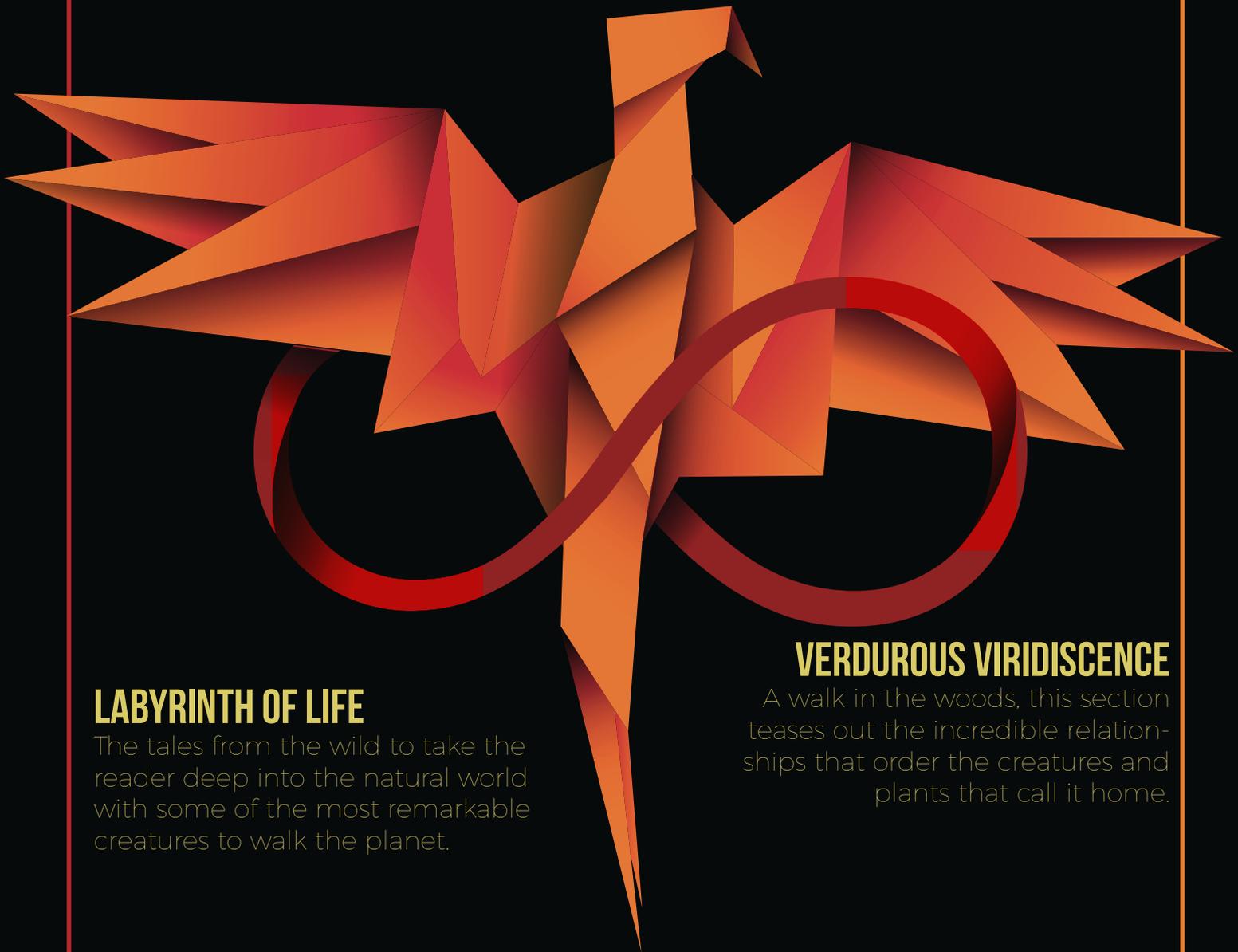




The Zoological Society  
Sri Venkateswara College  
presents

# Phoenix



## LABYRINTH OF LIFE

The tales from the wild to take the reader deep into the natural world with some of the most remarkable creatures to walk the planet.

## VITA VERITA

From Hippocrates to Ohsumi, this section will give the absolute truth of the functioning of life.

## VERDUROUS VIRIDISCENCE

A walk in the woods, this section teases out the incredible relationships that order the creatures and plants that call it home.

## PROLIFIC PROGRESSIONS

With one foot in the future, experience the taste of the things to come

Fifth Edition  
2016-17

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*While sailing in these latitudes on one very dark night, the sea presented a wonderful and most beautiful spectacle. There was a fresh breeze, and every part of the surface, which during the day is seen as foam, now glowed with a pale light. The vessel drove before her bows two billows of liquid phosphorus, and in her wake she was followed by a milky train. As far as the eye reached, the crest of every wave was bright, and the sky above the horizon, from the reflected glare of these livid flames, was not so utterly obscure, as over the rest of the heavens.*

– CHARLES DARWIN

# Teachers' TABLOID



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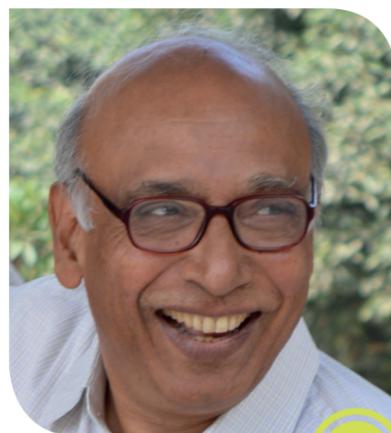
With the memory of a dolphin, Sir can not only jot down chemical reactions with incredible ease, but he also answers doubts with the same zeal and a smile.

*Specialised in Biochemistry.*

## **Mrs. Ramaa Sinha**

A fastidious and incisive intellect, well known as the 'Ocean of knowledge'. A patient and resilient educator; each lecture is evident of her efforts in making the classroom conducive to a deep understanding of the subject.

*Specialised in Endocrinology.*



## **Dr. V. V. S. N. Rao**

Do not let his sarcasm and his rapier-like wit fool you, an earnest professor with an eye for detail, he values punctuality above all else.

*Specialised in Parasitology.*



## **Dr. P. S. Dhanaraj**

Need directions? He is the 'Google Maps' of our department. Truly inspirational; an exemplary leader, he is the answer to all our woes.

*Specialised in Endocrinology and Pesticide Degradation.*



## **Dr. Om Prakash**

His 'devil-may-care' attitude and sassy retorts make his classes a thorough delight. His quirky dance moves are often the most memorable.

*Specialised in Fish Biology and Fish Endocrinology.*

## **Dr. Anita Verma**

With her endearing and comforting smile, she is the epitome of elegance and poise. She brings to light the best in us.

*Specialised in Entomology.*

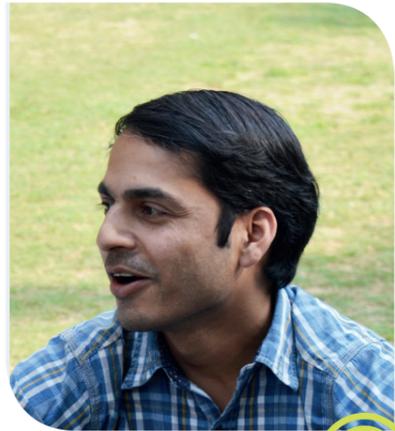


## **Dr. Vartika Mathur**

Maverick; she does things her own way. She encourages practical knowledge and creative thinking.

*Specialised in Entomology.*





### ***Dr. Ajaib Singh***

Serious in demeanour, meticulous in teaching. Persistently motivates us toward becoming our very best selves.

*Specialised in Molecular Biology*

### ***Dr. Rajendra Phartyal***

Not only is he level-headed and calm, his jokes add a humorous dimension to class. His interactive classes ensure that every student feels included.

*Specialised in Reproductive Biology of Fishes.*



### ***Dr. P. Jayaraj***

In a classroom, where each baffling question is followed by the next, you can imagine a teacher who makes each lecture memorable. Whether in a classroom or on the dance floor, Sir can charm everyone.

*Specialised in Cancer Biology.*



### ***Dr. Mansi Verma***

Confident and undaunted, she takes up any challenge without hesitation. Caring and understanding, she make it easier to deal with any problem.

*Specialised in Molecular Biology and Bioinformatics.*



### ***Dr. Khangembam Bronson Kumar***

Soft spoken as he may be, his words captivate the classroom with rapt attention.

*Specialised in Fish biology and Aquaculture.*

Relentlessly enthusiastic and spirited, his warm nature makes us feel at ease.

*Specialised in Neuroscience.*



### ***Dr. Riyaz Bakshi***

An understanding teacher who pushes students to do better. His anecdotes make the class not only interactive, but fun.

*Specialised in Neurophysiology.*



### ***Dr. Vagisha Rawal***

A friend before a teacher, her jovial and vivacious personality brings the classroom alive.

*Specialised in Entomology.*



### ***Dr. Manoj Jaiswal***

# FROM THE *Principal's Desk*



Dr. P. Hemalatha Reddy  
Principal

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Date: 04.03.2017

Since the establishment of the Department of Zoology, the department has shown relentless resolve in excelling at both academics and extra-curricular activities alike. From attaining university ranks to enthusiastic participation of the students in projects and organizing conferences and lectures by eminent professors, the efforts of this department never cease to amaze me.

The professors of the department have provided the students with an atmosphere conducive to learning more and allowing all-round development. The teachers are extremely dedicated and support the students in all their ventures towards a future they truly deserve.

The departmental trips and functions have served as great opportunities for better interaction and understanding among teachers and students. The department's exemplary performance is remarkable.

I would like to congratulate the department for releasing the fifth edition of '*Phoenix*' and express my best wishes and hope that the fifth edition is also a success.

  
(PRINCIPAL)

# FROM THE *Convenor & Co-Convenor*



The Zoological Society has been extremely fortunate to have the opportunity and the basis to take up exciting activities year after year. Last year, we had the opportunity to work with all other Science departments in 'Noesis, 2016'. This event hosted a lecture by Prof. L.S. Shashidhara, IISER, Pune; which was equally appreciated by students and teachers. A special event of 'Expressive Art Therapy'; was also held and helped staff and students alike to relieve stress and anxiety. This year, continuing the time-honored tradition, we unveil the fifth edition of 'Phoenix'.

Phoenix has been a continuous effort to bring forth novel ideas and gives the students of the department a chance to express and innovate. This makes us realize that the need for the magazine is not purely educational or entertaining, but it is also an effective method for channelizing creative energies. Phoenix has been the product of the continuous efforts of our editorial team and we are extremely proud to present it to you.

We realize this would not have been possible without the support and guidance of Dr. P. Hemalatha Reddy, our honorable principal.

We would also like to take this opportunity to thank all the society members, teachers and department members who have worked hard, without expectations for recognition. We hope that we can continue this association. Thank you, all.

Dr. Anita  
Mansi Verma

## FROM THE **Editors**



Dear Readers,

We are proud to present to you the fifth edition of 'Phoenix', the department magazine by the Zoological Society. This magazine is an attempt to unify various disciplines without alienating those without a background in Biology.

Each page reflects the amount of effort the team has put forth. We now feel reassured of our ability to pull off such a feat in spite of having countless other hurdles to deal with. This has certainly been an amazing experience.

We would also like to take this opportunity to express our gratitude to all those who have contributed to make this magazine a success. We profusely thank our professors and management for giving us this opportunity and the creative freedom to broaden our own perspectives. Last, but not the least, we would like to thank all the students that have sent their articles, and allowed us to produce an all-inclusive idea.

Thank you.

*Pankhuri Jain, Chief Editor*  
*Niharika Mukherjee, Creative Head*  
**TZH**

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## LABYRINTH OF LIFE



Times when

EVOLUTION

ran

BACKWARDS

Rohit Kumar, SZH

There are creatures which have been shaped through backwards or 'retrogressive evolution'. Although there has been some debate on the use of the term 'retrogressive evolution', as it is said, evolution doesn't run in reverse, nor does it operate in retrograde, it rather adapts to environmental challenges.

Some organisms that we see today, have been a result of this unique operation.

### Penguins Became Flightless Birds

Penguin ancestors were able to fly, but they lost that ability quickly after the demise of the large dinosaurs. The oldest known penguin, with fossils dating to around 60 million years ago, was already a flightless swimmer with stubby wings. Modern penguins retain signatures of their airborne relatives, including wing bones, a pointed, keeled breastbone

for wing muscle attachments, and feathers. Losing flight made penguins better suited to their environment, because it meant that the birds could get bigger. Flightless penguins were hence able to evolve bigger muscles to better power through the current of the water, denser bones that added strength and reduced buoyancy, and shorter, stiffer wings for more powerful swimming strokes with less drag and friction. An increased body size and proportion, makes them more efficient at conserving heat, capable of deeper and longer



dives, enabling them to target larger prey.

### Snakes Lost Their Legs

Plenty of evidence shows that snakes used to have limbs. Using detailed CT scans, researchers compared 3-D virtual models of the inner ears of aquatic, surface-dwelling, and burrowing snakes, lizards, and fossilized relatives. Specialized structures in the fossil animals akin to the ones modern burrowers use to hear low-frequency ground vibrations made by predators and prey were discovered. This evidence suggests that snakes descended from a burrowing ancestor, and their legs regressed so they could better wriggle through the ground.



### Birds No Longer Have Teeth

Birds evolved from dinosaurs, and ancient species like *Archaeopteryx*, the best known link between dinosaurs and birds, were just as long in tooth and claw. Thankfully, even today's most voracious avian predators do not have teeth, although scientists aren't entirely sure why birds lost their dental structure. One theory says that teeth grew smaller and eventually gave way to beaks to reduce weight for flight. But, a recent study in Science pushes back on this theory, finding that tooth loss and early beak formation occurred at about the same time.

It's possible to find various other examples in different habitats.



*We humans, too lost our proud, ape-like tails during the process of evolution. Who is to say we can't go back to the old ways?*

# ODOUR, POISON AND

# BLOWING UP

## ANIMAL KINGDOM THE MASTERS OF SELF DEFENSE

Over the million years of evolution, organisms across the animal kingdom have developed some remarkable and strange defense methods in order to avoid getting predated upon. The concepts of camouflage, mimicry and autotomy are some well known methods of defense, but let us take a look at some other extreme defense mechanisms which set the following organisms apart in the list.

### 1.Odour

The first name that comes to the mind when words like 'odour' and 'defense' are put together is probably Skunks. These mammals are known to have two anal scent glands which they use to produce sulfur containing substances (thiols) which constitute the

> A SKUNK USES THIOLS TO WARD OFF PREDATORS



*Ananya Banerjee, SZH*

infamous 'skunk spray'; which has an extremely nauseating smell that wards off huge predators such as bears.

### 2.Connective tissue for defense

The hairy frog aka Wolverine frog is amongst the strangest examples of self defense. This amphibian found in Cameroon, dislocates its bones to produce claw like structures which puncture through the toe pads in order to intimidate the predator. Later the claws are retracted and the skin heals. Another infamous animal is the Texas Horned lizard found in the North American desert. When under attack by huge enemies, it presses its sinus cavities to such an extent that the blood vessels of the eyes burst; causing a stream of blood be squirted onto the enemy.

