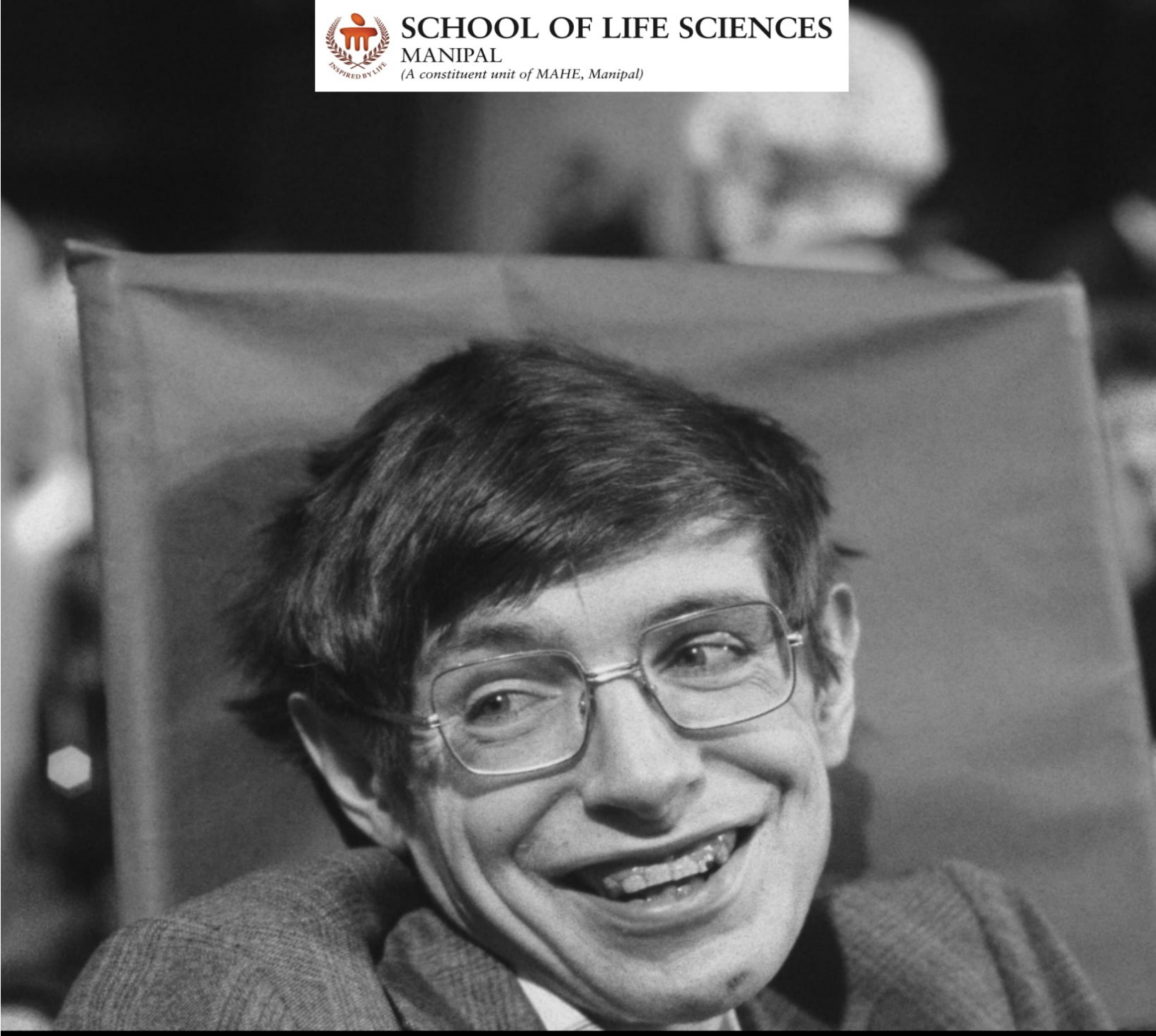
SCHOOL OF LIFE SCIENCES
MANIPAL
(A constituent unit of MAHE, Manipal)



VIVUS

Vol 4, Issue 2

EDITORS' NOTE

Hello!

We are pleased to present to you the second edition of VIVUS Volume 4.

This VIVUS cover is dedicated to Sir Stephen Hawking, in the light of his recent demise. Find inside a **feature article** to learn more about his life and works.

This edition also includes a broad spectrum of articles, from scientific ones on sleep paralysis and perceptions, to poems and auras. Along with our peers, we have had the pleasure to interview very eminent personalities and are excited to present them to you. 'Know Your Labs' in this edition covers two departments— **Department of Ageing Research** and **Department of Bioinformatics**.

A lot has been going on in the college, and the 'Events' section will keep you in pace.

If you wish to listen to the interview podcasts, explore media from the events, or just know what are the students up to, visit our website at www.sites.google.com/site/everythingatsls

Do visit the **EdBoard** on the first floor to keep yourself updated of any student meetings!

We sincerely thank the authors of the articles for their contributions to make this issue a success and request more contributions from everyone for future issues.

We would like to extend our gratitude to **Dr. K. Satyamoorthy** for his encouragement and guidance, **Dr. T. G. Vasudevan, Dr. Saadi Abdul Vahab** and **Dr. Vidhu Sankar Babu** for their supervision and advice and the **Student Council** for their support.

Lastly, we thank you, for having taken out the time to read through this issue and we welcome more participation, feedback and suggestions for the newsletter.

For any queries and suggestions, please contact us at sls.edboard@gmail.com

Thank You!

- **Harsh Ranawat and Tanaaz Khan**

III Year BSc Biotechnology, II Year BSc Biotechnology

Co-Editors

The Editorial Board

School of Life Sciences, MAHE

2017-2018

Cover Credit: www.hawking.org.uk

CONTENTS

SCIENCE

Altruism in animals?

Contemplate on perceptions..

A little DIY Biology,

And *much more*!

PERCEPTION

Rajat Agarwal (II Year, BSc Biotechnology)

Perception is a fairly common term which we come across and yet, it is one of the most interesting concept there is. Think about it: when you say perception it simply means the way you look at something or the way the thing appears to you.

It could be something as simple as a visual illusion or something more complicated like philosophical or political views on something more controversial. Just like one could say every coin has two sides, there could be several ways to look at something. But, how do you determine which one is the right one? Is it the view which is widely spread and accepted or is it the idea which is not very well understood and hence often misunderstood? Or maybe there is third view; like the lateral side of a coin, that has to be the correct one! But wait, why did I just assume there is a right one? Is there a correct perception, the kind which would tell me all of it?

> "Our conscious perception of the world, though relatively stable, is not static. We are incapable of being entirely objective, even in our most mundane observations and impressions. "

We will start with understanding the way we perceive the world around us with our senses.

The first thing which needs to be understood is one's perception is **always limited**. We assume that the external world maps perfectly onto our internal view of it.

There is no way one could perceive all things, as it is often limited to the information the person possesses. There is no way one could or should assume that one knows all there is to know. There is always something more to know, to understand, things which are beyond one's imagination. There is always a necessity of doubt, a little part of one should always think maybe what one assumes is wrong, so that it opens to greater possibilities.

The collective understanding about the world is that it is completely static and that is us, the humans that perceive it in a fixed manner, but is it really the case?

It is now a well-accepted fact that our awareness of the objects around us is informed and fine-tuned by number of transient factors—our **strength and energy levels**, our **sense of confidence**, our **fears and desires**.

There was an experiment conducted by **Proffitt,** a Perception laboratory in Virginia. In the experiment, the participants were asked to stand onto the edge of a hill and estimate the decline of the hill, quantifying it by assigning a number at the same time. Some of the participants were asked to carry heavy weight while doing so, others were made to do additional physical tasks before the estimation.

It was found that people who were tired, frail or scared often estimated the hill to be steeper. Proffitt argues that perception is not fixed: it is flexible, reflecting a person's physiological state. Our conscious perception of slant depends on our current ability to walk up or down hills.

Our perception of the world, though relatively stable, is not static. We are incapable of being fully objective, even in our most mundane observations and impressions.

But one could wonder, if humans are supposed to be the most evolved of creatures coming through millions of years of rigorous evolution then how is that our senses lie to us?

Let us consider an example, that of reindeers, which have ultraviolet vision - an ability that is far moved from us humans. This ability allows them to detect lichens which do not reflect the UV light, and are main source of food for reindeers. Similarly, bloodhounds have a highly developed sense of smell which essentially act as a homing device to locate food.

For humans to envision the image of their perception is impossible, it could be like trying to explain colour to a blind person.

This basically means our senses have evolved throughout to show us exactly what we need to see to survive. It has nothing to do with what is out there. Sound is basically vibrational energy and vision is based on radiation energy. It is our brain that makes sense out of it. And when it does, it tries to ensure a perceptual image with maximum survival. The chances of one slipping by the slope is much greater when one is exhausted or is carrying too much load. Hence, the hill seems a lot steeper which is to make one reconsider or at least be more cautious.

Perceptions also need to factor in **visual illusions**, which everyone of us must have come across a few times at least. Wondered how and why do they appear differently?

Remember *the dress*?! The dress which caused havoc on the internet, had literally thousands of people question their ability to perceive and wonder what is true and what is not?

The first thing to note is the reason so many people found this perplexing was because visual illusions normally appear the same to everyone. Hence, people assume what appears to most of them is the true picture. This dress is a perfect example to show that we may not realize it but things may often appear differently to different people.

There were multiple studies carried out on the mysterious or maybe not so mysterious dress and it was found that the difference in perception was based on the phenomenon of **unconscious inference**. This means the brain as it processes the visual information works upon certain assumptions or rather processes the information in a particular way before it is shown to the conscious brain.

We see the objects around us because light bounces off them and back onto our retinas. The brain has learnt to register what colour the actual light source is and then subtract that colour from the actual colour of the object [chromatic bias of the daylight axis].

To explain it more simply, imagine a yellow light on a white object - the brain understands that the yellow light is influencing the colour of the surface it lands on and will try and ignore it.

In the case of the blue/gold dress, the brain is trying to subtract the colour bias caused by the light source. But there is no quantification of how much reduction is to take place. So, while trying to reduce the source colour contrast, some people's brains are trying to get rid of the bluish tones - so they will see white and gold - while some are trying to get rid of the yellowy gold tones, which means they will see blue and black.

The fact is there are numerous visual illusions pointing at this exact phenomenon but what made this illusion interesting is the fact that this image seems to land squarely on a perceptual boundary. The amount of compensation even though minutely different, is different for different people and even that teeny tiny difference seems to create perceptual difference here and that is all there is to it.

To put into perspective, this image (shown on page 6) is a perfect example of difference in everyday perception however minute it may be.

Well, what do YOU see?!

All said and done, the gist is we cannot sense all there is to sense, and even if we could the information is highly ambiguous as it is in a constant flux. Even if we ignore that, the information we take in does not have any sense by itself. It is like looking at code for a software without knowing anything else about the software, it would be just letters and numbers; what defines the code is how it is executed. It is all about the context and the way we perceive it, the way we need to perceive it; what is essential for survival.

That was just about information we take in, how we work our way through it is again another story.

To put it simply, our inability to see things the way they are gives us the ability to adapt to see things the way we need them to. Engagement to the unfamiliar is the key to neural kindling which allows the brain to adapt. This forms the basis of **plasticity** of the brain, which is a story for another day.