### 3.Poison

While poison is a common method used by many organisms, the following case of Potato beetle is not very heard of. This insect's larvae feed on nightshade and other alkaloid plants and the alkaloids are excreted out as frass which is toxic to certain mammals. To protect itself the larva, hides

> PINK SPOTTED SEA CUCUMBERS FIGHT ENEMIES WITH THEIR GUTS



itself under layers of its own excreta. Also this frass is a delicacy for fire ants, which protect the larva till adult hood. A win-win situation!

### 4.Blowing up

Ants and termites are highly social insects which can go as far as blowing themselves up in order to protect their colony. *Camponotus saundersi* is one such species in which the ant under attack contracts its abdominal muscles so as to release secretions from gaster and mandibular glands which causes the insect to blast, taking down its enemies with it. French Guiana Termites (workers) also follow this method wherein the termite, as they age, accumulate protein crystals of haemocyanin which are released under attack and combine with moisture to form toxic blue liquid which kills multiple enemies at the same time.

### 5.Turning inside-out

Leopard Sea cucumbers fight their

enemies with guts; literally. These echinoderms under threat start to violently shake and eject their sticky intestines from their anal pore at the attacker (eviscerate) which thereby either gets tangled in them or are scared away.

### 6.Playing dead

To round up this list, is a very interesting phenomenon of playing dead in order to prevent death. As the phrase goes "playing possum", Opossums are strange mammals which out of fear of facing the enemies go into a comatose state (sometimes for hours) which causes the enemies to think of it as dead and hence does not feed upon it. Once the danger is gone, the animal reverts back to normal. It is a well known fact that female Praying mantis tend to eat the male after mating. In order to evade this sexual cannibalism, the males tend to drop dead so as to prevent getting eaten.

This kingdom has some real good masters to teach you about defense!

# THE JOURNEY OF SALMON: AN UPSTREAM BATTLE, THAT ENDS IN LIFE, AND DEATH.

*A journey without a kung-fu master, without any scope for mistakes, a journey that epitomises perseverance, demands grit, supreme fitness, and some Vasco de Gama navigational skills. Yet, it causes the death of its protagonists. The Salmon Run.*

The salmon is native to the world's two biggest oceans, the Atlantic and the Pacific and the rivers draining into them. Most salmon are anadromous, migrating up rivers from the sea to spawn. The salmon spends its adult life in the sea. When it's ready to breed, salmon would move upstream to the freshwater rivers, travelling for thousands of miles.

Not only is the salmon run is exhausting, skilled predators like the grizzly bear, bald eagles and fishermen await the salmon during the course of their migration. In the river, the female salmon will lay a few thousand eggs in a hole, digged in the gravel with her tail. The eggs, after fertilisation, remain in the gravel throughout the winter and hatch in the spring. The newly-hatched young ones or, alevins have the yolk sacs attached to their bodies. After spawning, the male and the female salmon, known as kelts, die. Eventually, the yolk sac is used up and the young salmon now known as fry emerge from the nest and feed on small insects.

*Sukanya Bhuyan, FZH*

Over the autumn, the fry develop into parr with vertical stripes and spots for camouflage. The parr stay for a few years in freshwater, feeding and growing stronger.

The parr change into smolts in the spring of their second, third or fourth year. This change, called smolting, is the process when the salmon are getting ready to move to seawater.

The salmon live in the sea until they mature, which is usually between 1 to 7 years depending on the species. When they are ready to breed, they return to the river where they were hatched. There are geomagnetic and chemical cues which guide back the salmon to their birthplace.

*The cycle, from here, is repeated once again when the urge to breed is irrepressible, and both sexes travel thousands of miles, hurdling obstacles and duping predators, maintaining the continuity of life.*

> SALMON HAVE TO FACE VARIOUS PERILS IN THEIR JOURNEY, INCLUDING RAVENOUS BEARS



## STRANGE ANIMAL BEHAVIOURS



*Being a Zoology student, one thing I have realised so far, no matter how much we discover about the nature and its wonders, there is always something that would surprise us; whatever we know is just the tip of the iceberg. This list includes some discoveries that are not just fascinating, but downright disturbing. But, again, it's all part of nature.*

*Taruna Verma, SZH*

### 1. Fainting Goats

Also known as myotonic goats, these are domestic goats that are worse at handling panic than a student the night before the exam. Their muscles completely freeze for about 10 seconds under stress, which usually results in the goat falling on its side.

### 2. All Cows in a herd face the same directions when they eat or rest

They pick one of the two directions, either north or south aligning to Earth's magnetic field. This phenomenon is also called Magnetoreception

### 3. Whale "voices" are getting deeper every year

Only by a few hertz but for the last 40 years almost every recorded whale song across all different regions, has gotten progressively deeper over the course of time.

### 4. Smoking

Even animals can get addicted to smoking. Tori, an Indonesian orang-utan, is addicted to smoking, and her zookeepers even have to deal with her tantrums if she doesn't get her daily fix! However, there are reports that Tori has given up smoking after giving birth.

### 5. Warring Chimps

Most animal fights, but chimpanzees do it in a decidedly human manner. They perform raids, employ tactics, and capture territory.

### 6. Animal eating herbivores

Some herbivores like cows and sheep will also turn on their fellow farm animals if their food is low in nutrients.

### 7. Compensation for ugliness

Zebra finches have been known to lay slightly larger eggs when their mate is considered to be less

attractive. Supposedly, the extra nutrients and room to grow are meant to compensate for the father's poor genes.

### 8. Grief and Burial

Elephants have several seemingly human rituals concerning death and the dead. For example, they have been known to visit gravesties regularly, to bury their dead. They even spend time in "grief" around the body of a fellow dead elephant.

### 9. Holding grudges

Crows have the ability to remember human faces, and apparently if they don't like you they won't forget you either.

### 10. Suicidal cows

Although scientists have a hard time establishing that animals might be suicidal, recently in Switzerland dozens of cows mysteriously plunged to their deaths over the side of a cliff.

# THE LANGUAGE OF LIGHT

Swostik Preetam Padhy, FZH

*From the countless wonders of the world, and the simple joys of life, the enchantment offered by a lazy summer evening, punctuated with the twinkle of fireflies, is seldom rivalled. A mystical experience, like handfuls of Lilliputian stars, scrambled and sprinkled across the Universe, just to be juxtaposed with the fresh dew, just to revel in the night. Magic. Bioluminescence. Bioluminescence is magic.*

A phenomenon occurring across various habitats and various species, Bioluminescence is widely observed in marine vertebrates and invertebrates, as well as in some fungi, microorganisms including some bioluminescent bacteria and terrestrial invertebrates such as fireflies. In some animals, the light is produced by symbiotic organisms such as *Vibrio* bacteria.

Aristotle had written that damp wood sometimes gave a glow, and Robert Boyle showed that oxygen, was involved in the process.

## Mechanism

The chemical reaction that results in bioluminescence requires two unique chemicals: luciferin and luciferase or photoprotein. The enzyme catalyzes the oxidation of luciferin. In some species, the type

such as squid, house bioluminescent bacteria in their light organs. Some organisms emit light continuously. Some species of fungi present in decaying wood, for instance, emit a fairly consistent glow, called foxfire.

Most organisms, however, use their light organs to flash for periods of less than a second to about 10 seconds. These flashes can occur in specific spots, such as the dots on a squid. Other flashes can illuminate the organism's entire body.

## Adaptations

### Defensive Adaptations

Some species luminesce to confuse attackers. Many species of squid, for instance, flash to startle predators, such as fish.

Many marine species use a technique called counter - illumination to protect themselves. Many predators, such as sharks, hunt from below. They look above, where sunlight creates shadows beneath prey. Counter - illumination is a type of camouflage against this predatory behavior.

### Offensive Adaptations

Bioluminescence may be used to lure prey or search for prey. The most famous predator to use bioluminescence may be the anglerfish, where a fleshy outgrowth from the head acts as a source of light.

### Attraction

Adult fireflies, also called lightning bugs, are bioluminescent. They light up to attract mates. Although both male and female fireflies can luminesce, in North America most flashing fireflies are male. The pattern of their flashes acts as a courtship ritual.

*It's like having your own flashlight, never having to fumble in the dark looking for the light switch.*

*Aristotle had written that damp wood sometimes gave a glow, and Robert Boyle showed that oxygen was involved in the process.*

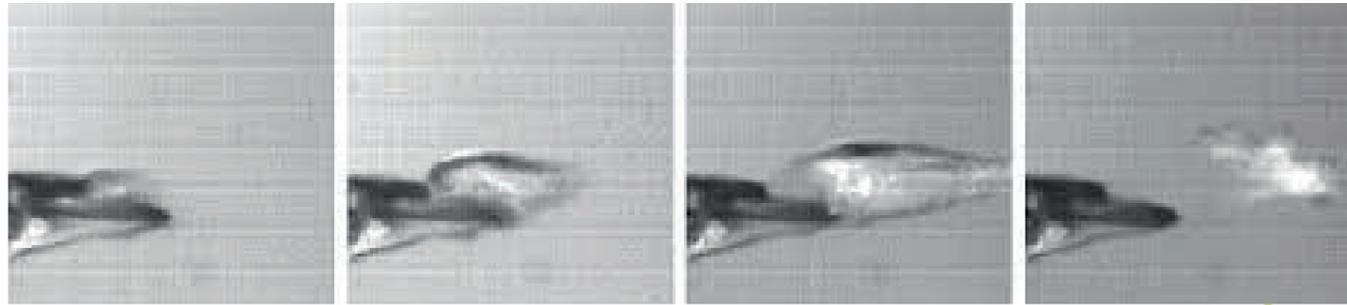
of luciferin requires cofactors such as calcium or magnesium ions, and the energy-carrying molecule adenosine triphosphate (ATP) may also be required. The interaction of the luciferase with oxidized (oxygen-added) luciferin creates a byproduct, called oxyluciferin. More importantly, the chemical reaction creates light. The bioluminescent color (yellow in fireflies, greenish in lanternfish) is a result of the arrangement of luciferin molecules.

Some bioluminescent organisms do not synthesize luciferin. Instead, they absorb it through other organisms, either as food or in a symbiotic relationship. Some species of midshipman fish, for instance, obtain luciferin through the "seed shrimp" they consume. Many marine animals,

THE



# OF THE ANIMAL WORLD: PISTOL SHRIMP



Priya Yadav, TZH

An old Western with the war cry of 'snap.. snap.. snap', cueing in the greatest gunslinger of all time. The shrimp that carries a real-life working stun gun. A booming sound of 210 decibels, louder than an actual gunshot, temperatures of 8,000 degree Fahrenheit, and a pulverized prey. Also known as snapping shrimp or alpheid shrimp, the pistol shrimps are commonly found in oyster reefs, submerged seagrass, flats and coral reefs and are known for digging burrows. They are very small in size and grow no more than 3-5cm.

**The M.O.**  
The pistol shrimp has two claws, a small pincer and an enormous

snapper. The snapper, which resembles an oversized boxing glove, can grow up to half the length of the shrimp's body does not have two symmetrical halves like the pincer. It uses this snapper to stun prey, such as small crabs, by snapping the oversized claw shut. When the claw snaps shut, a jet

of water shoots out from a socket in the claw at speeds of up to 62 miles (100 kilometers) an hour, generating a low-pressure bubble in its wake. As the pressure

*If a shrimp loses its snapping claw, the other (pincer) claw will begin to morph into a pistol, while the lost claw will grow back as a pincer. ...indomitable.*



stabilizes, the bubble collapses with a loud bang. The bubble collapses, producing a flash of light, which is thought to be similar to sonoluminescence, in which bubbles that are in a liquid driven by a strong sound field emit light. If a shrimp loses its snapping claw, the other (pincer) claw will begin to morph into a pistol, while the lost claw will grow back as a pincer. Rendering these already intimidating creatures, indomitable.

### Mutual relationship

For all their orneriness, these critters are sociable and maintain monogamous relationships and several symbiotic associations. Willing to act as hired muscle, these can scare away predators, and share their burrows with Goby fish in a mutually beneficial relationship. The Goby fish and the Pistol Shrimp, are both on the lookout for prey and predator. The Goby fish gives the Shrimp prior warning, and the Shrimp often tidies up the burrow. The Shrimps often form colonies and a social structure

quite similar to Bees and Ants (only wetter).

When pistol shrimps are together in a colony, they can interfere with underwater communication and sonar. These organisms are also crucial in understanding habitat health.

*Between 1944 and 1945, the US Navy deliberately used snapping shrimp colonies as an "acoustic screen" to hide from the underwater hydrophones in Japan's harbours, allowing their submarines to enter undetected. The shrimp might even have had their own part in early atom bomb tests on Bikini Atoll.*

> THE PISTOL SHRIMP CARRIES A REAL-LIFE WOKRING STUN GUN.



# FACTOID

## YEARS WITHOUT SUMMERS: NUCLEAR WINTER

Scientists believe that if a nuclear warfare takes place then the consequences of it will be devastating. Nuclear firestorms would burn over a total land surface area of tens of thousands of square miles. Vast amounts of soot will be injected into the stratosphere and spread by winds, blocking out the sun and the temperatures would plummet. Such an enormous loss of warming sunlight would produce Ice Age weather conditions on Earth in a matter of weeks. It would be too cold to grow food, and it would remain this way long enough to cause most humans and animals to starve to death. Secondary effects such as pandemics could kill even more.

Today, there are about 16,300 nuclear warheads, enough for a Nuclear Holocaust. But the world's major powers, have long argued that their large nuclear arsenals are required for deterrence. But nuclear deterrence can fail, as demonstrated during events like the Cuban missile crisis, when there have been escalations towards nuclear war.



# VITA VERITA

# BODY

## AND THE

# BEATS

Ananya Banerjee, SZH

*Music probably serves as the best means of communication across different languages.* Irrespective of what words are sung; a song's tempo, beats or mood are well received beyond all geographical boundaries. How is it that a particular song can evoke different emotions in an individual—making them cry, smile or simply feel a chill down the spine?

### How does the brain process music?

Music is an example of an organized sound which is represented by different pitch, amplitudes, rhythms and tempos. The processing of music as an entity makes use of almost every region of the brain. When a sound signal (compression and rarefactions of air waves) impinges the ear drum or the inner ear, it further activates the cerebellum responsible for motor control and coordination. The ear and cerebellum together constitute the low-level processing unit; which breaks down the sound signal into its components:

- >Pitch
- >Timbre
- >Distance from source
- >Amplitude
- >Onset of different notes

These data are further conducted via neurons to the frontal lobes of brain which host the high-level processing unit. These broken down signals are passed on to the thalamus and the parasympathetic system comes into play. The signal is weighed in as a potential danger or not by the communication with hippocampus. A signal may evoke a sense of fear or excitement. The judgment of the signal by hippocampus (e.g. Fear) is relayed to the amygdala, which in turn causes an emotional response (excitement, remorse).

*The judgement of the signal by the hippocampus is relayed to the amygdala, which in turn causes an emotional response.*

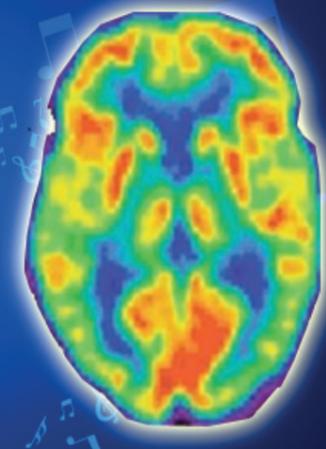
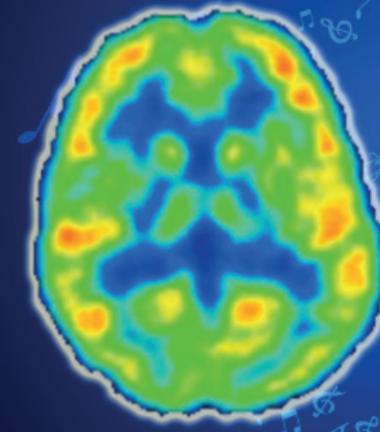
### Why do some sounds cause chills?

A song is usually made up of various combinations of sounds and the

## THE BRAINS REACTION TO MUSIC

The Brain at Rest

The Brain's Reaction to Music



brain keeps guessing them. When the brain guesses a particular portion correctly i.e. its expectations are met; it causes certain neurons to fire. Such as while listening to music, the neurotransmitter Dopamine is released from the nucleus accumbens. This neurotransmitter is responsible for the overwhelming feeling and thus in turn causes the hair follicles on the body to become erect; causing goosebumps or chills.

The perception of musical notes is closely associated with the amygdala and cerebellum. Music brings about a number of physiological changes in the body; which adjusts to a song based on its tempo or pace. A fast paced song causes an obvious increase in heart rate, blood pressure and breathing rates. Also a reduction in the baroreflex sensitivity is noted which thereby allows the rapid fluctuation in blood pressure. A slow paced song brings over

a sense of mental and physical relaxation. Also different genres of songs are capable of dilation of the pupils, bringing over a sense of euphoria and direct blood to the leg muscles.

### Looking ahead

Physicians have integrated music into medicine through “music therapy” to ease anxiety and other conditions, visual artists create illustrations using sound through the art of cymatics, and engineers work tirelessly to make the creation of music more accessible and more powerful.

At the same time, digital music has revolutionized the way we experience music. Electronic instruments are getting closer and closer to reproducing the authentic sounds and timbres of traditional instruments. Digital capabilities will continue to skyrocket. Science has helped pave the way for a multifaceted, exciting generation of music.

# ENDO- METR- IOSIS

The onset of menstruation cycle at the age of 12-13 years in girls when they hit their puberty is a turning point in their lives. Those five days of every month are a hormonal and emotional ride for every woman. Periods are something discussed as a hush-hush affair even amongst girls and hence it becomes all the more important to discuss the major problems that might accompany them.

*Ananya Banerjee, SZH*

**E**ndometriosis is a menstruation related disease in which the endometrium tissue (lining of uterus) begins to grow in regions outside the uterus. These regions include the fallopian tubes, ovaries, along the pelvis, bladder and in some rare cases, the lungs. The accumulation of these tissues may lead to the formation of cysts in certain areas.

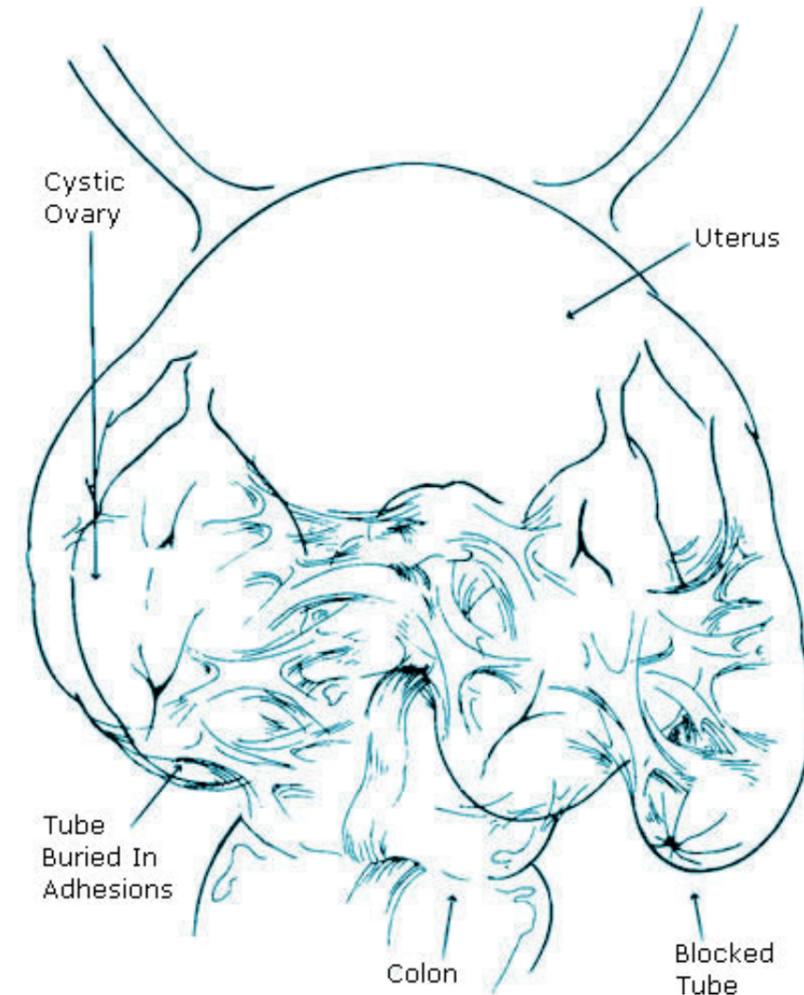
During the menstrual phase, the uterus begins to shed its inner endometrial lining along with blood vessels which exit the body from vagina. Also, abdominal cramps are experienced as the uterine and abdominal muscles contract to help removal of menstrual fluid.

In case of females suffering from endometriosis, the wrongly placed endometrium also begins to shed. However, it cannot be eliminated,

thus causing blood clotting and severe pain and inflammation.

There has been quite some speculation about the causes, and even though the exact reason is not known, researchers have put forward a number of theories for this. One theory speculates that the menstrual fluid sometimes flow back into the fallopian tubes (retrograde flow), emerge into the abdominal cavity, attach to structures and become endometriotic lesions. Another theory suggests that the immune system suffers some damage which cannot identify the dislocated endometrial cells as antigens and thus does not destroy them. Another theory states defects during embryonic development as a reason, which causes dislocation of these tissues.

About 5-20% of women worldwide suffer from this disease and



renders as many as 30-40% of affected females, infertile. It is a silent predator and an increasing threat. But, there still are certain symptoms that one can look out for. Endometriosis is identified by severe cramping that hampers daily activity. Also, blood clotting in other regions cause visible scar formation around those areas. If diagnosed early using laparoscopy, this disease can be slowed down thereby preventing infertility. Treatment involves a number of steps:

**Hormonal therapy-** this can be used as a manner of reducing cramp pains. With hormone derivative such as Donazol, the estrogen level are reduced, thereby causing a pseudomenopause which vvvcvin turn stops endometrial shedding.

**Gonadotrophin releasing hormone (GnRH) agonists-** which prevent ovulation for treatment period of six months. After treatment is completed, a woman may be able to conceive.

**Surgery-** in extreme cases, cyst removal surgeries need to be performed. However, as a last resort, hysterectomy (removal of uterus) may also need to be undertaken.

Endometriosis is a common problem, but, often women do not reach out due to the stigma associated with the issue. Hence, there is an increasing need for awareness in women across all age groups for a healthy reproductive system.

# IODINE DEFICIENCY IN PREGNANCY

## THE EFFECT ON NEURODEVELOPMENT OF THE FOETUS LEADING TO CRETINISM

Iodine deficiency is still one of the most common micronutrient deficiencies in the world today. Iodine is essential for the production of the thyroid hormones, thyroxine (T4) and the triiodothyronine (T3), which are vital for healthy metabolism, normal growth and development. Thyroid hormones in the foetus are necessary for neurodevelopment of the baby particularly the brain and CNS.

During the first trimester of pregnancy, the foetus is completely dependent on the mother for supply of thyroid hormone. Although the concentration of T4 in the foetus increases as gestation progresses, the reserves of the foetal gland are low and the gland itself does not fully mature until birth, thus maternal thyroid hormones continue to contribute to total foetal thyroid hormone concentrations until birth.

In order for a pregnant woman to produce enough thyroid hormones to meet her baby's requirement as well as her own, a 50% increase in iodine intake is recommended. If she is deficient in iodine and thyroid hormone during pregnancy, it results in damage to the developing brain of the foetus and the baby risks mental impairment. Severe iodine deficiency can lead to the extreme disability known as cretinism, characterised by profound

mental retardations.

Proper nutrition and diet is vital during pregnancy, specifically taking folic acid and vitamin-D supplements to ensure their growing baby gets the best start. Yet, iodine often gets overlooked. Studies have shown that pregnant mothers who were deficient in iodine were more likely to have children with learning difficulties.

Since our bodies cannot make iodine, we need to source it from our diets, mainly from milk and dairy products, sea foods, meat, etc. Various countries have adopted the norm to add iodine to table salt which is seen as the most effective way of raising a population's iodine level.

*Sukanya Bhuyan, SZH*

> A CHILD SUFFERING FROM CRETINISM-THINNING HAIRLINE REDUCED BMR, STUNTED PHYSICAL GROWTH, SEVERE MENTAL DEFECT



# THE BLOODY AFFAIR

*Urja Kalyani, SZH*

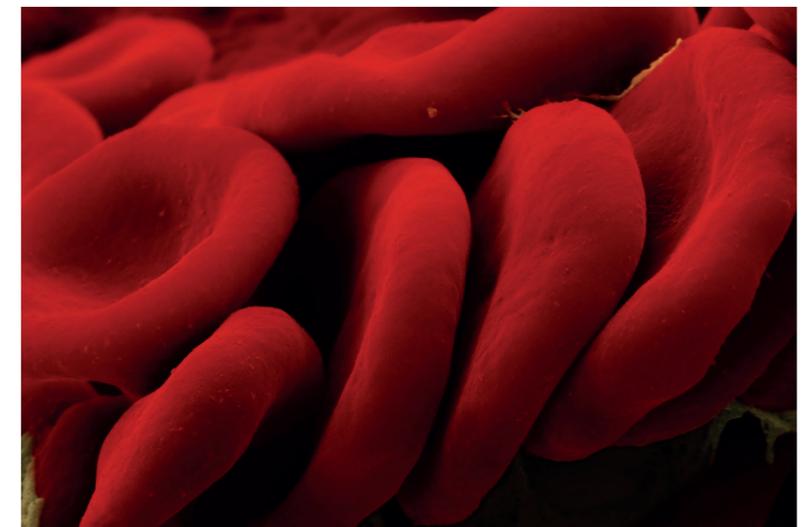
Our nation is one of the most diverse nations in the world so it does not come as a surprise that one of the rarest blood groups found on earth was recently discovered in India.

Blood is a fluid connective tissue of the body. It is mainly composed of plasma and different type of cells. The different cell types found in the blood are the RBCs (red blood cell), WBCs (white blood cells) and platelets. The ABO blood group is the most common blood grouping method used and is determined by the A B antigens found on the surface of RBCs. But every once in a while there are certain blood groups which do not match any previous blood groups known to mankind.

On 3rd September, 2016 in Surat, Gujarat a rare blood group was identified named INRA; IN stands for India and RA is the name of the blood donor. A person with a rare blood group is called a coltal in medical terms. Like all other discoveries this was also a chance encounter. A blood donation camp was held in Surat where the unique blood donor donated his blood. Later when the blood was taken to the lab for identification the doctors were unable to identify it and thinking that it was an uncommon blood group sent the blood sample to WHO (World Health Organisation). And they turned out to be right, the WHO confirmed that it was indeed a new blood group. The blood group is so rare that only seven people in the world

share it. The coltal's name has not yet been disclosed. What makes this blood group different is a question which cannot be answered yet. Research is being conducted on this blood to decipher its uniqueness.

One would think that it is nothing short of a miracle to be so unique in an already diverse world. But consider this, a coltal cannot donate blood neither receive it. This makes a coltal very vulnerable to succumb to injuries due to heavy blood loss. But this is not the first time for India. In 1952 another exclusive blood group was discovered in India called the Bombay Blood Group which is also extremely rare.



## WHAT REALLY DECIDES THE SHAPE OF CELESTIAL BODIES?

The form of a body is determined by the interaction between its gravity and solidity. Small asteroids and comets have little gravity, which is insufficient to force their larger rocks into a spherical distribution.

But the gravity of the significantly larger moons and planets is so strong, by contrast, that it turns these celestial bodies into spheres. There are, of course, still uneven features on the surface of planets, such as mountains and valleys, but they become smaller as gravity increases. Rotation – that is, the spin around their own axis – also plays an important role with regard to the shape of celestial bodies. The asteroid Cleopatra, for example, describes a full rotation in as little as 5.3 hours and therefore has the elongated form of a dumbbell: it is 135 miles long with a diameter of only about 56 miles. The large planets, too, are deformed through their rotation. The faster a planet rotates, the wider it becomes at the equator and the flatter at the poles. Our Earth is not a perfect sphere either. Its diameter over the poles is 26.5 miles smaller than at the equator.



## THE CURIOUS CASE OF CHROMOSOMES



# THE MAMMOTH TASK OF MAMMOTH DE-EXTINCTION

Anupama Nair, TZH

Every millennial grew up watching Manny the woolly mammoth in the Ice Age series, knowing that mammoths were an ancient relative of the elephant that died out thousands of years ago, possibly due to natural climate change or hunting by humans, or most likely a combination of both. But if you were told that there is a chance that these magnificent, giant creatures could be brought back from the dead, would you believe it?

Various researchers are currently attempting to achieve this very task, since the advent of newly discovered techniques that make it possible, theoretically, to once again welcome the woolly mammoth on to our planet. Two different techniques are being employed here; one by cloning and the other by DNA splicing. The scientists rooting for cloning are working on extracting intact DNA from the well-preserved remains of a few of these giants, inserting them into a donor egg retrieved from an Asian elephant, and then implanting the egg into a surrogate mother. The biggest challenge the scientists here face is the extraction of intact DNA, since regardless of the well-maintained remains of mammoths,

DNA is bound to get damaged over time. The second method, being employed by a team at Harvard University, involves using CRISPR to splice DNA from mammoth remains and inserting them into the DNA of Asian elephants. The DNA spliced include genes that make the mammoth adapted to sub-zero temperatures, including genes for their heat-trapping fur and their



short ears and tails. Once spliced and inserted, the researchers will have to ensure that the hybrid cells develop into specialised cells that exhibit these traits. And the step after this is one that concerns both methods: how can such an egg be implanted into the womb of a living elephant? Not only does this pose serious ethical questions but also technical ones, since there is no technique known to extract donor eggs from an elephant, let alone implant one into its womb.