REFERENCES:

- Deviate: The Science of Seeing Differently, by Beau Lotto, Hachette Books
- Draaisma, D. (2017). Perception: Our useful inability to see reality. *Nature*, 544(7650), pp.296-296.
- https://www.mirror.co.uk/news/technology-science/science/white-gold-dress-heres-science-5241292 (18-02-2018)

ALTRUISM IN ANIMAL BEHAVIOUR

Shahina Mazumdar (II Year, BSc Biotechnology)

Behaviour is said to be:

"the way in which an animal or person behaves in response to a particular situation or stimulus."

It is the range of actions and mannerisms made by individuals, organisms, systems, or artificial entities in conjunction with themselves or their environment.

Though humans are animals, animal behaviour usually refers to non-human organisms. It is said that unlike humans, animals do not have a concept of acute self-awareness. Thus, all their actions, instincts and behaviours are primal and have been coded into their very nature through millions of years of evolution. Understanding how animals act is fundamental to the understanding of evolution and ecology. Evolution impacts speciation, and different species undergo ecological interactions which again play a part in evolution.

We shall investigate an aspect of animal behaviour called altruism. Altruism refers to the behavioural pattern where an organism helps another organism to survive/reproduce at the **apparent cost of its own fitness**. Altruism may be interspecies interspecific, but most altruism is intraspecific, which can be explained based on **group selection**. Human altruism often has a moral basis. Why, then, would animals exhibit altruistic behaviour? How does it help the individual? If it does not, does it really mean that the individual is irrelevant, and the only unique entity in an ecosystem is the species?

"When it comes to choosing which organisms to help, an individual may pick others over their offspring."

HAMILTON'S RULE

Hamilton's rule basically states that organisms will help other organisms based on how high the genetic relatedness between two organisms is. Hence, when it comes to choosing which organisms to help, an individual **may pick others over their offspring**. The organism need not have its own children to pass on its genes.

If $r_bB>r_cC$,

(r_b = relatedness to some organism, B = number of those organisms, r_c = relatedness to own offspring, C = number of own children)

Hamilton's rule directly implies that the 'Selfish gene' (Richard Dawkins, 1976) concept holds true. It does not matter how many children you have, if you can take care of other people's children and still have more copies of your genes passed on. Higher fitness is attained by passing on gene copies, rather than directly having offspring. Here, the concept of reproductive fitness changes completely.

TYPES OF ALTRUISM:

RECIPROCAL ALTRUISM

Reciprocal altruism requires mutual help with a time lag. It must evolve because of consequent repeated interactions. In reciprocal altruism, if one organism helps the other over a period, it has to be helped by the other organism in its own time of need. If the help is mutual, the relationship is continued, else the relationship is discontinued.

E.g.: Vampire bats give and repay debts of blood.

Illustrations by Author

Vampire bats cannot survive without blood for more than 70 hours. Hence, bats that do not get the opportunity to feed are helped by their friends who regurgitate blood and feed them. If a **cheater** bat feeds on its friends and does not repay the debt, it suffers social exclusion. However, since the feeding mostly happens between close relatives, this behaviour seems to be an example of **kin selection**, as explained by Hamilton's rule.

FACULTATIVE ALTRUISM

Facultative altruism does not seem to have any apparent benefit to the organism itself, except sometimes forwarding the concept of **kin selection**.

It is believed that about 10 percent of bird species show "cooperative breeding" behavior, in which one or more mated pairs produce chicks that are then fed not only by the parents but by other birds sharing the territory. The incentives might be:

a. Helping relatives

b. Learning how to rear young

E.g.: In an Australian bird species called the superb fairy-wren, some breeding pairs have helpers and some do not. The baby birds of pairs with helpers get 20 percent more food than young fairy-wrens fed only by their parents, but curiously that gives the babies no long-term survival advantage. The one who benefits is the **mother**.

Egg laying is a difficult process for the mother bird who suffers physiologically each time she lays eggs. Each brood reduces the health of the mother bird, reducing her lifespan.

Helper birds allow her to rest and feed, thus increasing chances of survival.

Illustrations by Author

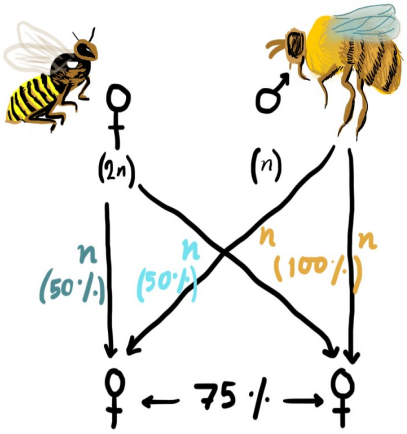
OBLIGATE ALTRUISM

Obligate altruism is observed within hymenopterans (ants, bees, termites). This kind of altruism is the biggest confirmation of Hamilton's rule.

Hymenopterans have a haplo-diploid system of sex determination. Males are haploid, and females are diploid. Hence when females mate with males, there is a 50% chance of the offspring receiving half of the mother's genes, and a 50% chance of the offspring receiving all the father's genes. Sisters have more than usual (75%) relatedness amongst each other. Due to their genetic similarity between sisters, more copies of genes are passed on by the process of rearing each other. Brothers are not preferred since they have only 50% similarity with the sisters. Therefore, most of the colony workers are female ants.

Relatedness between sister bees is 75%, which is higher than 50% relatedness between mother bee and her children. Sister bees help raise other sisters, which allows more copies of their own genes to be transferred on.

Hence, worker bees and ants help in the rearing of their sisters rather than having children of their own.



Illustrations by Author

REFERENCES:

- Okasha, Samir, "Biological Altruism", *The Stanford Encyclopedia of Philosophy* (Fall 2013 Edition), Edward N. Zalta (ed.) [https://plato.stanford.edu/archives/fall2013/entries/altruism-biological/]
- David Brown, “Birds' Cooperative Breeding Sheds Light on Altruism”, *Washington Post* (August 17, 2007)
- The Selfish Gene, by Richard Dawkins, Oxford University Press

SLEEP PARALYSIS

Raashi Chauhan (II Year, BSc Biotechnology)

https://en.wikipedia.org/wiki/Sleep_paralysis

Imagine waking up suddenly at night and feeling someone's hand on your throat, choking you slowly and painfully. You try to get up but the pressure on your chest does not allow you to do so. You notice demonic faces and shadows in your room, you hear someone climbing down the stairs and you can feel the knot in your stomach get tighter by the second. The terror begins to subside as suddenly as it started and everything fades into absolute void. *This is sleep paralysis, a waking nightmare*.

> "People hallucinate during sleep paralysis, it is like dreaming with your eyes open. "

Sleep paralysis is a period of transient and consciously experienced paralysis either when going to sleep or waking up. A person suffering from sleep paralysis is said to experience hallucinations. While sleeping we pass through two main stages. Non-Rapid Eye Movement stage [NREM] and Rapid Eye Movement stage [REM]. These stages progress in a cyclic manner starting from NREM, when a person is in a "light sleep" to REM. The REM phase is also called the phase of "paradoxical sleep". The EEG readings of a person in REM is like that of a person who is awake. At this stage the brain waves mimic activities that occur while a person is awake, the eyes remain closed but move rapidly from side-to-side due to the intense dream and brain activity.

Paralysis can occur at two different times. If it occurs whilst a person is falling asleep it is called the *hypnagogic or predormital form.* This is mostly associated with the sleep disorder Narcolepsy. During this time the body relaxes and begins to enter the stages of sleep. The mind remains conscious, aware that sleep is occurring, but it is unable to react through movement or speech. If the paralysis occurs as one is waking up from sleep it is known as *hypnopomic or postdormital form* of sleep paralysis. This is the most usual form of sleep paralysis without any other sleep disorders linked to it.

Normally, when we dream, we are paralyzed. This is essential, because otherwise we would regularly act out our dreams. In sleep paralysis, however, the normal cycles of our sleep become out of sync i.e. our mind wakes up, but our body is still in a dream state. Since vivid dreams occur in this phase the limbs are temporarily paralyzed, breathing is irregular and the heart rate increases. This explains why people hallucinate during sleep paralysis, it is like dreaming with our eyes open. Two brain chemicals that play a role in muscle paralysis are *glycine* and *gamma aminobutyric acid* (*GABA*). To prevent paralysis in REM, researchers had to "switch off" the receptors to both the chemicals. Acting out our dreams while sleeping can be an early symptom of Parkinson's disease, since the person suffering from this disorder has a deficit in the GABA and glycine receptors.

SLEEP PARALYSIS AROUND THE GLOBE

https://www.updevelopment.org/sleep-paralysis/

Sleep paralysis has been reported in many countries around the world. Distinct cultures have interpreted it in unusual ways. In **Newfoundland** (Canada), sleep paralysis is called the *"Old Hag".* They describe it as being paralyzed right after falling asleep and feeling a weight on the chest. This is accompanied by witnessing a grotesque human or animal

http://www.world-of-lucid-dreaming.com/sleep-paralysis.html

astride the chest.

In Hong Kong**,** a condition that seems identical to sleep paralysis is termed *"ghost oppression".* **Chinese** people have often thought that *"the soul of a person is vulnerable to the influence of spirits during sleep".*

Amongst the Inuit of Canada, sleep paralysis is interpreted as attacks *from "shaman or malevolent spirits".*

In Japan**,** sleep paralysis is called *Kanashibari* and is related to the magic of one of the Buddhist gods, *Fudoh-Myohoh*.

www.japanese-buddhism.com

Throughout Europe, from the 1500s until the 1700s, sleep paralysis experiences were often considered to be the work of witches who were accused of using their witchcraft to terrorize sleepers who had offended them in some way. Such episodes were sometimes termed as being *"witch-ridden*".

Sleep paralysis is a fascinating phenomenon and even though we are studying about it, there is a greater need for its awareness to minimize the effect of post-traumatic stress and anxiety caused due to it.

TREATMENT FOR SLEEP PARALYSIS

The treatment of sleep paralysis depends on its cause. Many times, it is caused due to irregular sleep patterns. This can be fixed by setting a constant body clock. That is sleeping on the same time every night and waking up on the same time every morning.

For people diagnosed with narcolepsy, sodium oxybate is prescribed. It does not have any direct effect on paralysis. It is a treatment for narcolepsy and by doing so, it minimizes the episodes of sleep paralysis.

Psychotherapy is advisable for people who suffer from sleep paralysis because of stress. It is said that therapy can help them to snap out of the zone much faster. Moving a small muscle such as eyes, fingers or toes can help them to "break free" from the episode. Sometimes getting attention of their bed-partner, for example by making a noise in the throat, so that s/he can touch them can also break the paralysis. However, some find it impossible to make any sounds.

Sleep paralysis can be a frightening experience and it is surprisingly very common. Yet many people are averse to this concept. There is no fixed treatment for this disorder and researchers are trying to understand the neurophysiological and neuropsychological effects associated and the complex pathways linked to it.

REFERENCES:

- https://www.sciencedaily.com/releases/2016/09/160919151320.htm (07-03-2018)
- https://www.psychologytoday.com/blog/am-i-normal/201112/sleep-paralysis-and-the-supernatural (07-03-2018)
- https://thepsychologist.bps.org.uk/volume-22/edition-8/terror-night (07-03-2018)

DO-IT-YOURSELF BIOLOGY

Malavika Sheena Rajeev (I Year, BSc Biotechnology)

https://gizmodo.com/a-guy-just-injected-himself-with-a-diy-herpes-treatment-1822705966

We all know about the Food and Drug Administration (FDA), USA. From medications to animal feed, we take comfort in knowing that a product is FDA certified. Rules and regulations have been placed so that the development and testing of new drugs follows a specific timeline of events before its release for public consumption. But did you know that there is an entire community that does not follow, or rather does not believe in this etiquette?