In spite of all the difficulties facing this larger-than-life project, there are many possible benefits that drive scientists to try and successfully revive this species. A “Pleistocene Park” has been created in a frozen corner of Siberia, well beyond the reaches of any civilisation, where animals such as bison, oxen, moose, reindeer and horses are slowly grazing and trampling the tundra.

This process exposes the underlying soil to ice-cold air, protecting it from thawing and releasing substantial amounts of greenhouse gases into the atmosphere. The addition of the woolly mammoth to this park could enhance the effect of such an ecosystem. A second consequence of this particular project would be an increased interest in attempts of bringing other

endangered or recently-extinct species back to life. A clone of the extinct bucardo, a type of Pyrenean goat, had been created by French and Spanish scientists, although it survived only for 10 minutes. Attempts at resuscitating the gastric brooding frog and passenger pigeon are also being made. These projects may yield promising results that could have us reverse our effect on the survival of dozens of species. Worth giving our best shot, don't you think?

# Vaccine against Malaria: MIRACLE OR MIRAGE ?

Urja Kalyani, SZH

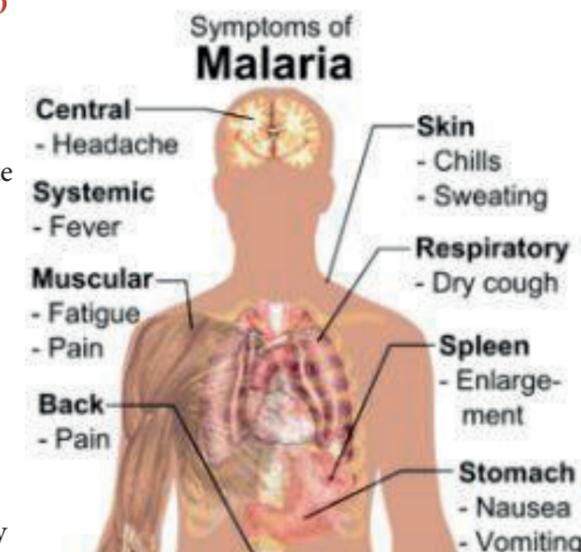
*The ubiquitous infection; the one we are too well acquainted with: Malaria. Every year, the world loses more than half a million people to malaria. Approximately, every 45 seconds, a child succumbs to malaria, ending in fatality.*

Malaria is caused by four types of Plasmodium species- *p. vivax*, *p. ovale*, *p. falciparum* and *p. malariae* though 120 species of the parasite genus Plasmodium occur in nature. Scientists have been fighting an indefatigable battle, with this malignant disease. In attempts to turning the wheel to a Malaria-proof future, a vaccine has been devised at the European Medicines Agency. Mosquirix (the RTS,S vaccine) is the contrivance of GlaxoSmithKline.

It is a recombinant protein-based malaria vaccine. Genetically modified yeast has been used to produce CS (circumsporozoite protein of Plasmodium falciparum) proteins in its repeat region denoted by “R.” The yeast is also manipulated to make a protein represented by “T” that alerts t-cells to recognize the pathogen. The “S” stands for the hepatitis B antigen used to elicit a stronger immune response by the body. A chemical adjuvant (AS01) has also been added to the vaccine to further increase the immune response. The final “S” stands for un-fused hepatitis B antigen which increases the surface area of the parasite making it conspicuous

to the immune system. When the malaria parasite (plasmodium) enters the human body, it first invades hepatocytes, multiplies, and then bursts out of the liver cells. Then it enters the erythrocytes where it continues multiplication and finally ruptures from the RBCs and enters body circulation. So the primary infection takes place in the liver. The vaccine works by inducing humoral and cell immunity in the organism and stops the parasite from entering the liver cells. After much scientific assessment and evaluation the agency has given a positive opinion to the vaccine. This is a first in prevention against a parasitic infection in humans. Trials among children in seven African countries have shown mixed results because of which there is a dilemma has struck scientists and policymakers alike; over its efficacy. However, scientists believe it to be a major milestone in development of a vaccine against parasites.

GSK initiated research on this vaccine 30 years ago and the first human trials began in 1998





in Africa. GSK established a partnership with PATH Malaria Vaccine Initiative in 2001 which was funded by Bill and Melinda Gates Foundation. World Health Organisation is yet to decide whether to recommend it or not and will give its final verdict. WHO will take into account issues not considered by regulators like feasibility, affordability and cost-effectiveness of the vaccine. Malaria is caused by the bite of female Anopheles mosquito which the carrier or vector and transfers the parasite into the human body. Creating a vaccine against bacteria or virus is easier than creating it against a parasite as it follows a complicated life cycle. This vaccine works by activating the immune system to shield itself against first stages of infection by Plasmodium falciparum. However, it is still only an additional protection against malaria along with proper barrier and chemical prophylaxis.

The Mosquirix jab was shown to provide best protection to children

aged five to seventeen months who were administered three doses a month apart and one booster dose at 20 months. Here the infection rates were cut by a third in four years. But the jab is required after this period which would require commendable organisation and additional cost as it is timed apart from childhood vaccine schedule. Moreover it is seen that all the four doses of the vaccine are required to benefit an individual.

Although, this is a small step towards an effective, cost productive vaccine against malaria, it validates that it is at least possible to design a vaccine against parasites.

# ORTHOPOX VIRUS BASED VACCINES

*Vaibhav Singh, SZH*

**M**ERS-CoV is a novel positive sense ssRNA virus of genus Betacoronavirus. The recently discovered coronavirus referred to as MERS-CoV (Middle East Respiratory Syndrome) causes an infectious respiratory disease in humans which can be fatal and virus is thought to be transmitted to humans after coming in contact with dromedary camels. A gene for so called spike protein of MERS was introduced into the genome of weakened strain of pox virus. The resulting modified particles expressed the protein on the surface of infected cells and these form the basis of new vaccine. Although camels infected with virus, show relatively mild symptoms still they can transmit the pathogen to humans, who can subsequently pass it on to others. Hence, vaccination of camel against MERS virus, is an obvious method of choice for the prevention of human infections. Immunization would deprive the virus of its primary host and will thus break the chain of transmission, but this vaccine turns out to have another advantage too. Immunisation with MVA-MERS-S simultaneously protect camels from camel pox which is similar to small pox of humans.

The camels infected with MERS

virus show symptoms that are confined to upper respiratory tract. The vaccination with MVA-MERS-S even reduces the number of viruses present in the nasal epithelia of camels.

The origin of outbreak where more than 180 people were infected with MERS in South Korea in early summer of 2015 was traced to a single carrier who had recently returned from Middle East. Thus all confirmed infections in humans have so far been linked to directly or indirectly to that part of the world only hence the name MERS-CoV (Middle East Respiratory Syndrome Coronavirus) for the pathogen responsible .

Thus along with implementation of hygiene measures to limit further camel to human and human to human transmissions , vaccine mediated reduction of MERS-CoV spread from animal reservoir may be envisaged . A modified vaccinia virus Ankara (MVA) expressing MERS-CoV spike protein confers mucosal immunity along with a significant reduction of excreted infectious virus and viral RNA transcripts of vaccinated animals upon MERS-CoV damage.

# Schizophrenia:

## Researchers pinpoint rare genetic risk variants

*In the largest genome-wide study of its kind, researchers have uncovered several rare genetic variations that can increase the risk of schizophrenia by up to 60 times.*

Swostik Preetam Padhy, SZH

### What is schizophrenia?

Schizophrenia is a chronic mental disorder characterized by delusions, hallucinations, abnormal thoughts, and agitated body movements. According to the World Health Organization (WHO), more than 21 million people worldwide are affected by schizophrenia, with the disorder being more common among males than females. In the United States, schizophrenia is estimated to affect around 3.5 million people, making it one of the leading causes of disability in the country.

### How genetic variations increase the risk of schizophrenia.

In recent years, researchers have been learning more about the genetic causes of schizophrenia. Earlier this year, for example, Medical News Today reported on a study revealing how a variant of a gene called C4 contributes to schizophrenia development. Now, an international team of researchers from the Psychiatric Genomics Consortium has uncovered further genetic variations

that raise the risk of schizophrenia. Eight genomic regions hold mutations linked to schizophrenia. The team searched the genomes of 41,321 individuals, of whom 21,094 had schizophrenia and 20,227 did not. The researchers identified eight regions of the genome that possess mutations called “copy number variations” (CNVs) that are associated with increased risk of schizophrenia. In other words, these mutations are significantly more common in people with schizophrenia than those in the general population.

CNVs are copies or deletions of DNA sequences that can affect normal gene functioning, increasing the risk of certain diseases and disorders.

In this study, the CNVs identified by the researchers were shown to increase the risk of schizophrenia development by four- to 60-fold. What is more, these CNVs were found to be more common among genes that play a role in the function of synapses - the structures that connect nerve cells, or neurons, and transmit chemical signals.

The researchers note that only a

small percentage of study subjects had the schizophrenia-associated CNVs - around 1.4 percent - showing that these mutations are rare.

Further analyses are needed in order to uncover more rare genetic variants that may increase the risk of schizophrenia, the researchers note, but the current research has made a strong start.



# VERDUROUS VIRIDISCENCE



# DECLINING GATOR POPULATION IN EVERGLADES

*Sukanya Bhuyan, FZH*



Alligators have thrived in the Florida Everglades for years, inhabiting freshwater swamps and marshes, rivers, lakes, and smaller bodies of water. Adult male alligators occasionally reach 13 to 15 feet in length and the maximum length for females is approximately 10 feet. However, recent studies reveal that alligators in Florida's Everglades National Park are in trouble; scientists studying their population are now finding fewer and smaller gators. They are remarkably thin, weighing 80 percent of what they should, and their growth is delayed. In most other places, if an alligator is 10 years old it is easily 6 feet long whereas in the Everglades, it is only 4 or 5 feet at the same age. What's worse is they are reproducing less and dying at a younger age, which raises concern among wildlife conservationists. Alligators are an indicator species of the Everglades; their health is reflective of the health of the watershed's ecosystem. It is believed that human activity is largely to blame for altering the area's water flow, and subsequently the animals' food supply. The declining health of the alligators, is thought to be tied to a massive drainage project that first began in the Everglades decades ago. In order to develop what is now metropolitan South Florida, massive pumps were installed in the 1950s to drain much of the Everglades out into the ocean.

Scientists say the redirecting of water dramatically polluted and shrank the wildlife refuge. About a century ago, the Everglades stretched about 4 million acres, but today that's down to about 1.9 million acres.

"The Everglades food machine is broken," Frank Mazzotti, a professor of wildlife ecology at University of Florida, added. "We've screwed up that pattern that produced and concentrated food, meaning alligators are getting skinnier."

A constant echo, lately, the decline of populations of various species, far and wide, with one repetitive pattern emerging. Us. The vast decline and decay due to humans, in this short span of time we have been on earth is appalling. Must we wait till the very end to change our ways?

# DROWNED OUT

*Akhil Sadiq, SZH*

Think about climate change and animals, and a picture of a Polar Bear comes to your mind. In fact, it is very unlikely for anyone to think of a rat-like species found in Australia. Bramble Cay Melomys (*Melomys rubicola*) are the first mammals to go extinct because of global warming. These rodents were endemic to the Great Barrier Reef. The last known sighting was in the year 2009. A comprehensive survey was conducted in 2014, however, the rodent was found. The Bramble Cay Melomys is named after the island they had previously inhabited. The Bramble Cay was just 340m long and 150m wide in the Torres Strait, between Queensland in Australia and Papua

New Guinea. The cay is about 3m from sea level. Rising sea level is the main culprit. In a report co-authored by Natalie Waller and Luke Leung from the University of Queensland, it is indicated that about 97% of Melomys' habitat was destroyed by rising sea level. "For low-lying islands like Bramble Cay, the destructive effects of extreme water levels resulting from severe meteorological events are compounded by the impacts from the anthropogenic climate change-driven sea-level rise," Waller and Leung wrote in the report. With the rising temperature, the polar ice caps are melting at an alarming rate and the sea level has risen by 7.5 inches in the last

century. So if we don't do anything fast, these rodents might not be the last animal to die due to anthropogenic climate change.





# Mini Forests Mega Change

Disappearing islands, thawing permafrost, melting polar ice. How the Earth is changing. These are some of the consequences of our activities that have led to this ongoing catastrophic phenomenon, Global Warming. We are burning ourselves with our own hands. Slowly and slowly but surely this fire will consume the entire planet. This is true, we have taken measures to prevent it or at least control it, but to no avail. We all know about the rampant, reckless felling of the trees or worse, entire forests. All in the name of Urbanisation. Yes, development is a requirement but at the cost of our own along with each and every creature's life is so not justified. Once a forest's lost, it's lost. Or is it? A forest planted by a team of researchers led by senior faculty

member Dr. T.V. Ramachandra (Energy and Wetlands Research Group) in the IISc CSE campus is breathtakingly beautiful. The man-made forest began as an experiment to study the adaptability of tree species endemic to the Western Ghats to a habitat and conditions considered alien to these species. It was also done to conserve native woodland trees and study their adaptability to afforestation programs in urban spaces. To do this, 500 saplings of 49 species were planted on two hectares land in the late 1980s. The region chosen was scrub jungle infested with Parthenium weed and an annual rainfall of just 850 mm compared to the 6000 mm received by the Western Ghats. In less than 25 years, the mini-forest transformed into a lush jungle of dense fruit and flowering trees, which have had a positive

*Soumya Mallick, FZH*

impact on the micro-climate of the campus. Walk around it and you will encounter several species of trees, native and exotic. The 400 acre campus is home to 112 species of trees and 45 species of grass. Some of the species thriving here are *mahua*, *arjuna*, *hirik*, *ylang-ylang*, and the lovely *liana*, found only in the moist tropical forests of the Ghats. These green spaces also act as carbon sinks, sequestering atmospheric carbon, lowering temperature, and mitigating climate change issues. They are also capable of rising the water table by several feet. We must carry this novel experiment forward. These are the kind of efforts that may undo the havoc we have already wreaked, and may be a glimmer of hope for mankind.

# INDIA LOSES SIBERIAN CRANES



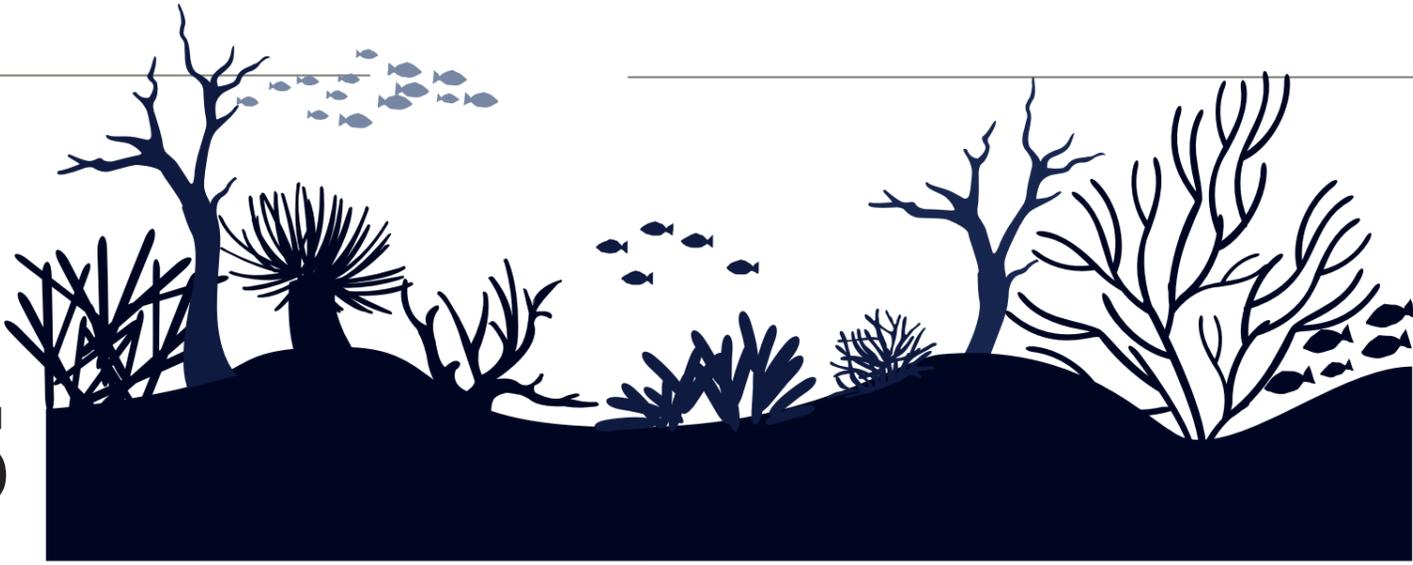
*Sukanya Bhuyan, FZH*

Every winter, the famous Keoladeo National Park (formerly known as Bharatpur Bird Sanctuary) of Rajasthan housed the majestic Siberian cranes. These birds migrated to India to escape the dead cold winter of Siberia and to rear their young ones and for better living conditions. Usually, the Siberian Cranes would start flying towards India in mid-October and stay here till March or April. But sadly, It has been 15 years since this bird was last spotted in this part of India. Why don't Siberian cranes flock to India during their annual winter migration anymore? At its peak, in 1965, Bharatpur hosted over 200 Siberian Cranes. Less than 30 years later, in 1993, only five were sighted there. Then, after a gap of three years, four were spotted in 1996. That was reduced to barely a pair of these birds by the late 1990s, followed by the last pair seen in 2001. Depending on their breeding habitats, the Siberian Cranes

were classified into central, western and eastern populations. Birds belonging to the eastern population spend their winter along the middle Yangtze River in China. The western population spends it's winter's in Iran. The central population, which used to come to India during winters for over two centuries, is now considered to be extinct. Mohammed Dilawar, founder of Nashik-based Nature Forever Society is of the opinion that the war-ridden migratory path of the birds is the main reason behind the decrease in numbers. The route falls over countries like Russia, Kazakhstan, Uzbekistan, Afghanistan, Pakistan. The birds halt for a short amount of time in the Abi-I-Istada Lake in Afghanistan. They are hunted in large numbers in this lake. This combined with their natural habitat destruction reduced the numbers to a great extent.

# The End of The Reefs

Soumya Mallick, FZH



*A fine view of majestic architecture, the vista of a vast magnificence, unparalleled beauty. A site, teeming with life, the way the parrot fish gnaw at the bright coloured reefs for algae. Or how the fire coral shimmers in sunlight.*

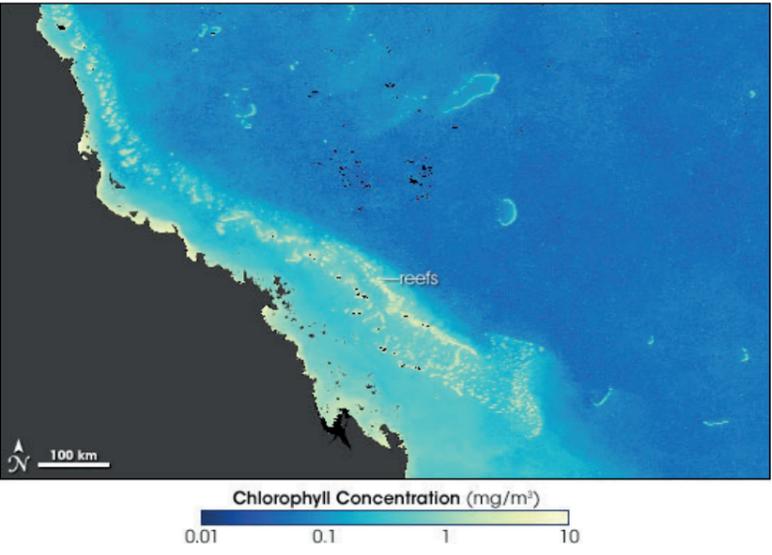
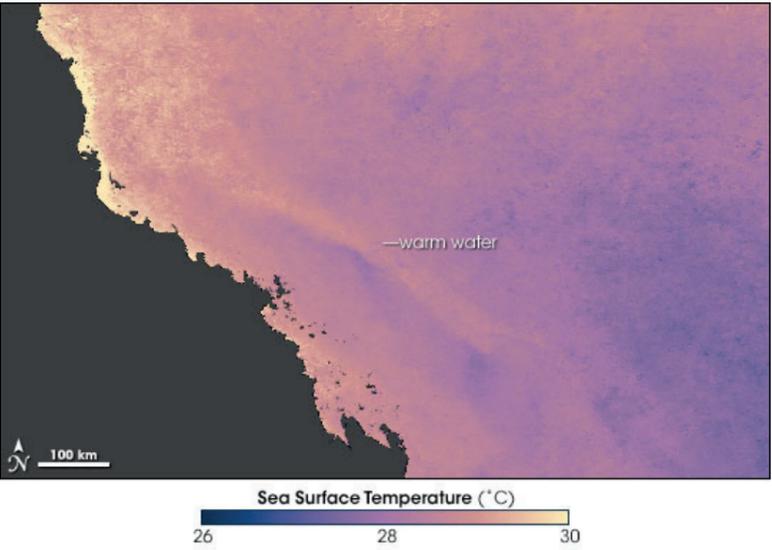
Corals are tiny animals that live in large communities made up of individual polyps that secrete a calcium carbonate substance that hardens and builds up to form the reef structure over time. Classified as marine invertebrates in the class Anthozoa of phylum Cnidaria, these organisms form a unique ecosystem of Coral reefs. Coral reefs can be best described as a blast of colours in a huge monochromatic blue space. They are not just mounds of limestone but entire ecosystems that are home to several thousand different varieties of other creatures like fishes, molluscs, arthropods etc. They are the richest of all marine biomes. They are home to nearly 25% of all known marine species. The corals have been a part of our

Planet Earth since the Ordovician Period of the Palaeozoic era. Yes, that long. So, it won't be wrong to say that the reefs have a lot of tales to tell. But here is where misery strikes these reefs. Human intervention. Thanks to us that two-thirds of a 430-mile stretch in the northern part of the Great Barrier Reef is dead. Coral bleaching is a process by which the corals due to adverse conditions expel out the zooxanthellae in their tissues causing the coral to turn completely white. These reefs took millions of years to form and now, globally, many coral bleaching events have been taking place. Ocean acidification, global warming, toxic oil spills, coral mining to obtain calcium carbonate, overfishing, habitat destruction, etc. are the biggest threats to their lifelines. Gifts that mankind has given to nature. Corals and coral reefs are extremely important to marine ecosystems. They provide shelter, protection, food to a multitude of creatures. The three kinds of reefs, fringing, barrier and atolls provide land to terrestrial animals and plants to live on. Even the avian diversity is just as vibrant. How can we bear to destroy something so precious, without shedding a

thought? No one can deny that the beauty of these reefs is truly enchanting. There must be something left for the future generations to hold onto except the ignominious remains of the fragmented environment.

**Preserve the reefs.  
Preserve the heritage.**

*Thanks to us, two-thirds of a 430-mile stretch in the northern part of the Great Barrier Reef is dead.*

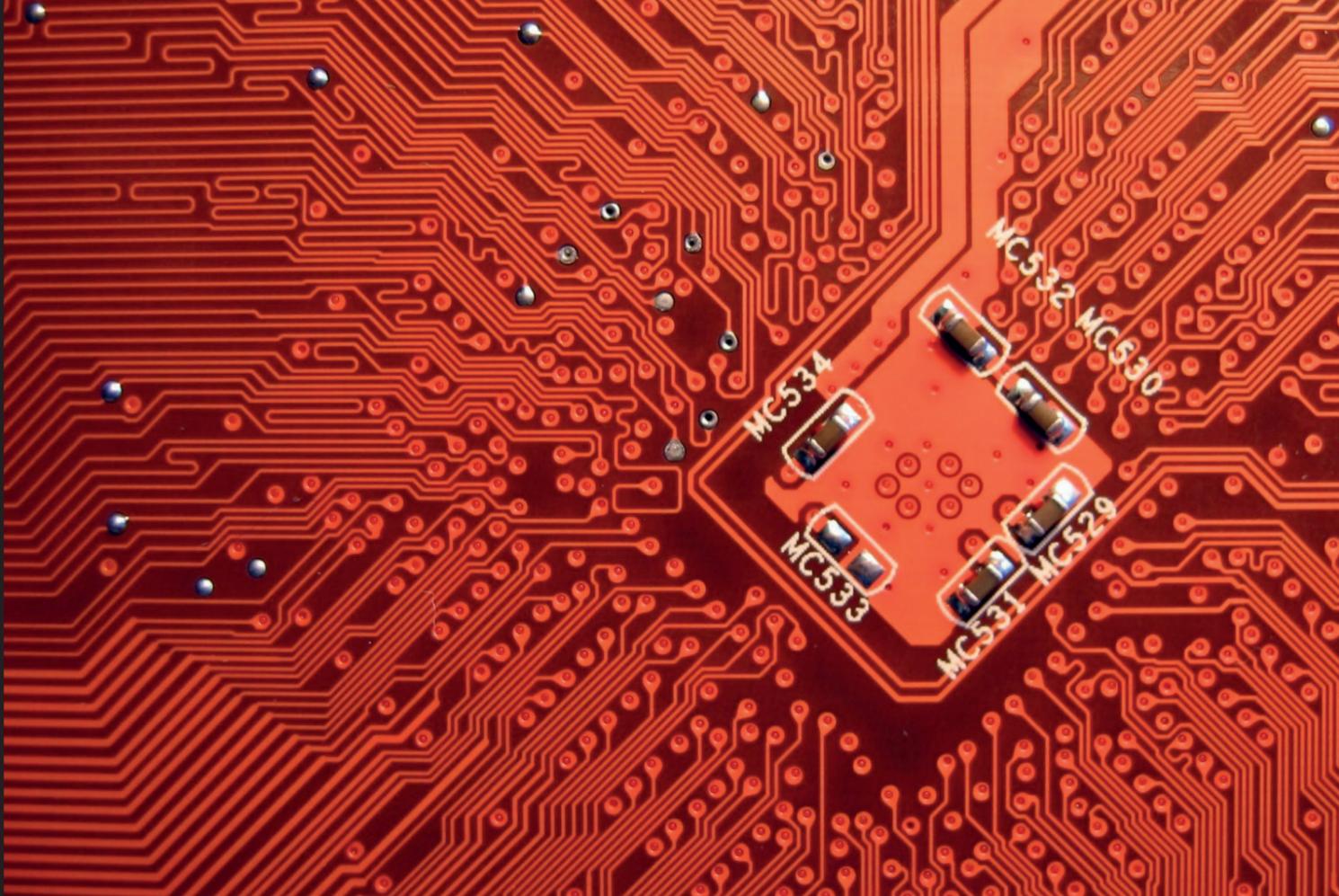


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## ECHOLOCAATION

Echolocation is the process of using sound waves to locate objects that may be at a distance or invisible. It is used for orientation, avoiding obstacles, locating prey and also for social interactions. Small bats are mostly insectivores that find their flying prey at dusk using echolocation. Bats produce sounds with their larynx which is adapted to produce loud, high-frequency sounds. The quality, frequency, duration, and repetition rate of the sounds produced varies with the species of bat and with the situation.

Dolphins and toothed whales use echolocation to orient themselves and locate objects in the water. These animals rely on sound production and reception to navigate, communicate, and hunt in dark or murky waters where sight is of little use. In addition to the larynx, a complex system of cavities connected to their blowhole is also adapted for this purpose.



# PROLIFIC PROGRESSIONS

# SYNTHETIC BLOOD VESSELS

Saiyami Bhardwaj, SZH

The rapidly advancing world of regenerative medicine just got wilder as researchers have reported a better technique for growing starter arteries for people with vascular disease who need replacements. The researchers have achieved early success on animal studies and hopes to soon move into human trials.

Blocked blood vessels can quickly become dangerous and, often it becomes necessary to replace a blood vessel taken from a body or from artificial vascular prostheses. The landmark work comes from the researchers in the US who made synthetic arteries that could grow when they are implanted within the body. These synthetic blood vessels that are bioengineered in lab are capable of growth within the recipient. It serves as a product not affected by financial and timing constraints. As a result it is believed that children born with serious heart defects could be treated in single operation instead of multiple rounds of open heart surgery because earlier used implants - known as conduits used to replace their malformed blood vessels do not grow in line with their heart and the rest of the body. So far ranging from 2 mm to 24 mm wide synthetic blood vessels have been made to suit heart from babies to adults. Thus this is a very attractive approach from clinical point of view.

Synthetic blood vessels are made from gels seeded with living cells called "Fibroblasts". Fibroblasts



basically churn out the stretchy collagen web that gives skin its strength. These are wrapped around in little rods and grown in a bioreactor so as to provide the cells with all the warmth, exercise and nutrients they need to grow to prevent the immune reaction in the recipient the blood vessels are washed in detergents to strip out all of the living cells. One skin biopsy holds enough cells to make thousand of synthetic vessels. These bioengineered blood vessels when implanted in three young lambs as a replaced section of pulmonary artery which carries oxygenated blood from heart to the lungs showed positive results. These blood vessels grew at a normal rate as the animals aged and these had an inner lining and contained smooth muscle cells and elastin.

*This is an exceptional effort towards saving millions of lives, and another opportunity for us to bow our heads in gratitude to Science.*



# NOVEL ELEMENTS

Urja Kalyani, SZH

The science community has four newly named elements in the periodic table and these names are here to stay.

Following convention, an element can be named after a place, or geographical region, a mythical character, a scientist's name, a substance or a property of the element. The new elements named are nihonium, moscovium, tennessine and oganesson with atomic numbers 113,115,117 and 118 respectively. An atomic number is the number of protons surrounding the nucleus of an atom. Therefore, heavier the element more will be its atomic number.