> "He publicly plunged a small syringe into his left thigh to demonstrate a therapy for Herpes"

Do-it-yourself biology (DIY biology, DIY bio) is a growing biotechnological social movement. It is primarily undertaken by individuals with extensive research training from academia or corporations, who then mentor other DIY biologists with little or no formal training. It is usually done as a hobby or as a not-for-profit endeavour for community learning and open-science innovation, or for profit, to start a business.

Such a business is **"Ascendance Biomedical"**. This company can be described as "a strange biotech firm funding with a very unorthodox approach to biomedical research." The term unorthodox here refers to how drugs developed by this company are not made at "fancy" academic labs and more importantly, are not put through the FDA's rigorous clinical trial application process. This was showcased onstage at a conference when **Aaron Traywick**, CEO of Ascendance Biomedical, publicly plunged a small syringe into his left thigh. The syringe was filled with an experimental **Herpes therapy** developed by Austrian biohacker, **Andreas Stuermer**. The treatment method had only previously been tested in mice, and Traywick was the first human to ever try it.

Stuermer came up with the vaccine after combing through academic literature for clues as to how to develop such a vaccine for Herpes that would prevent people from ever getting infected in the first place. He based his development on the theory that for herpes virus to enter the human body, they rely on a surface protein called **Glycoprotein D**. The paper he referred to suggested that if you delete the protein from the virus, it cannot spread.

To create the virus, Stuermer and other biohackers working with Ascendance, got their hands on Herpes Simplex Virus and modified the virus' code to delete the glycoprotein D gene. They then inserted that code into a DNA construct known as a **Bacterial Artificial Chromosome** that would make the modified viral DNA replicate. They designed it all on a computer and then placed an order over the internet

from a company that typically supplies such things to professional labs. From there, the plasmid was purified and sent out to an external lab to make sure that it did not contain any miscellaneous junk. Then, the viral plasmid got mixed with a transfection agent intended to allow it to enter the body's cells. If successful, this modified virus should theoretically float around in the body until the immune system kills it off, generating antibodies to Herpes.

Biological breakthroughs and conference deadlines however are not something that comes hand in hand. Stuermer's vaccine was several days behind in development. Luckily (or unluckily) Traywick, who had contracted Herpes five years ago, volunteered himself as lab rat. And thus, the spectacle of Traywick with his pants down before a crowd and injecting himself with the vaccine was drawn.

"If we succeed with herpes in even the most minor ways, we can proceed with cancer," Traywick told the crowd. Thus, with no approval, no prior testing or endless FDA procedures this vaccine was tested on a human being.

Biohackers have a knack for making the sort of science that academic researchers spend entire careers working on in a lab sound like something that can be accomplished with just a few all-nighters. But there are issues. A grand debate ensues on whether FDA procedures and protocols provide a seatbelt to the tedious and tiresome journey of drug development or whether they are a constant red light to scientific development and research.

In countries like the United States of America, practising DIY Biology is legal for the most part, as long as they abide by the Code of Ethics put down by the DIYBio Congress but these laws are not legally binding. The authorities are yet to make hard binding regulations for this scientific sector. Until then, agencies like the FDA and the like, will just monitor the release and distribution of these products to avoid any form of damage in the community.

From one perspective the numerous tests and trials are what make drugs open and viable to the public, because seeing the FDA's approval on a product does silence any doubts in our minds. But on the other hand, do the numerous long and expensive tests and trials put a brake on scientific development and breakthroughs. Biohackers sure seem to think so. What would be your take?

REFERENCES:

- https://gizmodo.com/a-guy-just-injected-himself-with-a-diy-herpes-treatment-1822705966 (06-03-2018)
- https://en.wikipedia.org/wiki/Do-it-yourself_biology (06-03-2018)
- https://www.livescience.com/61666-self-injected-diy-herpes-vaccine-bad-idea.html (06-03-2018)
- http://www.slate.com/articles/technology/future_tense/2017/05/the_fuzzy_regulations_surrounding_diy_synthetic_biology.html (15-04-2018)

THE MOST (UN)CERTAIN PRINCIPLE?

Harsh Ranawat (III Year, BSc Biotechnology)

You would have probably heard about the dual nature of light - of how it exists as both a **particle** and a **wave**, depending on the kind of experiment it is subjected to. When it is the photoelectric effect, where light can knock off electrons from shells of molecules, light behaves as a particle. But when it comes to Young's double slit experiment, light produces band patterns as if it were waves!

This wave-particle duality is applied to all scales of objects - from electrons to elephants. *It is an inherent property of the universe.* It fits in our current standard model of the universe.

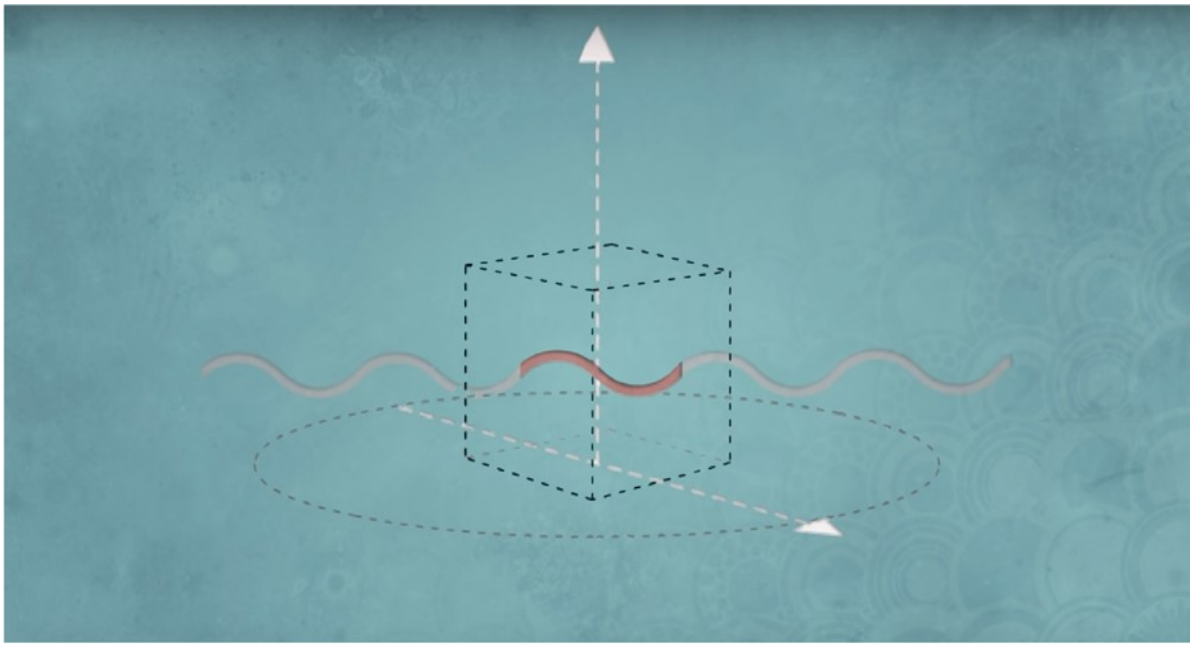
Let us define what it is to be a particle or a wave, in the first place.

A particle, by definition, exists exactly at one place at any time. A graph of probability would then show one single spot - 100% probability there, and 0 everywhere else.

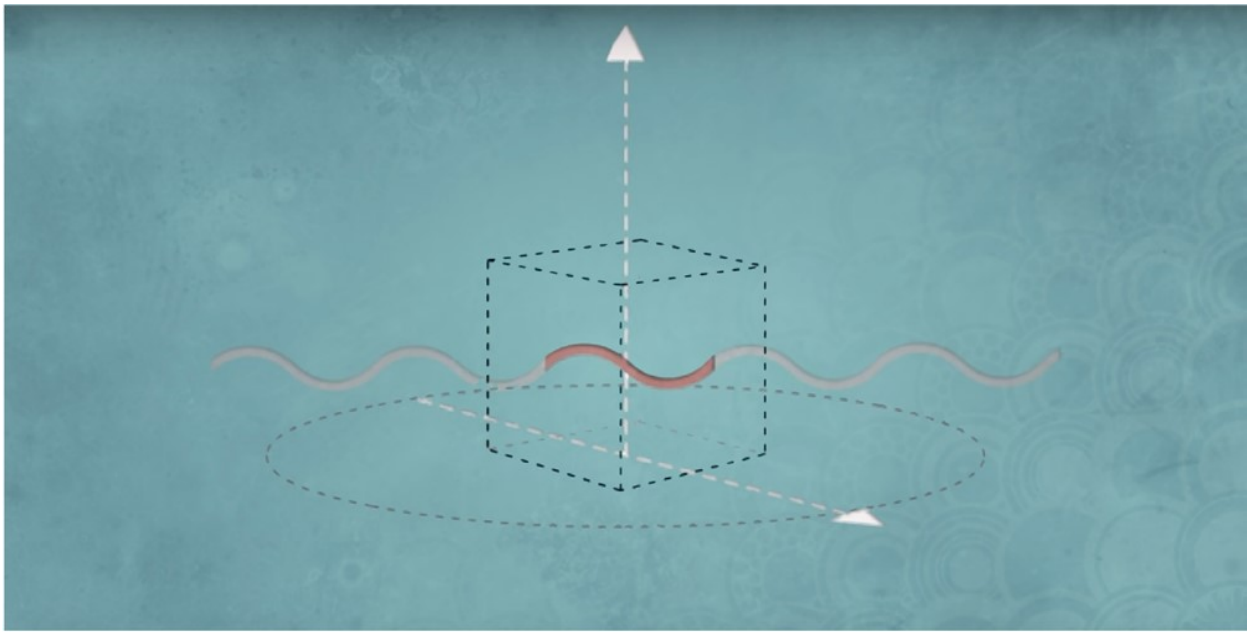
Waves, on the other hand, are disturbances in space, like that on the surface of water. We can identify the features, such as wavelength and frequency, but cannot tell exactly where it is.

Wavelength is key in quantum physics - because it tells us about the momentum – mass*velocity. A fast-moving object (say a bullet) has a high velocity, corresponding to a short wavelength and so does a heavy object even at low speed, because of its large mass. To give an example, if a tennis ball is tossed in the air, its wavelength is 10^{-31} m far too small to even detect. For small light objects like atoms and electrons, these wavelengths are larger and can be detected.

So now we have a pure wave whose momentum, and hence the wavelength, can be measured, but we cannot pin-point its position; and a particle whose precise location is known, but it does not have a wavelength.



https://ed.ted.com/lessons/what-is-the-heisenberg-uncertainty-principle-chad-orzel



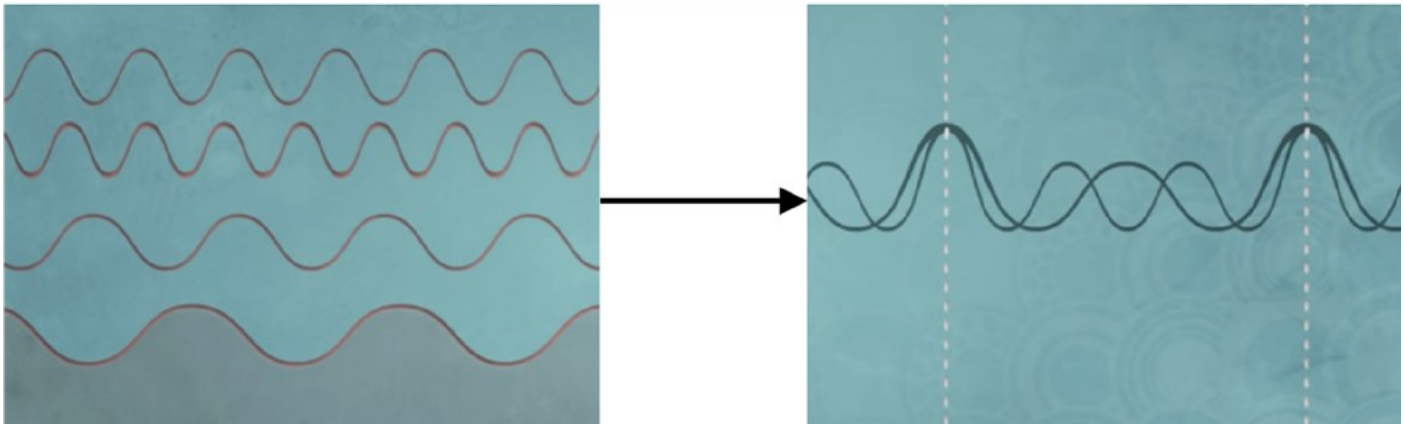
https://ed.ted.com/lessons/what-is-the-heisenberg-uncertainty-principle-chad-orzel

If we must describe the duality of light and electrons and elephants then, we need to mix these

two concepts - make a graph that has waves, but only in a small area.

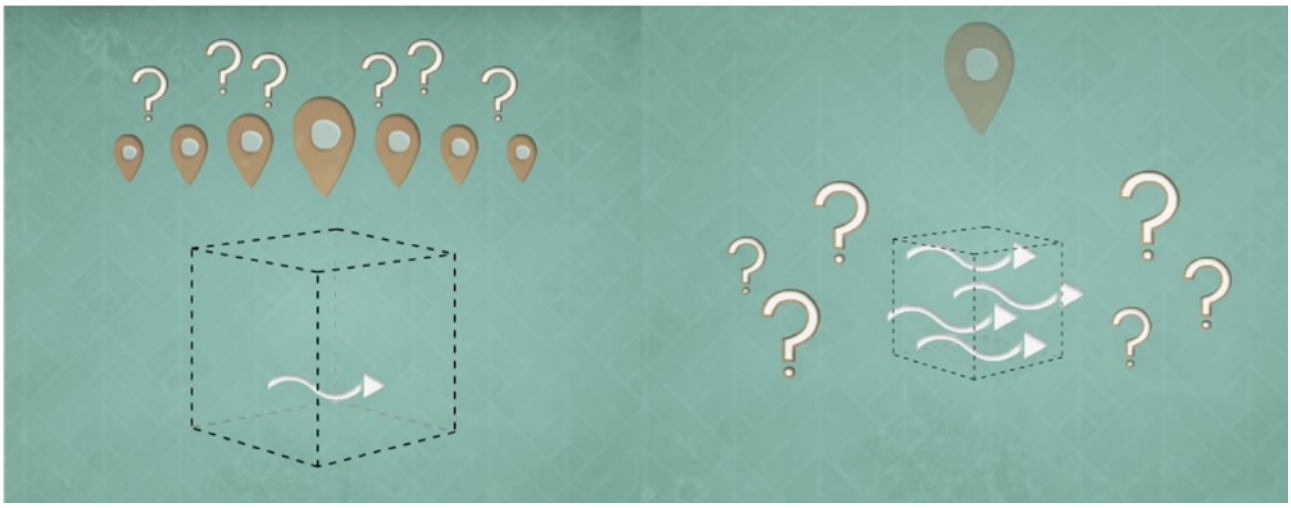
How do we do this?

We combine waves, of different wavelengths - which means we give our quantum object a possibility of having different momenta. Some peaks of waves will add up, and some will cancel out, till eventually we can have a single peak in the probability wave - to exactly know its position.



https://ed.ted.com/lessons/what-is-the-heisenberg-uncertainty-principle-chad-orzel

But there is a catch - to get a thin sharp peak of probability, we need to add more waves - which means greater possibility of the object to have different momenta. If we want to restrict the momenta of the object, we will give it less waves, which will spread out its position wave.



https://ed.ted.com/lessons/what-is-the-heisenberg-uncertainty-principle-chad-orzel

This tradeoff, was identified and calculated by a German physicist, **Werner Heisenberg**, as the **Uncertainty principle**. It states that there is always an uncertainty of how well we can determine the position and momentum of an object.

Mathematically, its expressed as,

$\Delta x \times \Delta p \geq h/2\pi$

Where,

Δ x - uncertainty in position **Δ p** - uncertainty in momentum **h** - Planck's constant

This uncertainty is not a fault of measuring well or badly, but an inevitable consequence of combining the particle and wave nature of objects.

In our quest to understand the universe, we make up stories and models, and then put the models to the test. Some theories are ruled out and are replaced by better ones (*ahem!* gravitation! *ahem!*) and these are what make up the standard model of the universe - the most accepted one.

The wave particle duality makes the core of this standard model of the universe, and the Heisenberg's uncertainty principle, is the most certain principle in it.

Oh, and if I may, things get more fascinating when there is no any observer. For then, the quantum object is in a super-position of all its states. It has all the possible momenta and is at all the positions at once. When we measure any property, however, this super position collapses and the quantum uncertainty of the particle is lost. How this works, is content for another article.

REFERENCES:

- https://ed.ted.com/lessons/what-is-the-heisenberg-uncertainty-principle-chad-orzel
- Tomas Bzdusek (2014) "Making of a bond", www.tomasbzdusek.wordpress.com
- Don Lincoln (2018) "Why measuring a tiny, spinning article is such a big deal", www.livescience.com (tech)

STEPHEN HAWKING

Apoorva Jnana (Research Scholar)

https://www.forbes.com/sites/startswithabang/2018/03/14/the-4-scientific-lessons-stephen-hawking-never-learned/

Did you get a chance to look up at the sky in the early hours of Wednesday (14th March, 2018). "Remember to look up at the stars and not down at your feet", he said. You probably missed it, but the sky did shine a little brighter, having obtained one of the greatest admirer/detective of its mystery, the most remarkable cosmologist of our time.

> "He introduced me to these strange concepts of singularity, the fabric of space time, string theory, Hawking radiation and black holes"

Professor Stephen Hawking was a brilliant scientist with the most revolutionary ideas. Diagnosed at the age of 21 with Amyotrophic Lateral Sclerosis; a progressive motor neuron disease that involves the nerve cells responsible for controlling voluntary muscle movement, he lived for an impressive 55 more years. Seated in his wheelchair, his mind provided us with the biggest leaps in unravelling the mysteries of the universe and expanding our knowledge on gravity, the beginning and end of space and time. From big bang to black holes, he had a theory for everything. Some of his brilliant theories documented in his books "A Brief History Of Time" and "The Grand Design" include a unification of general relativity with quantum mechanics, the possibility of multiverses, the cosmological phenomena of black holes (they are not as black as we imagine) and several others.

To me, Stephen Hawking was not just a physicist. He was a scientist who spoke of topics beyond ordinary. I had studied about magnetic poles, anatomy of a flower, trigonometry but he introduced me to these strange concepts of singularity, the fabric of space time, string theory, Hawking radiation and black holes. Albeit these were 'out of syllabus' concepts that caused great distress for my parents when I would go on and on about how like playing a note in a violin, the strings of the universe vibrate to produce particles that shape the universe. Quantum theory that makes it possible for there to be multiverse was quite a pain too. You can imagine how they provided validly put yet unsupported by observation arguments to get out of trouble?

Hawking's wildest and most revolutionary theory that raised so many questions, most of which are still unanswered, revolve around the black hole information paradox. Can information really be lost forever? Among the chaos of everything around us, there is always an underlying singularity that demands discipline. Black holes are highly condensed masses that was considered as well, a black hole, sort of that "Arrange later" folder on your desktop that just keeps accumulating files over and over. Imagine once you put stuff in that folder, you can never really get it back from it (You can but let us face it, you never actually go back to it. If it was important, it would have its own folder). You cannot access it

but there is that comfort of it being somewhere on your desktop with the date, size and other relevant information. It is gone but it is there (or is this just me?). What if I told you, as time passes on, every file in there is slowly disintegrating, one byte at a time. Until, one fine day the folder is 0 bytes! Oh! This is what Hawking discovered and called "Hawking radiation". He proposed that black holes do not just accumulate stuff, they emit their information and eventually shrink, evaporate and disappear. This defies Quantum mechanics, which states that you must be able to account for the entire history of any particle. All that chaos must be accountable. If all information of the particles/files that went into the black hole/ folder were emitted out as thermal radiation with no information of the contents, then there is no way to know what went in. This is the black hole information paradox. Of course, this is a theory with exceptionally well supported math but unsupported by observation, for obvious reasons. However, I imagine the quest to answer this will unveil several more mysteries of the universe.

That is the true legacy of Stephen Hawking; his ability to inspire and make us question existence. He will forever live on as the visionary scientist with a zesty personality, unperturbed by his disability whose mind travelled multiverses decoding the beyond. "There should be no boundary to human endeavor … We are all different. There is no such thing as a standard or run of the mill human being – but we share the same human spirit. What is important is that we can create. However difficult life may seem, there is always something you can do, and succeed at" – Stephen Hawking at the Paralympic Games, London, 2012

Stay Inspired!

INTERVIEWS

Of those who know better.

Dr. ARNAB RAY CHAUDHARI

Niharika Jhawar, Vallabha Mohta (III Year, BSc Biotechnology)

Dr. Arnab Ray Chaudhuri visited the School of Life Sciences (SLS), MAHE, Manipal and gave guest lectures on February 9 and 10, 2018. He is the Principal Investigator and Group leader of the Erasmus Medical Centre, The Netherlands. He received his MSc in Medical Biochemistry from Manipal University in 2005. He carried out his PhD research in Molecular Biology at the Institute of Molecular Cancer Research (IMCR), Zurich. He moved on to his Postdoctoral studies on the modulation of DNA replication pathways which affect chemo resistance at the National Cancer Institute, NIH, Bethesda. Presently, he is focused on the structural and molecular understanding of DNA replication stress in tumorigenesis and chemo resistance. At SLS, as part of a lecture series, he delivered talks on 'Replication Stability' and 'The Remodelling of Replication Forks'. Here, we have excerpts from an interview conducted by the Student Council.

Student Council (SC): Sir, what are your major interests in research?

Arnab Ray Chaudhuri (ARC): Basically, I'm a research scientist working on **DNA replication** connected to DNA damage and its implications in **chemotherapy, tumorigenesis and chemo-resistance**. We use mouse models to develop tumours and we look in to the mechanisms of DNA replication stress and its implications in tumorigenesis and chemo-resistance. We use a variety of technologies in which we investigate structural, biological and proteomics technologies trying to bring them together to make sense of the whole DNA replication process and its role in cancer.

SC: As a student, how were you particularly interested in this field?

ARC: Well, I mean, we had courses in DNA repair where we never quite understood the implication of it out of the books, to be honest, until we started working on it. It was by chance that I managed to enter BARC after my Masters trying to do a post Masters project where I was introduced into the DNA repair field. I decided to do a PhD where I ended up in a starting lab. My previous mentor's first PhD student and first hire, he worked on DNA replication and that is where I could start connecting DNA repair with replication and so on and so forth. Since then I have always worked with DNA replication and repair throughout my life.