All these elements are synthetic and do not occur in nature. Also, these elements belong to the p block of the periodic table. The names were approved by IUPAC (International Union of Pure and Applied Chemistry).

## Nihonium

'Nihon' means 'Japan' in Japanese language and its literal translation is 'land of the rising sun'. Nihonium is the first element to be discovered in an Asian country and is given the symbol Nh. This element is named honouring the nation where it was discovered. The name was proposed by the team headed by Professor Kosuke Morita at RIKEN Nishina centre for Accelerator based science (Japan).

It is a highly radioactive element with only few atoms previously

made and has an atomic mass of 286. Very little is known about its chemical properties. It was formerly named ununtrium which means one one three in Latin.

## Moscovium

Moscovium with atomic mass 289 is part of group 15 of the periodic table and is expected to have similar properties as Bismuth. The heavy metal element is named after Moscow, Russia's capital. The metal is so named because the discovery experiments were done in Joint Institute for Nuclear Research which is in Moscow.

It is again a radioactive element and has 4 isotopes none of which are stable. Assigned the symbol Mc, Moscovium has replaced its transient name ununpentium (115, in Latin).

## Tennessine

This element is as the name suggests named after the state Tennessee in the U.S. for its contribution to its discovery. The name was collectively proposed by the scientists at Oak Ridge National Laboratory, Vanderbilt University and University of Tennessee at Knoxville.

Tennessine is also a radioactive element with atomic mass 294. It can be produced by bombarding

Bk (249) and Ca (48) in a heavy ion accelerator. It was previously named ununseptium which means one one seven in Latin. It is denoted by Ts.

## Oganesson

Named after physicist Yuri Oganesson, the element honours his work in the field of element pursuit such as transactinoid elements and super heavy metals along with his contribution to the nuclear physics regarding super heavy nuclei, namely the experiment providing evidence for 'island of stability'. The heavy metal was discovered by team steered by Yuri Oganesson and Ken Moody. Oganesson is part of group 18 of the periodic table and is a noble gas i.e. it has maximum number of valence electrons in its outer shell. It is harmful because of its radioactivity and has atomic mass 294. Called before as ununoctium (118, in Latin), it is denoted by the symbol Og.

With these new elements the seventh period (row) of the periodic table is now complete and the search for more heavy elements continues.

*Nihonium, Moscovium, Tennessine, Oganesson*



A. Tharanirakshita, FZH

The beep of ventilators and infusion pumps, the hiss of oxygen, the whirl of carts and the murmur of voices as physicians and nurses make rounds — these are the typical noises a premature infant hears spending the first days of life in the neonatal intensive care unit (NICU). While the sounds of such life-saving equipment are tough to mute, a new study suggests that some sounds, such as lullabies, may soothe pre-term babies and their parents, and even improve the infants' sleeping and eating patterns, while decreasing parents' stress. At its core, music is sound, and sound is rooted in vibration. Several researchers are exploring whether sound vibrations absorbed through the body can help ease the symptoms of Parkinson's disease, fibromyalgia and depression. Known as vibroacoustic therapy, the intervention involves using low frequency sound, similar to a low rumble to produce vibrations that are applied directly to the body. During vibroacoustic therapy, the patient lies on a mat or bed or sits in a chair embedded with speakers that transmit vibrations at specific computer-generated frequencies

that can be heard and felt. In 2009, researchers, found that short-term use of vibroacoustic therapy with Parkinson's disease patients led to improvements in symptoms, including less rigidity and better walking speed with bigger steps and reduced tremors. The group is also examining something called thalamocortical dysrhythmia — a disorientation of rhythmic brain activity involving the thalamus and the outer cortex that appears to play a role in several medical conditions including Parkinson's, fibromyalgia and possibly even Alzheimer's disease. Since the rhythmic pulses of music can drive and stabilize this disorientation, it is believed that low-frequency sound might help with these conditions. The hope is that using the therapy to restore normal communication among brain regions may allow for greater memory retrieval. There are glimmers of hope in a case study being conducted on a patient who has been recently diagnosed with the disorder. After stimulating her with 40-hertz sound for 30 minutes three times a week for four weeks, the patient was

able to recall the names of their grandchildren more easily, and reported positive improvement in condition. The goal of all of this work is to develop "dosable" and "prescribable" music therapy and music as medicine protocols that serve specific neurologic functions and attend to deficits that may result from many of these neurologically based conditions. Rather than viewing music only as a cultural phenomenon, the art should be seen as a vibratory stimulus that has cognitive and memory dimensions.

Next time your mother tells you off for listening to music, channel your inner scientist and challenge her to a sing-along.



# MEASURE THE STARDUST



Aparna, SZH

*Imagine watching the birth of the stars, the formation of the universe, the stuff of myths and legends. Imagine being a spectator to the beginning of time.*

ALMA, or the Atacama Large Millimetre Array, an astronomical interferometer of radio telescopes in the Atacama Desert of northern Chile, may provide insight to the formation of stars, and the early universe, and provide detailed imaging of local star and planet formation. An incredible feat, in itself. A concept born from an international partnership among Europe, the United States, Canada, Japan, South Korea, Taiwan and Chile, ALMA, can measure size of very minute particles, like newly formed dust particles of a star, nebula, any radiation hitting some cosmic bodies, emitting particles or matter.

### How it works

Essentially, an interferometer of 66 12-metre (39 ft.) and 7-metre

(23 ft.) diameter radio telescopes, observing at millimetre and submillimetre wavelengths, the initial ALMA array has 66 high-precision antennas, which operate at wavelengths of 0.3 to 9.6 mm. What is peculiar about this technique is the high sensitivity and the overall resolution it can achieve, as compared to other submillimetre telescopes such as, single-dish James Clerk Maxwell Telescope or other existing technologies. This interferometer has spatial resolution of 10 milli arc seconds, 10 times better than the Very Large Array (VLA) and 5 times better than the Hubble Space Telescope, but still considerably lower than the resolution achieved with optical and infrared interferometers.



**Performance so far.**

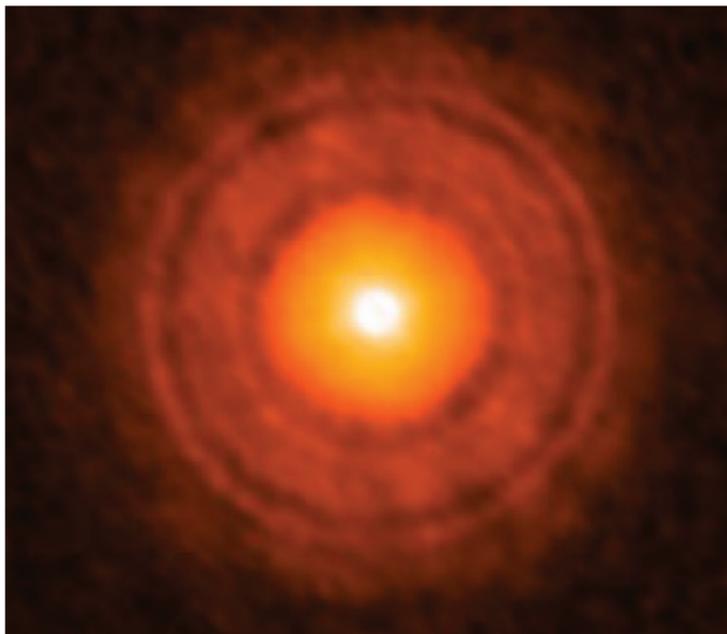
ALMA has consistently produced unique and spectacular results. The fields in which it has delivered its most outstanding results include:

>Providing images of protoplanetary disks such as HL Tau, which transformed the previously accepted theories about the planetary formation.

>Observing phenomena such as Einstein Rings in extraordinary detail, providing a level of resolution not achieved by the NASA/ESA Hubble Space Telescope.

>The detection of complex organic molecules — carbon-based, pre-biotic structures, necessary for building life — in distant protoplanetary disk, confirming that our Solar System is not unique in potentially fostering life.

From one giant leap for mankind, to finding inconceivable answers to unthinkable enigmas, Science has been advancing with astounding speed. It is truly a privilege to be a spectator in this ever-changing universe.



>ALMA IMAGE OF THE DISK AROUND THE YOUNG STAR TW HYDRAE

**QUOTABLE**

“  
Twinkle Twinkle little star  
I don't wonder what you are  
Through the spectroscopic ken  
I know that you are hydrogen.”

-Lewis fry Richardson

**THE HYPE OVER THE**

**HYPERLOOP**

*The 21st century has been pictured in sci-fi movies as the century of lasers, robots, flying cars and transit as fast as light. While we do have a lot of technological advancements, most current mass transit systems are outdated, overburdened and costly to maintain. Too many cities are plagued by traffic congestion and poor air quality, factors that are eating up our time.*

*Mrigya Kaushik, SZH*

**B**ack in August 2010, China saw the mother of all traffic jams, with traffic packed roads that stretched for more than 100 kilometres and it lasted for 12 long days. Coming closer to home, Delhi, sees people spending an average of 3.43 hours on the road every day with an average speed of 20kmph during peak hours! Experts say unless immediate steps are taken to unclog its roads, Delhi may find itself crawling at 5 KM/hour — the average speed of a human walking — in the next 10 years.

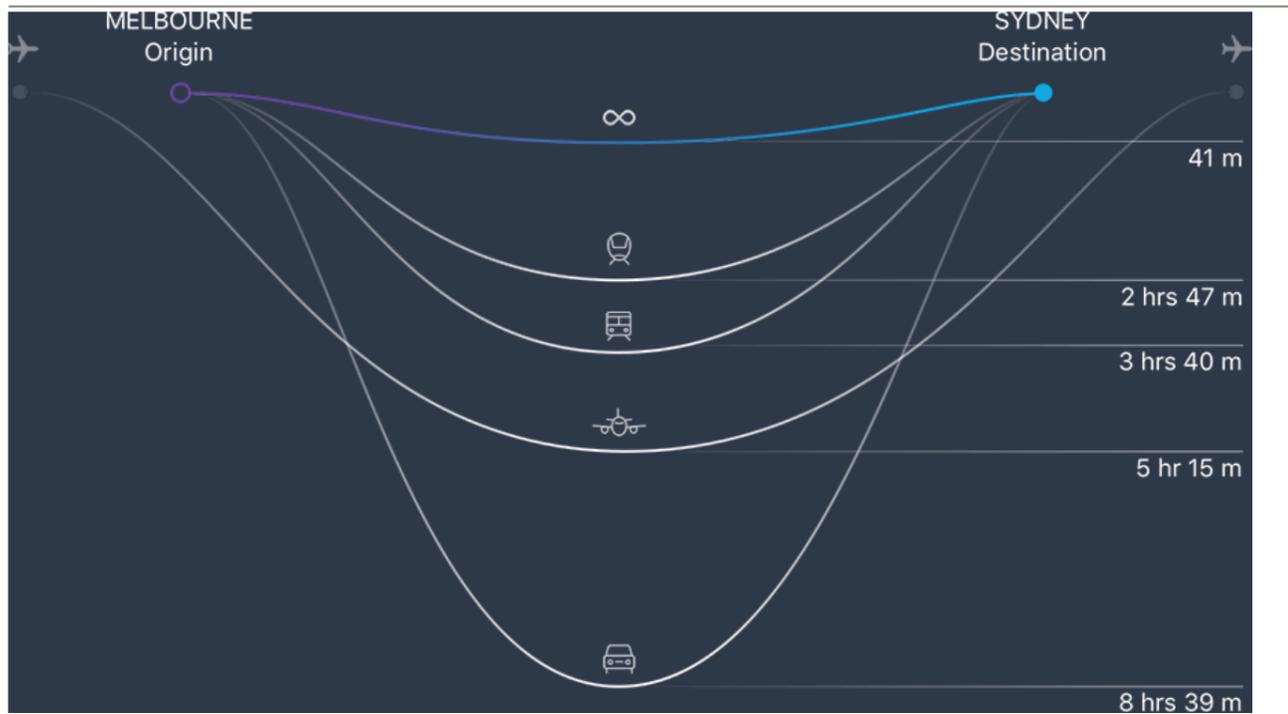
The man of the hour: Elon Musk. The Tesla Motors and SpaceX founder, released a concept for a new form of transportation that he called the “Hyperloop,” an invention that would revolutionize the way we commute between major cities while severely cutting down the travel time. The Hyperloop would propel riders in pods through a network of low-pressure tubes at speeds ranging from 900kmph to 1200 kmph. Musk suggested that the Hyperloop could take from 7 to 10 years to be ready for consumer use.

**What it is:**

A new way of land transportation with airplane speeds. As some like to call it, “broadband for transportation”, the Hyperloop is essentially a futuristic train that Mr. Musk calls “a cross between a Concorde, a railgun and an air hockey table”. It’s based on the very high speed transit (VHST) system which combines a magnetic levitation train and a low pressure transit tube. Mr. Musk has likened it to a vacuum tube system. A tube in which passenger carrying pods will levitate by the use of air bearings for pods instead of traditional wheels.

**How is it better:**

- >Better speed, it could take you from Mumbai to Pune in about 25 minutes and LA to San Francisco in 30 minutes against the average 6 hours.
- >Energy efficient, it will be a self-sufficient machine which will run largely on renewable energy sources.
- >Lower cost of construction,



compared to other mass transport systems, the cost of setting up a Hyperloop will be significantly lower. In some cases, it can also be built over land already in use for public transportation, such as in the medians of freeways.

>Affordable Travel, since there is less going in to the construction of the system, it will directly reflect in the prices of the tickets.

It's happening faster than we think. Many companies have taken the responsibility to commercialize the technology, and available for consumer usage. Experts believe that Hyperloop could be a reality by the year 2020!

So prepare yourselves for a revolutionary change in the way we travel. The world is soon going to change into the sets of a Sci-fi movie!