SC: So, you always knew you wanted to go in to the research aspect and not the industrial sector?

ARC: I couldn't do anything else. The only thing I think I can do is research. That is what I keep telling people that you should do what you like doing; as long as you like doing whatever you are doing, you will always be good at it.

SC: According to you, what is the difference between studying here in India and abroad with respect to Masters and PhD?

ARC: People who have done their Masters in India are theoretically very solid and now of course with the technology coming up, students are getting exposed to the technical aspects as well. But, back in my days, and even now when I still get Masters (degree) students from India, I always have a feeling that they are theoretically very solid but lacking in technological growth. On the other hand, Masters students from abroad are not very theoretically strong but they have got excellent technical exposure and you must decide whether you want one or the other. Technique is somebody that anybody can catch up to provided they put all the effort to learn that technology but on the other hand I feel that Indian students come with a very clean head and brilliant analytical minds. PhD is a process, so you usually catch up one way or the other. This is the significant difference.

SC: What do you plan on doing in the future in terms of your

projects?

ARC: I have multiple projects right now. We are working on finding factors that affect **DNA replication forks**. We are doing high throughput screens to try and figure out **chromatin modification** at stall replication forks and how they affect tumorigenesis. Finally, what we are trying to do is to go for screens to find out factors, which can now re-sensitize chemo-resistance because that is a problem in clinics. One of the ways you get chemo-resistance is by stabilizing replication forks. We want to destabilize the forks by targeting specific factors and destabilize them again and see how that works. Again, we have multiple screens and processes in the lab. We are studying RNA processing factors at replication forks and what their role in tumorigenesis might be.

SC: Sir, what is your advice to budding researchers?

ARC: You need to be focused and you need to work hard. Biological research involves a lot of effort. You need to wait and be patient. Patience is the key. You need to like what you are doing. I keep stressing on that continuously because unless you like what you do, you are never going to succeed at it. If you want to go into academia or industry, put your heart and soul into it. No matter what you do. If you are liking what you are doing, you are good. The moment where you stop liking it, that is where the problem starts. I work 16 hours a day in the lab because I must, and I like doing it. The fun of good data can be life changing. To get that good data you need to put in effort. The effort can come in some way or the other and it will work.

SC: Having so much workload, how do you manage to keep yourself relaxed always?

ARC: I switch off very easily. I try to work 8 hours a day. You can work 8 hours a day and be productive and be organized. For me, **organization** is very important. That's what I keep telling my people. They should stay for not more than 8 hours a day, but they should get the work done. I really don't care if somebody works two hours a day and brings me data and shows me beautiful data rather than somebody who works 24 hours a day and shows me nothing. I'm going to judge people on their productivity. That comes from proper organization and nothing else. You don't need to kill yourself with work just because you are called a scientist. That's not the case. Once I walk out of the lab, it's my life. I don't think about the lab too much.

SC: When it comes to research, don't we have to be a little creative?

ARC: That doesn't necessarily have to be the case. Not everybody is Einstein. This comes in with proper training. Ideas come in with continuous reading. You need to keep yourself updated with literature. You read, you think about it and then of course you publish your paper, it's not fool-proof. There are loopholes in the paper and they get exploited and then you come up with new research questions and that is how research keeps going forward. Out of the box ideas come from the fact that you are constantly getting innovative ideas from what you know about what's going on around you. If you don't know what is going on around you, there is no box to think out of. You must create a box of knowledge to know how to think out of that box. That is the knowledge I can give you.

Dr. NITIKA TANEJA

Russell Lorenzo Castellino, Tanaaz M Khan (II Year, BSc Biotechnology)

Dr. Nitika Taneja visited the School of Life Sciences (SLS), MAHE, Manipal on February 10, 2018 to give a guest lecture. She is the Principal Investigator and Group Leader at the Erasmus Medical Centre, The Netherlands. She received her MSc in Biotechnology from the Jawaharlal Nehru University, New Delhi in 2008. She obtained her PhD in Molecular Life Sciences, University of Zurich where she studied the epigenetic markers relating to centromeres (male meiosis) in Drosophila melanogaster. She moved on to work at the National Institute of Health, USA where she continued her post doctoral training at the National Cancer Institute (2013-2017). She was studying the chromatin remodelling factors affecting DNA replication. Currently, she is working at the Erasmus Medical Centre, The Netherlands where her research focuses on the role of Chromatin remodelling and re-organisation on suppressing DNA replication stress and also on the role of chromatin remodelers in counteracting chemoresistance.

Student Council: Hello Madam, could you please tell us a bit about yourself?

Nitika Taneja: I am Nitika Taneja and I am the Principal Investigator at the Erasmus Medical Center, The Netherlands. We have started our group very recently. It is only six months old. So, we are looking at **Chromatin remodeling** and **replication** in human cells (Tumor and non-tumor cells).

SC: So where do you see your current field of research leading into?

NT: If you can see, the current chemotherapeutic methods for cancer that are being used such as platinum therapy to treat cells. The cells do get treated and the cancer does get eliminated but many patients keep coming back with the problem that they relapse, and it is more aggressive and more resistant to the chemotherapeutic drugs. For that, you need new targets. In those drugs, they target the replication mechanisms. These cells get secondary mutations in those pathways and then they become resistant. So, you basically need new targets that do not make them resistant.

SC: What led you to this field of research *per se*? How did you decide to study this specifically?

NT: I have been working in the **Epigenetics field** for almost ten years. The epigenetics factors affect the genome study as well as there is a lot going on there and they can be very helpful in terms of treatment. And when I went to the National Cancer Institute for my postdoctoral study, I found that this is actually a very good factor because they are the ones that are majorly mutated in many cancer cells. Meaning, cancer cells need them to be mutated to become resistant to drugs. So, we need drugs that target the epigenetic factors.

SC: Would you have any advice for students in general that you thought you would've needed at our stage?

NT: I would say that personally that I felt that you need **exposure**. When you talk to other people, it is important. I did my Bachelor's (degree) from Delhi University. That was great. I don't think I got any more exposure there in talking to any more professors or outside faculty to know what to do next. Then I went to JNU for my masters. There, I got a lot of exposure where a lot of faculty from abroad were coming down there. We used to talk to them and I found out that we could apply outside and we could do research that was fundamentally important and apply this fundamental research clinically. So that is what made me very keen to go into this field.

SC: Have there been any defining moments in your career so far?

NT: There are! I think my turning point was when I went into the **National Cancer Institute**. That's when I realized the experiments sometimes work and sometimes don't work. It can be really degrading for your morale. Always keep thinking about the solutions. Always keep your motivation and determination high. Think that you have always wanted to do this.

SC: What has been your favorite aspect of your work so far?

NT: For my research, one thing that I am happy about is that my research might come into real use. Secondly, I really like that I am helping some students and giving direction to them. At least if that helps them to prepare their career, then good. Many times, it has happened to me that I did not know where to go. If somebody gives you that direction, then just be determined and do that work. That is what I like about talking with students and about my research.

SC: Have there been any hurdles that you have had to overcome during your career?

NT: There were hurdles, of course. I have been lucky, and I have also been mentored by big scientists. I have seen many of my colleagues worry about funding. But somehow, I got good mentors who told me how to write grants and told how to focus on the problem. After completing my postdoc, I wanted to become a faculty, but you need to apply for these grants. But I have learnt from these people and I have overcome that part that was somewhat of a hurdle.

SC: During you research, have you ever come across results that have ever been surprised? Like completely unpredictable results?

NT: Yes! I think science is all about getting surprised. Because you never expect it when you have started some screens and got this factor and you have never thought it would be also required with respect to my research that it would not only be affecting the **heterochromatin** also so much **genotoxicity**. You never know so much about the epigenetic markers that play a role in euchromatin! That's what is helping in maintaining the cells to be healthier. These factors fight against drugs and I think that was very surprising to me.

SC: Would you say that as far as research is concerned, students who wish to pursue research or go to industry, what would you say to them? Also, how to decide between the two factors is one question that we come across a lot?

NT: That question is something I faced as well right after my masters. So, one thing you can ask yourself is, I used to love brain teasers and I used to love solving those things. I knew what industry was like and I am not saying that in industry there is no good research going on. There is good research going on. But if you go right after your Master's, you will get stuck there and you will just be involved in doing the same technique, the same monotonous work everyday in and out of your life. That is not bad. Some people like a simple life, you do your 9 to 5 work and you come back home but I think I liked solving problems. I always had something going on in my head and I always liked to look out for a solution and until it is not there I am always thinking. That gives me so much happiness. Maybe it is nothing for somebody but that makes me happy that I have found a solution. I receive satisfaction at the end of the day. You must think whether you are happy doing a 9 to 5 job and that is not bad. Anyhow if you are interested in solving problems and you are keen to do such stuff, then academia is the best to go for.

Dr. MATTHIAS K REUMANN

Harsh Ranawat, Harithaa Anand (III Year, BSc Biotechnology)

Dr. Mathias Reumann visited the School of Life Sciences (SLS), MAHE, Manipal on February 13, 2018 to deliver a guest lecture. In 2003, he received his Masters of Engineering in Electronics with a Tripartite Diploma from the University of Southampton, UK. He continued his PhD in Karlsruhe Institute of Technology, Germany on the translational research in cardiac models. He carried on his System Biology at IBM after that. He focused on creating high end translational cardiac models for various journals. He expanded his research in Genomics where he studied single nucleotide polymorphisms in Breast and Prostrate Cancer. He has built a research facility in Australia that focuses on healthcare analytics, medical imaging and genomics. Currently, he is working for IBM, Germany where he focuses on high- performance computing in the field of Systems Biology.

Dr. Mathias was born and brought up in Germany. He always wanted to see the world beyond him then so he decided to do his Masters at the University of Southampton. He did a five-year course in the Master of Engineering in Electronics. The course entailed a study period of one year each in Germany, Paris and Southampton itself. After his Masters, he moved on to do a PhD (2007) in translational research in computational models for the heart. This work was inspired by one of his professor that taught him biomedical machines. Rather than choosing his work, he always chose his mentors and worked in a particular field accordingly.

After this he moved on to do his post-doctoral research at New York City which was offered to him by a colleague who worked at IBM. This was where he gained experience in working with supercomputers. This changed his mindset on how to work with data during this period. He was then offered a position at IBM, Australia to work in collaboration with the University of Melbourne. He used his expertise on data analysis using supercomputers to analyse their data in the field of Genomics. He always preferred using the term “Actionable data” . This term came about his ideology that data would be of use only when translated into results and that could only be done using various computational tools. After his stint in the research facility there, he started thinking about the impact of data on health systems. He began a research facility in Africa where he started delving into the field of Epidemiology. They worked on improving the quality of clean water for residents.

After moving back to Germany, he moved to the field of Public Health. He worked under Ms. Angela Brand, University of Maastricht, Netherlands who helped him get his PhD in Public Health. He believes that data sits everywhere but is not accessible and that’s what he is working to change. Another challenge he is working on the ability to work on various kinds of data after its acquisition. He believes that countries like India and Africa could contribute immensely in terms of data as well as analysis because we are yet to establish a working framework to do so.