## QUOTABLE

“ It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change. ”

—Charles Darwin

# SCIENTIFIC METHOD



RESEARCH



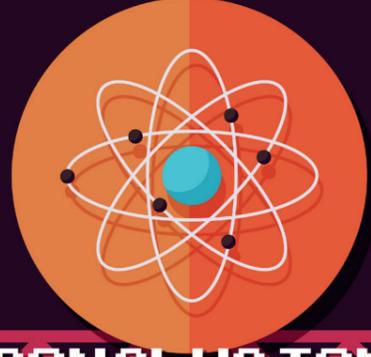
PROBLEM



HYPOTHESIS

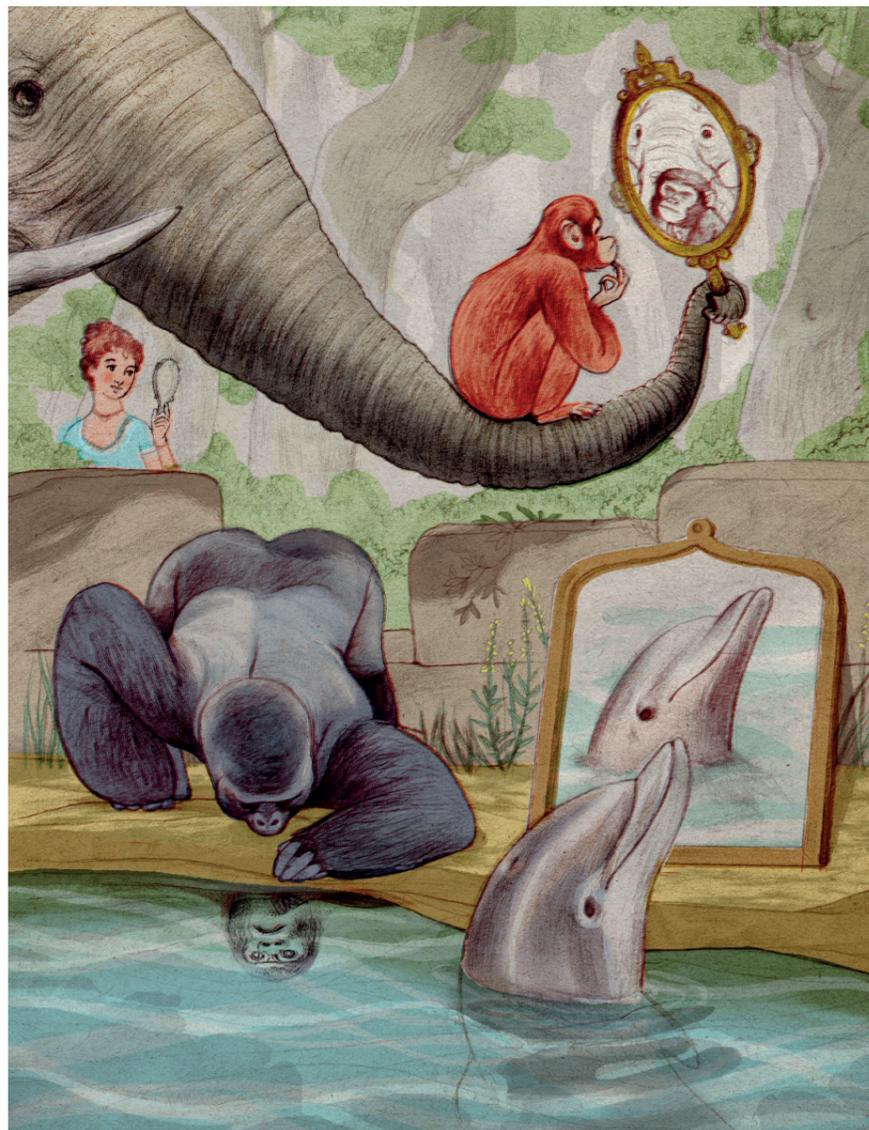


EXPERIMENT



CONCLUSION

# CURATED CONCOCTION



Anwasha Mukhopadhyay, TZH

# MIRROR, MIRROR ON THE WALL

An average human being looks into the mirror approximately 25 times during the day. We don't even notice half the time. But what about other animals or humans who haven't been exposed to a mirror? How do they react? Do they immediately know that the person looking back at them from this strange object is nobody but themselves or do they need time or training to understand? Self-recognition is a process by which an organism distinguishes itself from foreign organisms and agents. The most common technique used to test self-recognition is the Mirror Test or Mark test or Mirror self-recognition Test (MSR) developed by Gordon Gallup Jr. In this test a mark is placed on a part of the body of the animal which it cannot see without the aid of a mirror. The animal is placed in a room or a cage with a mirror for a certain period of time. If it is observed that the animal attempts and succeeds to remove the mark by looking at its reflection then it is said that the animal as passed the Mark test. Homo sapiens show self-recognition from about 18 months of age or the "Mirror Stage". Human infants show 5 stages of development leading to self-awareness as told by Rochat. Level 0 is Confusion. Level 1 is Differentiation. Level 2 is called Situation. Level 3 is Identification. Level 4 is called Permanence. They can recognise themselves in pervious pictures of different or a younger self. Level 5 is Self-consciousness or Meta self-awareness. Gordon Gallup Jr. examined the possibility of self-recognition in chimpanzees (*Pan troglodytes*). He selected two males and two female preadolescent chimpanzees with little or no

experience to mirrors. Each animal was placed in a cage alone. After two days of isolation a mirror was placed and the responses such as bobbing vocalizing and threatening were observed and recorded every 30 seconds for 15 minute sessions twice a day for 10 days. It was observed that over time these social responses decreased and self-directed behaviours such as grooming parts of their body which would not be seen without the mirror, picking bits of food out from between teeth while watching their reflection, making faces etc. were seen. It was concluded that chimpanzees after a long period of exposure to mirrors showed signs of being able to recognise themselves. Orangutans have also shown signs of self-directed behaviour in the presence of a mirror. Tests on Spider monkeys, capuchins, macaques, mandrill and hamadrya baboons, Gibbons were also conducted. However, they were unable to demonstrate self-awareness in them. Apart from humans and apes, it is seen that Dolphins (*Tursiops truncatus*) and Asian elephants (*Elephas maximus*) also show evidence of self-recognition. Similar tests were conducted on these animals. The elephants were exposed to the mirror and a white or a yellow mark was placed on their head. To test the possibility of tactile cues, sham marks or marks of the same colour of skin were placed. This proved the absence of odor or tactile cues. On seeing the reflection on the mirror, after an initial aggression, they made attempts to remove their marks using their trunks which proved the possibility of self-recognition in these animals. Studies have shown that pigeons can distinguish between themselves and videos of themselves even within a 5-7

second delay proving that pigeons have higher cognitive abilities than an untrained 3 year old human who has a difficulty in recognising their self-image after a 2 second delay. Eurasian Magpies (*Pica pica*) have developed mental skills including tool use and episodic memory similar to those found in humans and apes. Currently, research is being done on self-awareness in Zebra Finches and Common crows. Turns out Humans aren't the only self-aware beings on this planet. Who knows who will rule the earth a million years from now.

### "Self-Awareness" in the Pigeon

Abstract. Each of three pigeons used a mirror to locate a spot on its body which it could not see directly. Although similar behavior in primates has been attributed to a self-concept or other cognitive process, the present example suggests an account in terms of environmental events.

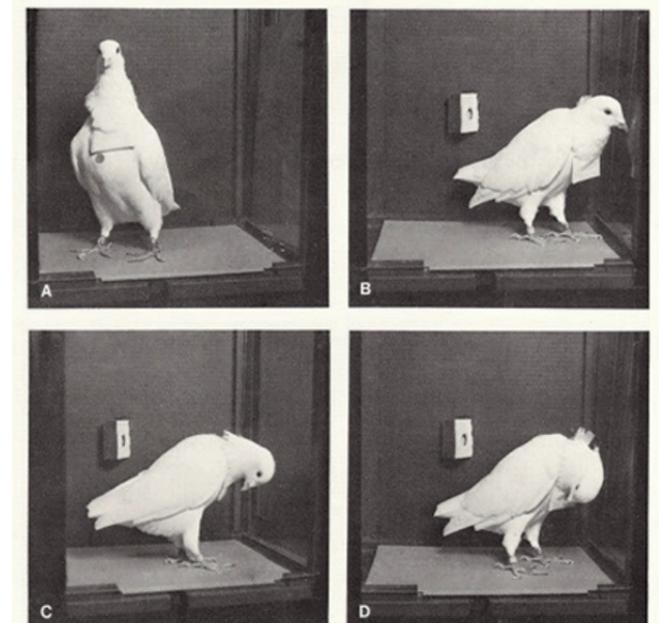


Fig. 1. A pigeon using a mirror to locate a spot on its body which it cannot see directly. (A) With the bird standing fully upright, the spot is just visible below the edge of the bib around its neck. (B) The pigeon faces the mirror (not shown) at right. Note that the bib covers the spot when the bird leans forward. (C and D) The pigeon bobs and pecks toward the position on the bib that corresponds to the hidden spot.

# OFFBEAT CAREERS IN BIOLOGY

Yukti Taneja, SZH

Turned off with the conventional, trodden paths of careers in Biology? This is your ticket to win it.

## 1. ORGAN DESIGNING:

Deals with the designing of a physiologically functioning organ from the cells of one's own body to serve as a graft for organ transplantation, reducing rejections and the dire need of organs for patients. This Bioengineering field is one of a kind and has a lot of future research in its kitty for the aspirants.

## 2. ANIMAL BEHAVIOUR AND REHABILITATION:

It deals with understanding the behavioural patterns of animals and their interactions with their environment. They are often hired by Zoos, Museums, Government and Private Research Institutions for the study of Drug Effectiveness, post disease changes and Habitat loss effects on behaviour, etc. Animal Rehabilitationists are trained in providing care and treatment to the injured and disturbed animals as detected by the changes in behavioural patterns. Your concern and proper education in Rehabilitation can return the

otherwise suffering animal, to its healthy and active state.

## 3. COGNITIVE NEUROSCIENCE:

This correlates the science of the brain with the psychology of mind. An amazing opportunity to know and understand the mysteries behind learning, memory, behaviour, the very thought process and way of our being- knowing the complexity of our existence. Cognitive Neuroscientists are involved in various research of Brain disorders, breakthrough discoveries and as educators and explorers.

## 4. MARINE BIOLOGY AND OCEANOGRAPHY:

Blending the science of Zoology and Ecology with Geology to unleash the beauty of marine life - the ecosystem of the ocean, the plate tectonics, distribution of species, sea floor spreading, chemistry of sea water molecules

with the physiological patterns, adaptations, etc. This definitely, is one of the most booming careers of Biology in this Era.

## 5. ATTORNEY:

For those who want to make a difference can become Lawyers in the field of Life Sciences – Environmental Sciences, Oceanography, Biotechnology Patenting, Intellectual Property, etc. This field requires prior scientific knowledge of the field, so as to carefully examine the consequences on life of organisms and the environment as a whole before rolling out policies and laws. Being an Attorney in the field of biology, you have the direct power and role in making changes for a flourishing life on Earth.

## 6. PET GROOMING:

How about if you get to know that you can spend your day with your favourite pet, just keeping their hygiene and health sane, their looks alluring, their body and muscles fit- making them a well groomed pet. Yes, people nowadays, hire personal Pet Groomer for their dogs, cats, horses, etc. Various Pet Grooming Parlours have also come up increasing the demand and providing umpteen opportunities.

## 7. SYNTHETIC BIOLOGY:

This field is an upcoming contemporary. It includes the synthesis of biological constituents and equipment, the recreation and replenishment of the old life forms – all in vitro, in the labs through Genetic Engineering. Jump into the pool of Genomics and Proteomics, along with biotechnology and systems biology!

## 8. DANCE AND ART THERAPY:

Want to do some creative healing to humans? Dance Therapy is the psychotherapeutic use of Dance and movements to heal the emotions and Cognitive functions of the body. It help reduce Stress and anxiety. Art therapists can help deal with psychological and behavioural disorders, combat addictions and resolve emotional conflicts, and help connect better with self.



> SOFT FUR EQUALS GOOD TIMES. TRUE THERAPY FOR YOU AND THE PETS.

## 9. FOOD BIOLOGY:

What else sounds more interesting than stirring biology in Food. Food Technologists deal with bringing out innovation in the quality of food, technically enhancing their value and safety in the market. Food Microbiologists, on other hand, study the evil as well as chief microbes associated with food responsible for causing contamination and further diseases.

## 10. HUMAN ROBOT INTERACTION SCIENTISTS

HRI Goals for human and robots to interact better, and not to keep it in technical labs but in practical life so as to share a roof- for sound accomplishment of tasks and evolve together for mutual and societal benefits.

**11.CONTENT WRITER AND BLOGGER IN BIOLOGY:**

If you have a penchant for writing, and want to keep learning Biology; this is your happy place. Various academic organisations and research institutions require such writers to present their data and discoveries creatively. Also, Blogging about your biological sense and reaching out to kids at school or graduates at colleges – makes it simpler for them to study and relate. YouTubers revealing the Biological mysteries, can also be a creative cup for your Biology tea.

**12.EPIDEMIOLOGIST:**

The study of diseases in populations is what the job of this career is. Considered as ‘disease detectives’ – they study the statistics of disease outbreaks, its frequency and potential in spreading and causing harm to population plus the feasible measures to treat the diseases.

**13.PALAEONTOLOGY:** Digging down and analysing the origin of life forms on earth is not the most recent thing in Biology but definitely interesting in all senses of the word. It is way more than Archaeopteryx and Dinosaurs! Blending of the Biological and Geological sciences to analyse fossil records.

**14.GENETIC COUNSELLOR:**

The intermediary between the medical professionals and the patients, they serve as the effective communicators, and deliver scientific concepts in easier ways to connect well with the patients, and help them analyse and combat genetic disorders. Involves the Study of pedigree of families, detecting incidents of disease outbreak in future and psychologically aiding

the patient with support and treatment.

Biology is a vast field and has a broader scope for exposure. All these career options are prevailing in the present times and hold potential for further expansion as well.

> PALAEONTOLOGY IS ANOTHER AREA OF INTEREST FOR ENTHUSIASTIC ZOOLOGISTS



# ICE NUCLEATION

Saiyami Bhardwaj, SZH

**I**ce formation is one of the most important processes on Earth which always occurs at the surface. On one hand, where identical surfaces can both inhibit and promote ice formation, optical interaction between the surface and matter always acts as a promoting factor for ice nucleation. The first step in formation of either a new thermodynamic phase or a new structure via self-assembly is Nucleation.

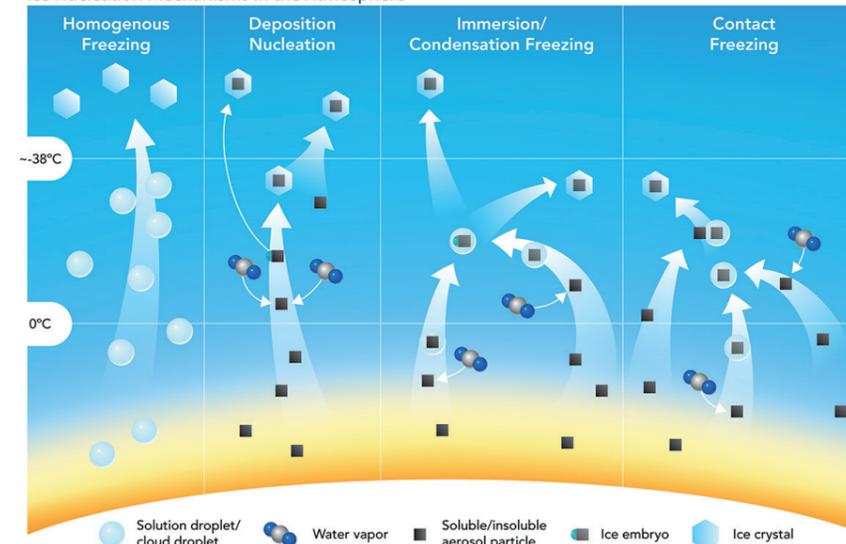
Several bacterial species are able to catalyse ice formation even at a temperature much higher than that of organic and inorganic substances. For example *Pseudomonas syringae* produces a surface protein that serves as nuclei around which ice crystals form at warmer temperatures than usual. Examining them shows that they are able to initiate ice formation because of their ubiquity on the surfaces of frost sensitive plants.