Dr. UWE SCHOEN & Dr. HELENE ROSSOUW

Aadhya Setya (I Year, BSc Biotechnology), Harsh Ranawat (III Year, BSc Biotechnology)

Dr. Uwe Schoen

Dr. Uwe Schön is currently the Director of BioMedHeliX, a cryogenics solutions company based in Cape Town, South Africa. Dr. Uwe Schön started his career at the Fraunhofer Institute for Biomedical Technology (IBMT) where he developed mobile clinics and laboratories. He headed the development of the first mobile BSL3 (Bio Safety Level 3) laboratory, that has been active in South Africa since 2010 in HIV and TB VTC projects. He was also involved in the development and design of cryotechnology and biobanks. In 2008, a biobank, based on this technology was installed at the Department of Virology, University of Stellenbosch. This biobank serves as a storage for patient's virus samples. He is coordinating the work of the Health Helix of the Stellenbosch University School of Public Leadership.

Dr. Helen Rossouw

In her six-year term in the Western Cape Ministry of Health, Ms. Hélène Rossouw played a role in facilitating the launch of partnerships between the Department and private sector investors, the establishment of the Public Private Health Forum in its current format and the establishment of The Health Foundation. Her previous experiences include media liaison for several years across a spectrum of departments in the Western Cape Government, including Health, Tourism, Agriculture, Environmental Affairs, Public Works and Cultural Affairs and Sport. As an official delegate to the SA Germany Year of Science workshops in 2013, she delivered abstracts in Stellenbosch and Berlin, and project managed the Mobile Laboratory project. Hélène is a qualified public relations practitioner, with a B.A. degree majoring in Latin and Afrikaans-Netherlands and several post-degree diplomas, including Protocol and International Etiquette, as well as Cultural Communication. She specializes in coordinating multi-partner projects, stakeholder communication and crisis communication techniques.

Here are excerpts of their interview, taken with the Student Council, SLS.

Student Council: Do the demographic differences between India and SA not cause any deviations from the methods developed primarily with the SA population in mind?

Uwe Schoen & Hélène Rossouw: The challenge is always to have the understanding to see what it means to be innovative in a certain context. We are developing innovating solutions, but how to make the next step and bring it to the market and apply it to the health systems. a lot of people underestimate that challenge. We have made some innovative services and the devices. To implement them now in the Indian context - I don't see a problem, but I cannot imagine us to know how to do it in India. We can understand what you to create here what you make here in the point of care for cancer diagnosis and cancer therapy and to implement that in clinical studies in SA. I don't think the demographic differences between the two populations would have a negative impact in the study. It is progressive and will strengthen ties between BRICS countries.

Student Council: How do you find India for such an opportunity?

Uwe Schoen & Hélène Rossouw: This is our first visit to India. We can see it is a completely different dynamic compared to South Africa especially for me coming from a Ger-

man background originally, from a R&D background. I find it interesting that kind of the same ideas like Fraunhofer Institut are found here in institutes like SLS. I've felt a good connection with people here and had fruitful discussions here about technology. The Health Conference in New Delhi gave a lot of important insights into the health systems and technology side. It is a matter of finding funding for such projects, but I have been positive about this venture. We have travelled to Taj Mahal and Delhi and was a life changing experience! We also went to the Gandhi Memorial and the museum - since he spent some years in South Africa it was inspiring to know about him.

I find the work here at SLS is very exciting with jasmine, genes and the stuff is interesting!

KNOW YOUR LABS

An attempt to inform you of the history, research and people here at the School of Life Sciences, MAHE, Manipal

DEPARTMENT OF BIOINFORMATICS

Dr. Bobby Paul
Assistant Professor & HOD
High-throughput data- NGS,DNA Sequencing
Database Design

Mr. Sandeep Mallya
Lecturer
Genome and Transcriptomics
Big Data handling & Visualisation

Mr. Manoj Bhat
Senior Grade Lecturer
Pathway and System Biology
Protein Modelling & Interaction

Mr. Ankit Tanwar
Junior Research Scholar
Zinc Finger Proteins
Personalised Medicine

Initially under the Department of Biotechnology at Manipal Life Sciences Centre (2006), the department of Bioinformatics was established in 2015. Bioinformatics is a discipline focusing on the development and application of theoretical models and computational methods for the analysis of biological or biomedical data. The department is involved in the research and developmental activities including the analysis of microarrays, mass spectrometry and Next Generation Sequencing data. Since its inception, the department has handled and analyzed massive amounts of data that is being generated in the school from the various projects that are being undertaken here.

The department as of now is primarily working in the development of software and analysis of biological data. Some of the developmental activities are accessible through internet (https://slsdb.manipal.edu) and intranet portal. The department is being headed by **Dr. Bobby Paul** whose primary areas of research are genomics, proteomics and metabolomics. He has been working closely with the microbiology lab and involved with the whole genome assembly of different strains of *Staphylococcus aureus* and *Streptomyces*. In proteomics and metabolomics, he is studying various biological molecules and their metabolic pathways. He is also an expert in computational biology, Database designing, web designing and NGS data analysis. **Mr. Manoj Bhat**, who is Senior Grade Lecturer, is concerned with systems biology and protein modelling studies. He has worked on *'One Carbon Pathway Analysis'* in which he has constructed database of carbon vitamin folate genes and investigated their functional aspects such CpGs etc. **Mr. Sandeep Mallya**, Lecturer, whose core focus is in the area of genomics, dealing with sequence analysis and visualization. He is primarily involved in analysis of RNA-seq, exome-seq, miRNA-seq and bisulfite-seq by building pipleines for the same.

The departments consist of two research scholars, presently. **Mr. Pradyumna Jayaram**, is working in the field of Multiple Omics. He has also developed the Bisulphite Pipeline which is being used as part of the servers in the college. **Mr. Ankit Singh Kanvar**, is working on zinc finger protein analysis in cancer genes. He is studying the factors involved in the regulation of these proteins in cancer tissues, Additionally, he is also developing a software in collaboration with Max Planck Institute, Germany called MODCELL for personalized medicine. He is aiming to increases its prediction power in estimating the patient's lifespan.

In terms of future projects, Department of Bioinformatics is looking into Cloud Computing and HPC Based Analysis to improve the technical aspects of computational models and the like.

The department has two IBM servers for Data Analysis and Storage that are enabled with Red Hat Operating System running with a 64 GB RAM and 22T HDD SAN storage. Additionally, a 12 CPU 48 GB Ram and 12 TB hard drive and 16 CPU, 2 GPU, 128 GB RAM and 27 TB hard drive servers are dedicated for the analysis of NGS data.

Courses offered:

M.Sc. Bioinformatics (2 Years)

Certificate course in Bioinformatics (2 months)

Department Research activities:

- Whole Genome Sequencing and Assembly of *Staphylococcus aureus* and *Clostridium* species.
- Analysis of exome and transcriptome sequencing data.
- Study of Polymorphisms and Mutations in various clinical conditions.
- One Carbon Pathway Analysis.
- Zinc Finger Protein in Cancer genes.
- Development of software for Personalized Medicine
- Targeted Bisulphite sequence data analysis pipeline

Graduates and post graduates projects:

- Classification of Clostridium species.
- Targeted miRNA analysis.
- Development of database for HBB gene sequences from thalassemia patients.
- Development of Database for specie specific markers.

DEPARTMENT OF AGEING RESEARCH

Dr. KP Guruprasad
Professor & HOD
DNA Repair & Ageing, Evaluation of Traditional Medicines

Dr. Manjunath B Joshi
Associate Professor
Vascular Biology, Neutrophil Biology, Insulin Resistance & Metabolomics

Mr. Bharath Prasad AS
Senior Grade Lecturer
Microbiology, Immunology & Cytokine Biology

Mr. Aswath Balakrishnan
Senior Research Fellow
Endothelial cellular signalling crosstalk and epigenetic mechanisms

Ms. Mangala Hegde
PhD Scholar
Epigenetic mechanisms in breast tumour angiogenesis

Mr. Sampara Vasishta
PhD Scholar
Epigenetic mechanisms in type2 diabetes and impact on vascular disease

Mr. Sujeesh Sadhujan
Junior Research Fellow
Traditional medicine and its impact on ageing

Mr. Gangadhar Prabhu
Technician

Mrs. Usha Nayak
Technician

Mr. Manoj Kumar
Technician

Mrs. Jyothi Nayak
Technician

The department was inaugurated on January 19, 2007 as the 'Ageing Research Unit' by Sir William Castell, Chairman, Wellcome Trust, UK. The department now mainly focuses on traditional medicines and their impact on ageing, physiological processes involved in age-related diseases and the factors associated with delayed wound healing.

Why Traditional medicines?

The history of such compounds dates back to five to six thousand years, with a lot of acceptance in the society. Many such compounds are herb derivatives, with relatively low side effects when compared to modern medicines. Accessibility and availability ia also a big advantage. Folklore medicines are not in the purview of our knowledge, which may potentially have therapeutic effects for conditions that modern medicines are struggling to achieve.

The question is to improve the quality of life for aged individuals, since the lifestyles of most populations are associated with many diseases. *"People are not able to enjoy healthy lives, so we are looking into traditional, specially ayurvedic medicine to check if they are rightly postulated to improve the quality of life"* - Dr. K. P. Guruprasad.

One project was on Medhya rasayana, where the group used *Clitoria ternatea* to understand its effect on ageing and memory. An increase in DNA repair and autophagy was observed, along with enhanced memory and differential expression of genes in adult rats after ingestion of the rasayana. The impact of this and other such ayurvedic formulations is presently under investigation in diseases such as Alzheimer's disease, Parkinson's disease using Drosophila and Mice models.

Previous work in the laboratory included work on evaluation of Amalaki rasayana, obtained from *Phyllanthus emblica* fruits, on DNA repair and immune profiling of subjects. When subjects given rasayana were compared with those given placebo, the DNA repair efficiency was more in the former group.

Another major focus of the department is in the areas of physiology –vascular biology, neutrophil NETs and metabolomics. In the area of vascular biology, investigations into the epigenetic mechanisms of endothelial cells are being carried out. Insulin resistance with age and other conditions in relation to change in nitric oxide release causing instability in blood vessels - rooting to vascular diseases like atherosclerosis - are being studied.

Neutrophil NETs, much like a fisherman's net, are expelled DNA with bactericidal compounds by neutrophils upon pathogenic or immunological stimulation. Conditions such as Type2 Diabetes are being studied where patients are known to have recurrent infections. It has been investigated by the group, that such patients do not produce NETs in response to bacterial stimulation, and produce NETs without stimulation instead - in a pro-inflammatory fashion. The group was first to identify that high glucose induces NET formation and that homocysteine - a sulphur containing amino acid derivative, is a potential inducer of NET and is related to platelet aggregation.

Metabolomics is the study of metabolites at a given time and condition, since metabolism is very dynamic with respect to time and surrounding conditions. Using liquid chromatography and mass spectrometry, the group analyzes metabolites in cells taken from serum, urine, saliva and other biological fluids to understand the metabolomic changes occurring during pathological conditions. This helps in prediction, diagnosis and designing the treatment for a condition.

The department also focuses on the influence of host factors and microbial community on diabetic wound healing. Age, immunodeficiency, microbial infection or diabetes or such conditions interfere in the process of wound healing, since it is a very complex system. Due to a bacterial infection, cytokine and growth factor levels will be up or down regulated, and the profiles of these chemicals, along with the profiles of microbes infecting diabetic and non-diabetic foot ulcer are being investigated by the group. The mechanisms of microbe associated delay in wound healing are being studied in depth, including biofilm formation and multi-drug resistance to narrow down to some virulence factors which can then be used as markers. This study will help in better management of wounds to make treatment faster and more effective.

Many undergraduate and postgraduate students have been working the department on the evaluation of various ayurvedic rasayanas on DNA repair, autophagy and their immune profiling, using drosophila and mice as the model organisms. Cytokine profiling from diabetic foot ulcer patients along with functional studies on neutrophils in response to virulence factors have also been undertaken as projects. Students are also looking at molecular mechanisms of the glucose-induced reprogramming of neutrophil metabolism, along with the effect of altered gut microbiome in diseases causing the production of toxic substances like trimethylamine on neutrophil function.

In the future, the department aims to take on a more comprehensive approach to encompass more than just DNA re-

pair and to look into age-related diseases and to involve epidemiologists and social groups. The group also aims to investigate further into exposomes - the study of conditions we have been exposed to in life - including stresses, lifestyle changes, long-term drugs, diet, nutritional supplements, occupational effects and their effect on metabolomics and its memory by epigenetic mechanisms.

The department had, and is presently running projects with grants from various institutions such as DBT, Australia-India Strategic Fund, DST and others.

" Say you know somebody practicing folklore medicine– if you can find out some active ingredient that is useful and not used in modern medicine, you should think of researching deeper into it and publicising it to the world, thus benefiting society."

- Dr. K P Guruprasad

COMPILED BY:

Abhimanyu Ray (I Year, BSc Biotechnology)
Arbaaz Sait (I Year, BSc Biotechnology)
Harsh Ranawat (III Year, BSc Biotechnology)
Mayukha Bathini (I Year, BSc Biotechnology)
Megan D'Souza (II Year, MSc MBHG)
Shiksha Saraogi (I Year, BSc Biotechnology)
Shruptha Padival (II Year, MSc MBHG)
Talitha Keren Kurian (II Year, BSc Biotechnology)
Tanaaz Khan (II Year, BSc Biotechnology)
Yash Goel (I Year, Bsc Biotechnology)

CREATIVE CORNER

Straight out of the right cerebrum.

AURAS – WHAT ARE THEY?

Nishtha Singh (II Year, BSc Biotechnology)

Aura is a luminous form of energy that surrounds a person like a halo. Now, auras do not necessarily have to be spiritual or religious. On the contrary, they help signify a person's personality and attitude in general.
The auras that I will be talking about here are kind of my own version of the version that is known to all.
So, auras, to me are this subtle force of energy that you feel around a person. Every person has a field of energy around them which usually stems from their charisma and personality.
To explain it scientifically, everything that has mass has gravity. When I say gravity I do not mean the exponential force that keeps our Solar system intact. For that, an object would have to have an enormous amount of mass that humans do not usually possess. Everything that has mass has gravity. Gravity and mass are directly proportional. Therefore, humans have gravity (in subtle amounts) and what this gravity does is that it bends the space around the person. When the space around this person is bent, usually air is bent as it is the lightest form of kinetic energy available, and light passes through this bent air, it naturally creates a color, like the colors of a rainbow that you start (unconsciously) associating the person with. You do not consciously see the color with the cones in your eyes; you see it in your mind because the images being delivered to your brain are not developed for what your brain already understands.
So the next time you are talking to your best friend concentrate hard on the color you associate her/him with and you will get an undisputed answer.
Here are some colors and their meanings-

https://in.pinterest.com/pin/468022586245446192/

FEATHERS

Yash Goel (I Year, BSc Biotechnology)

A dusty pinch of blue covered the sky as I stared out of my window against the slight morning chill. And on the sill of the window sat a blue rock pigeon, with a crest harbouring the colours of a rainbow as the slight morning sun hit its preened feathers. And with that it flew away leaving behind an illusion of a rainbow, ironically which they always are. These pigeons turn out to be a constant in my life. A string that binds me through all the windows and balconies I have woken beside and the childhood where me and my grandfather tended to injured pigeons.

It is with this flow of colours my day started with a slight cooing or a mysterious sharp and small tweet-tweet. Sometimes I wonder if the little tailors sew my thoughts every morning. Ready I walked off the hostel to my college and was greeted by the beautiful calotropis and some blue, bell-shaped flowers (foxgloves) along the way. There is always something interesting going along this road, sometimes it is the dead snakes haunting you; and at other times, it is the flower hopping huge bees. I go in, seeing how much there is around me, observing the cormorants fly across the sky or little white egret hunting for insects in the grass via little green pond, which often strikes as a witch's cauldron. Some sort of potion holding a colony of a world of moving darts. And in this garden somewhere hidden are the little sunbirds, which have always been a source of great joy to me as I imagine them amongst calliandra in my backyard. They float like a bright sun over the orange ocean.

And then …. a very familiar voice of a koel distracts me from my daydream and guides me to the canteen. Here among the trees is the bird with patches of white over a light black body with bloodshot eyes munching on the berries as I munch on my delicious breakfast. In another corner, hidden among the bushes near the drain, are the white breasted waterhen wagging their tails as they move to play peek-a-boo. Never much is heard from them and I still wonder how beautifully they might sing.

There is always a deep silence in these moments as if the streets were covered under snow and all these little blooms of colours were tiny houses. Each one encapsulating a new joy or a strange calm.

I finally climb the stairs of SLS and sit at the huge open space. Sometimes on the top of the mysterious animal house there is a Red Wattled Lapwing, with a long screechy call and on other days Pariah Kites just fly around with triangular tails. I sit alone in this house as the day grows old and finally under the orange canvas the sky is filled with the Indian Flying Foxes settling on the big fig adjacent to the witch's pot. And I trail along the setting sun and little stars appear in the sky and I am to my window while dreams fill my sleep.

Illustrative image only, but let that not stop you from looking for these!

THE STORY GOES ON

Luke Zeon DaCosta (III Year, BSc Biotechnology)

Life is a river, and time the water.
It flows downhill, always forward. Never looking back, never the other way.
And it is the same with everything.
Time doesn't go back, it doesn't look upon the past. For the past is irrelevant.
It flows, regardless of circumstance.
Endlessly, inevitably.
And so we look upon ourselves.
Humans, marvels of biological complexity.
Born on this planet.
Our story, began with a cry for air.
And the clock has been ticking since.
Our story, not authored in some divine script.
But written word by word, by our choices.
Our story, a blank canvas of human decisions and an unfathomable universe of thoughts with which to paint with.
Here we stand, in the light of our insignificance.
Pilgrims on a voyage to our grave.
A journey of struggle and conquest.
One that traverses the valleys of disappointment, and the trenches of failure.
Hardships at every step.
And yet, as we all know, the story goes on.
Irrespective of whether we get hurt.
Life doesn't seem to care.
And it would be folly to expect it to.
But fret not, for there is hope.
Amidst all this darkness, there is much to be found.
Our downfalls are only stepping stones.
We alone hold the power, to alter our story.
It will go on, with or without us.
Whether we like it or not.
And in the face of these unfair odds.
We must look back on ourselves.
And acknowledge the courage with which we stand here.
And understand that it is us who decide what our story shall read.
A good book, or a bad one.
The future lies not in what happens *around* us, but rather, what happens *within* us.

PHOTOS

Pollinator at work

-Shiksha Saraogi (I Year, BSc Biotechnology)

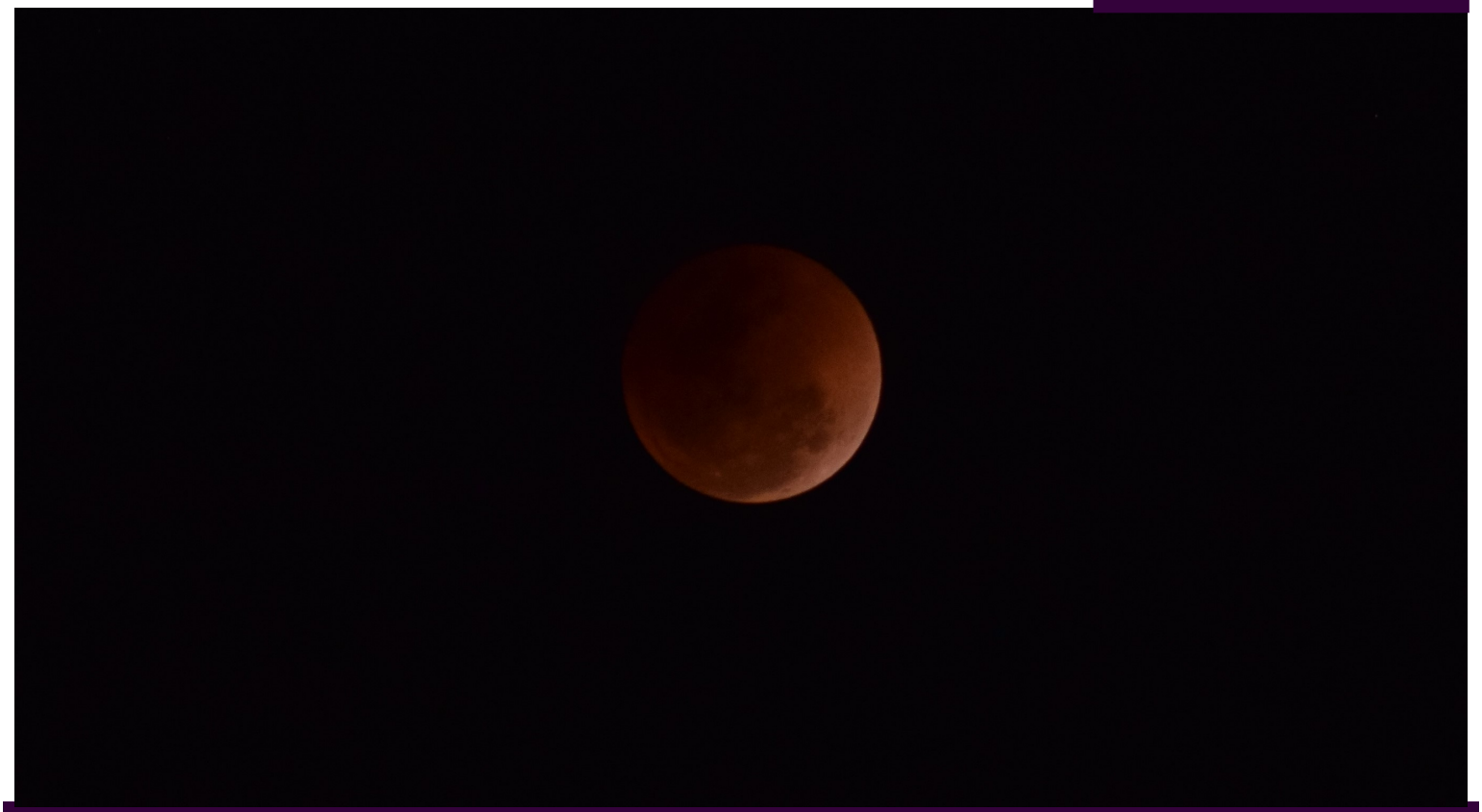
'Polly'nesian

-Manish Naik (I Year, MSc MBGH)

Hampi Sunset

Shiksha Saraogi, I Year BSc Biotechnology

Red moon



EVENTS

A lot has been happening.

VORTEX

Nishtha Singh (II Year, BSc Biotechnology)

Vortex, a one of its kind student interactive session that was conducted on February 10, 2018 brought together various minds from School of Life Sciences, MAHE, Manipal to discuss topics concerning their interests.

This very first student interactive workshop in Manipal, had eight speakers from SLS talking about various topics covering religion, music and life. Each speaker spoke for about thirty minutes.

With the success of this first event, the wait has already started for more such workshops in future

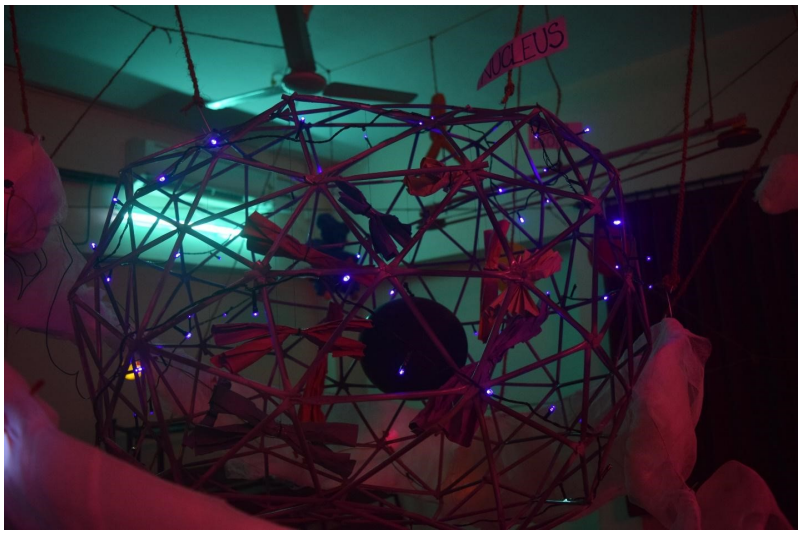
PRIMER 2018

Kanaya Bhattacharya (II Year, BSc Biotechnology)

The cultural fest and intra-college competition in School of Life Sciences, MAHE, Manipal is called "Primer". Primer gives all students a platform to perform and come out of their shells. This year, we had a week long Primer with Art, Literary, Speaking, Music, Dance and Photography events. Music and Dance were on the February 7 and February 9, 2018 respectively in the Basement area. The sounds of fun and frolic in the college allow the researchers, professors and busy students to come out of their labs and enjoy the performances. This year we introduced some new categories like Creative Jam, Collage, Folk Dance. The week long Primer from March 6 to March 13, 2018 created memories for everyone and provides a bonding opportunity amongst students of different batches.

SCIENCE DAY 2018

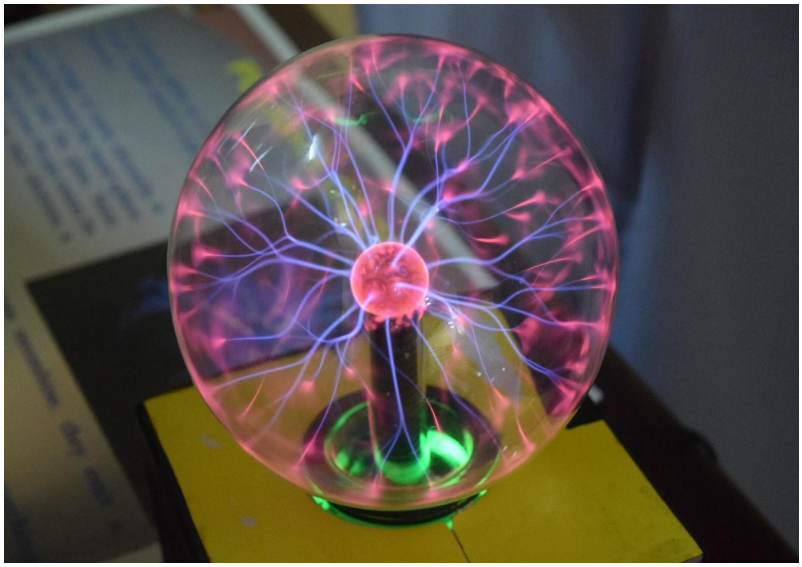
Yash Goel (I Year, BSc Biotechnology)



On February 28 2018, the **School of Life Sciences, MAHE, Manipal** took the initiative to bring students together to celebrate the growing spirit of science and technology. The theme for this year's Science Day was **Science and Technology for a Sustainable Future**. Various models concerning Waste Disposal, Green energy and Fuel production from Algae were displayed by the students from SLS and schools in and around Manipal. Renowned space scientist, Prof. YS Rajan (Dr. Vikram Sarabhai National Professor, ISRO, Bengaluru) graced the occasion and enthralled the students with his curious questions and inspiring talk.

The charm of the day turned out to be the massive room size model of The Cell, which left students in awe to the beauty of science. The Manipal OSA Student Chapter put up three theme-based models which included a carbon dioxide absorber, solar powered irrigation system and a solar oven. There were displays of distinct types of Drosophila and other animal models, cells, models of Mars Mission, Wound Healing, optics with hologram, light painting, chemistry based demonstrations etc. - all of which helped the school children to understand the role of science behind these magical displays. The day inspired many irrespective of age and acted as a stage of display for curiosity, creativity and innovative ideas.

The day was an inspiration for many and acted as a stage for display of curiousness, creativity and innovative ideas making it a grand success.



OLD AGE HOME VISIT

Bhargavi Karna, Syeda Inaas (II Year, BSc Biotechnology)

On February 7 2018, the Social Committee paid a visit to Sandhyadham, an Old Age home at Goretti Hospital, Santhekatte, Kallianpur. On reaching, we could see smiling faces and waving hands to welcome us. The team dispersed to the rooms with keen, hopeful eyes awaiting us. The residents and us; we tried to communicate as much as possible, in whatever language we knew could help: English, Hindi, Kannada and where none seemed to work, we smiled and held hands. While some worried we were doctors with injections, some assumed we were their relatives. While some sang songs to us, some taught us the essence of smiling in despair. Almost after we were done meeting them all, we arrived to a couple who were there to celebrate 59 years of their wedding in a week. They showed us their black and white wedding pictures; and even after more than half a century, their charm was still the same. The love between the two was so radiant, we got reminded of the Day being "International Rose Day". Taking the opportunity, we got a bunch of roses and handed them to one and all. The smiles on the faces of the old age Home family, was overwhelming.

The purpose of the visit was to give away joy and respect to the wrinkles that have seen generations of life and transformations of infrastructure. The volunteers, however, left with more joy and satisfactions than they imparted.

MATRUBHASHA DIWAS

Namita Bhyravbhatla (I Year, MSc MBHG)

Matrubhasha Divas or International Mother Language Day, was celebrated at the School of Life Sciences on the February 21, 2018. A cultural program was held to celebrate and promote awareness of cultural and linguistic diversity around the world.

The program commenced with speeches by the faculty members, Dr. Vidhu and Dr. Vasudevan, addressing the importance of our mother tongue, its link to our heritage, the importance of retaining our culture through our mother language, and the diverse array of languages that span the globe. Following these speeches, a Masters student gave a heartfelt speech about the importance of our mother language and the beauty of India's linguistic diversity. This was followed by a passionate recital of a Bengali speech dedicated to those who lost their lives defending their language and heritage.

The cultural program consisted of a Tamil dance number, a group performance of Bengali songs, English and Hindi medleys, an Assamese song recital, a Tamil song recital, a group recital of Malayalam songs, a group performance of Kannada songs, and a Tulu song recital. The program concluded with a presentation on Odisha and a screening of popular Oriya music.

Prof. JV BHAT MEMORIAL ORATION

The estimable Prof. JV Bhat Memorial Oration is an annual event organized by the School of Life Sciences (SLS), MAHE to honor and perpetuate the memory of Prof. JV Bhat; a renowned microbiologist of international repute. The recipients of the award are eminent scientists in the field of life sciences with exemplary achievements in the field of microbiology.

The 12th Annual Prof. JV Bhat Memorial Oration at Manipal was delivered by Prof. M. K. Lalitha (Advisor Lab Services at Malabar Institute of Medical Sciences, Former HOD of Microbiology, Christian Medical College, Vellore) on March 3, 2018 in the presence of Dr. H Vinod Bhat (Vice Chancellor, Manipal Academy of Higher Education (MAHE), Manipal), Dr. K Satyamoorthy (Director, School of Life Sciences, MAHE, Manipal) and Dr. PM Gopinath (former Senior Scientist, School of Life Sciences, MAHE, Manipal).

Delivering her oration, Prof. M. K. Lalitha eloquently described her leading role in spearheading several surveillance studies to tackle antimicrobial resistance among fastidious, anaerobic bacteria such as *S. pneumoniae* and *H. influenzae*. Prof M.K Lalitha emphasized on how "Respiratory infections are the major cause of mortality among children aged less than 5 and these are vaccine preventable". As a technical assessor for National Accreditation Board for Testing and Calibration Laboratories, she ended with a note on the importance of producing research work that is reliable and technically valid.

In his presidential address, Dr. H. Vinod Bhat spoke of the inception of the event and the need for organizing such memorial orations to inspire and motivate students and other researchers in the respective areas to contribute more towards the betterment of the society in general. He spoke about the emerging important role of microbiologists in a clinical setting and the need of antimicrobial stewardship to contribute directly to society's good. Dr. K Satyamoorthy welcomed the audience that also included the immediate family of the late Prof. JV Bhat, his friends, associates and many students and faculty members of the constituent institutions of MAHE, Manipal. Dr. Padmalatha Rai S (Associate Director Academics, SLS, MAHE) proposed the vote of thanks.

SPORTS WEEK 2018

Rudranath Ghosh (I Year, MSc MBHG)

The School of Life Sciences, MAHE hosted its sports week for the academic year 2017-18 from February 3 to 15, 2018.
The Sports Week kicked off with 11-a side cricket match held at Endpoint Ground from February 3 to 11, 2018. The final was a nail biter where the Staff team pulled off a remarkable victory against the Research Scholars team to lift the trophy.
The second set of sports events were the indoor sports events held at the basement of SLS that included carrom, chess and table tennis. Carrom was held on February 5, in which Mr. Kiran K (Research Scholar) won the singles event from Mr. Gautham R (II Year, MSc MBT). The doubles event was won by Dr. Murali and Dr. Bobby Paul, with Mr. Chatan Rai S and Mr. Nitish (II Year, BSc) being the runners-up. Mr. Keshav (Research Scholar) won the chess event on February 6 defeating Ms. Apoorva Jnana (Research Scholar) in the final.
Chess was held on 6th February at SLS basement, where the winner was Mr. Keshav (Research Scholar) and the runner-up was Ms. Apoorva Jnana (Research Scholar).
Table Tennis was the most exciting indoor event held on February 7 and 8, 2018 . The Women Singles event was won by Ms. Padmavathy R (II Year, MSc) with Ms. Aishwarya Srinivas (III Year, BSc) the runner-up. Later Ms. Aishwarya teamed with Ms. Apoorva Jnana (Research Scholar) to win the Women Doubles event against Ms. Deepika Bhat and Ms. Pallavi (Research Scholars). Mr. Prabodh Kumar (Research Scholar) defeated Mr. Manish KS (I Year, MSc) in the Men Singles final. The Men's doubles segment was won by Mr. Murali T S and Sourav Patege. Next, we had a 7-a-side Throwball match at Sharada court on February 9, 2018. The winners were the BSc team and the runner-up was the MSc team.
The event ended with a 6-a-side Football match which was held at End Point from February 13 to 15, 2018. A Total of 11 matches were played that includes 10 Group stage match and 1 final. The final match was intense between MSc and III Year, BSc which concluded with MSc defeating the BSc team and winning the Championship.

“Curiosity is the engine of achievement”

-Ken Robinson