The high temperature of ice catalysis conferred by bacterial ice nuclei makes them useful in processes like artificial snow production, freezing of some food products and in other ice nucleation limited processes. Because of the ease and sensitivity with which ice nucleation can be quantified, the promoterless bacterial ice nucleation gene is valuable as a reporter for transcription. Target genes to which this promoter is fused can be used in cells in natural habitats. A planar array of hydrogen binding groups that closely complement that of an ice crystal face can be predicted from models

of ice nucleation proteins. Even Generic crystalline substrates have the ability to promote ice nucleation as a function of hydrophobicity and morphology of their surface. The lattice mismatch of the surface with respect to ice is regarded as the most important requirement for the for a good ice nucleating agent. Ice nucleation rates can be altered by changing the balance between the morphology of surface and its hydrophobicity. The formation of a water overlayer, emergence of contact layer buckled in ice and nucleation on compact surfaces can lead to high rate of heterogeneous ice nucleation. Even Active sites in heterogeneous ice nucleation are examples of K rich feldspars. Ice formation on aerosol particles is a process of crucial importance to Earth's climate and environmental sciences. Recently observations have been made regarding deposition of aligned ice crystals on feldspar

– an atmospherically important component of mineral dust. This alignment has arisen from the preferential nucleation of prismatic crystal planes of ice on high energy surface planes of Feldspar. The microscopic particles of surface are thought to be even responsible for the high ice nucleation efficacy of K-Feldspar particles

Ice Nucleation Mechanisms in the Atmosphere



# THE SCIENCE OF BATMAN



*“He doesn’t have any superpowers except for his extraordinary capacity for self-discipline.”*  
 Christopher Nolan, director of the Dark Knight Trilogy

Himanshu Chauhan, SZH

**B**atman, the caped crusader, the dark knight whatever we call him is a superhero that doesn't have any superpowers. He is not an alien form from outer space, a speedster or an undefeated warrior. He is just a man in a black suit. Batman may be a fictional character but he can be used as a metaphor to examine human potential for being ultimate in human condition.

Batman's alter ego, Bruce Wayne, is a normal human being.

Batman doesn't rely on superpowers rather than he believes in his combination of strength, knowledge, skill and perfection.

The secret of his strength  
 Maintaining Batman's physique, super strength and agility includes a lot of training. His workout, as circulated by DC states he does 1000 pounds bench press and 2500 pounds leg press. His workout is greater than the world record holders. World record holder William Silva has, for instance, leg pressed 1,000 pounds which is less than half of Batman's routine.

Intense exercises help him to bulk

up by wearing and tearing his muscle fibers with all that strain on his muscle fibers. When doing intense workout, muscle fibers rupture and cytokines are released to activate immune system to repair the tissue. The body then creates even more tissue and the body can lift that much weight or resist that strain. To sustain this intense workout, there is a high calorie requirement.

Dr. Paul Zehr estimated that Batman would need up to 4000 calories a day, which he would require to stay in peak shape, otherwise it will get stored as fat.

He can even control his body temperature, can limit the amount of oxygen he needs to survive and can go into the state of comatose to conserve energy. It all sounds unrealistic, however there is a technique that is scientifically proven to allow the development of such incredible adaptations: 'Tummo meditation'. Wim hof (The iceman) uses a similar technique, and has ability to withstand cold. He also ran a marathon in the Arctic Circle wearing nothing but shorts.

However, Batman is more than a

Body builder.  
 Besides strength batman also has genius level intellect. He has an IQ of 192. Albert Einstein and Stephen Hawking have an IQ of 170 and 160, respectively. In attempts to learn as much as he could and as quickly and efficiently as he could, he mastered various learning methods. He is ambidextrous and has mastered speed reading.

He also uses a method strikingly similar to that of Sherlock Holmes. He is only focused on gathering information important to his work and 'deletes' other things that would take up unnecessary space and brainpower.

He has more time than a normal person.

Batman roams at night, fighting criminals, and in day time his alter ego Bruce Wayne has to manage 'Wayne Enterprises'.

So when does Batman sleep? Well, he does require sleep like the rest of us. He uses micro sleep and sleeps for short intervals. He trained his mind so that in these intervals he can get REM sleep.

Batman's sleeping pattern is like that of Uberman sleep pattern. The Uberman Sleep Schedule (coined by Puredoxyk, the first Uberman sleeper) is a sleep schedule consisting entirely of 20 minute naps, spaced equidistant throughout the day. In its traditional form Uberman is 6 equidistant naps throughout each day. In each nap, motive is to get REM sleep.

This way, he reduces the time wasted in taking a single long nap lasting for about 8 hours.

As stated earlier, Batman is the epitome of an ideal human being. And shows how far a person can push

his limits. The amount of motivation and dedication Bruce Wayne shows is phenomenal. His childhood tragedy plays a very important role in creating Batman. So Batman is the result of Bruce Wayne's pain and his will to fight crime.

One can see Batman as a comic character who does not exist in real world. While there are others who look up to him as a true role model.

## [//FACTOID]

### LEOPARD SHARK PARTHENOGENESIS

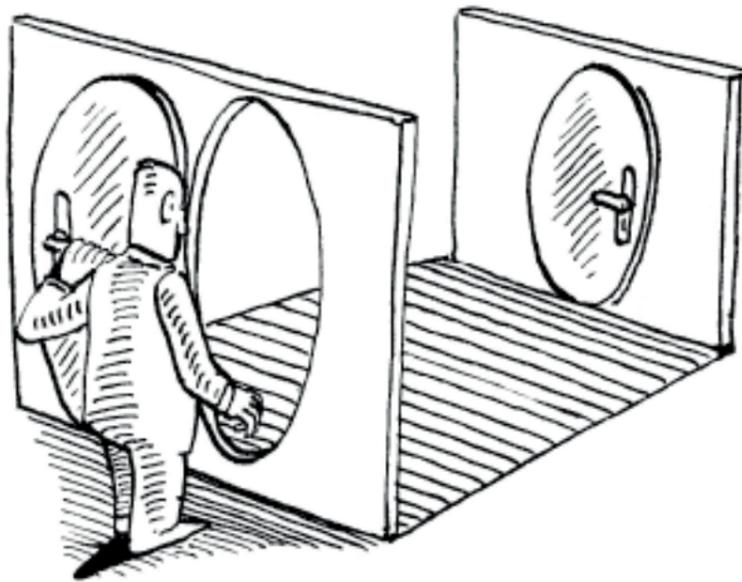
*A leopard shark in a Queensland aquarium has shocked scientists by being the first in the world to give birth without a male, after previously mating in the usual way. The shark named Leonie, hatched three eggs recently, despite being kept apart from male sharks since 2013.*

*The breakthrough research confirms that no male sperm was involved in the eggs' fertilization. It is theorized that this adaptation occurred due to the population plummeting. The pups are not genetic clones of the mother, and only have half of her genetic diversity. Switching to asexual reproduction could be a useful strategy to allow a population to hold on in extreme isolation.*

# DOORS AND PORES

## *Understanding NPC*

**H**obbit houses, jigsaw puzzles, and nuclear pores have a lot more in common than we might think. In 1937, J.R.R. Tolkien introduced his dearly beloved hobbits as “a little people, about half our height, and smaller than the bearded Dwarves.” Their domiciles “had a perfectly round door like a porthole, painted green, with a shiny yellow brass knob in the exact middle. The door opened on to a tube-shaped hall like a tunnel.” Not such a bad description of nuclear pore complexes either, those intricately constructed portals that pierce the double membrane enveloping the nucleus and control traffic into and out of the organelle. Of course, the aptness of the analogy has a lot to do with the level of magnification.



Which brings us to jigsaw puzzles. But the pieces which fit together are two-dimensional, and 3-D puzzles boggling our mind. Nuclear pore complexes raise jigsawing to a far more rarefied level. We can describe these “massive molecular machines” as put together from “more than 1,000 protein subunits with a total molecular mass of approximately 120 million Daltons—the equivalent of more than 6.5 million water molecules.” The subunits self-assemble to form more than 30 types of nucleoporin proteins, 17 of which constitute the beautifully symmetric three-ringed core of the nuclear pore complex. Through the pore’s central channel smaller molecules enter and exit by diffusion while proteins or ribosomal units in their native states hop a ride on cargo ships known as karyopherin.

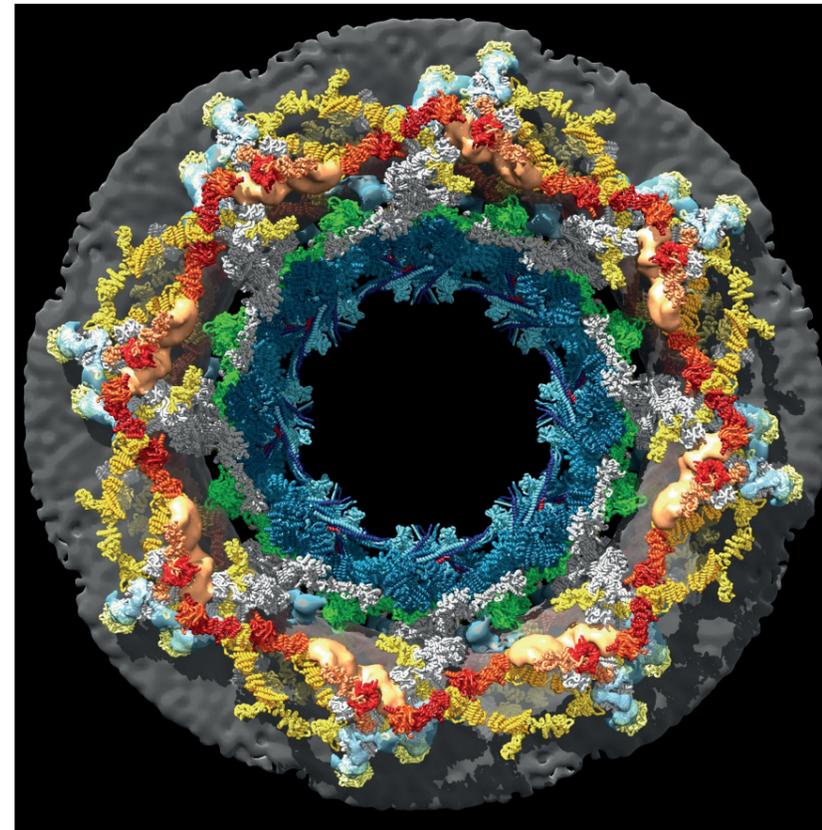
Nuclear pore complexes (NPCs) are huge molecular structures that penetrate the nucleus’s two lipid bilayer membranes and

mediate the transport of macromolecules into and out of the cell’s command centre. The structure of the NPC, which consists of more than 1,000 individual protein subunits, is coming into sharper focus, and biologists now have a better understanding of the function of this massive molecular machine.

Eukaryotic cells store their DNA in the nucleus, cordoned off from the cytoplasm by the nuclear envelope. Made up of two lipid bilayers called the inner and outer nuclear membrane, the nuclear envelope protects DNA from damage by reactive by-products and intermediates of cellular metabolism. It also serves as a critical regulator of gene expression, restricting access to the genome and dictating which transcripts can exit the nucleus. This regulatory responsibility ultimately belongs to the thousands of massive molecular machines that penetrate both nuclear membranes to form gateways between the nucleus and cytoplasm.

*A.Tharanirakshita, FZH*

> STRUCTURE OF A NUCLEAR PORE COMPLEX OF A HUMAN CELL



Each nuclear pore complex (NPC) consists of more than 1,000 individual protein subunits with a total molecular mass of approximately 120 million Daltons—the equivalent of more than 6.5 million water molecules. Over the last decade, however, technological advances have spurred an explosion in data on the structure of the NPC. Improvements in electron microscopy have led to snapshots of NPCs in their native environment at moderate, but improving resolution. Simultaneously, X-ray crystallographic analyses of the individual protein subunits and their interactions with one another at the atomic level have given us high-resolution details of how the pieces fit together. And this year, the powerful combination of these two approaches finally revealed the structure of the NPC’s symmetric

core. Continued interrogation of the structure and function of the NPC will open the door to a deeper understanding of one of the cell’s most important machines. Given the NPC’s role in ensuring the flow genetic information from the nucleus to the translational machinery in the cytoplasm and in protecting the genome, and given the many additional functions of nucleoporins in the cell, it is not surprising that a wide variety of human diseases have been associated with the dysfunction of the NPC or its component parts. Several cancers involve genomic rearrangements that have resulted in nucleoporin genes fused to other genes, for example. And several mutations in nucleoporins have been linked to heritable diseases that result in lethal developmental defects.

Researchers have also recently linked NPC function to

neurodegenerative diseases including amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD). Recent animal studies found that nucleoporins are extremely long-lived proteins in nondividing cells such as neurons, with half-lives on the order of months. Thus, unlike most cellular proteins, damaged NPC proteins are not replenished by protein turnover in these cells, but instead would accumulate over time, meaning aging NPCs may have an important role in human disease. Taken together, it is clear that building on our current understanding of NPC structure and function could lead to novel ways to combat a wide array of human diseases.

# INSIDE A PSYCHOPATH'S MIND

Himanshu Chauhan, SZH

Psychopathy is one of the most discussed mental disorders in media, be it movies, books, television series or even comics. And most of the time, they portray a psychopath as a very violent person. Which may not always be true. Even though, not seemingly rare, psychopathy is not something we identify easily, often because even though psychopaths lack human emotions, they go to great lengths to display these, to prevent detection.

**“A Psychopath is an intelligent and cunning person skilled at manipulating others and indifferent to their pain”**  
-Hervey Cleckley,  
The Mask of Sanity

Psychopathy as a term is now recognized as an extension of antisocial personality disorder. Psychopathic features include lack of guilt, empathy, deep emotional attachment. Researchers believe psychopaths have a special brain. If we compare the brain of a psychopath to that of a normal person, we will find an average of 18 percent reduction in volume of brain's frontal gyrus. This portion of the brain allows us to consider the consequences of our action, and discourages risk taking. As it is reduced in psychopaths they understand their actions, but they cannot present the remorse. A reduced amygdala is often observed, and makes them reckless and not afraid.

Adrian Raine, neurocriminologist said “The amygdala is the seat of emotion. Psychopaths lack emotion. They lack empathy, remorse, guilt.” There also appear to be differences in the corpus callosum, which joins the right and left hemispheres of the brain - which has been linked to their impressive ability to lie and cheat and manipulate people.

Often the cause of personality defects is Nature and Nurture. And, hence both genetic factors and

environmental cues. A traumatic childhood like in the case of the infamous Pogo Killer Clown, John Wayne Gacy could also be responsible for developing psychopathic traits.

One pioneering study in 2002 was done by Avshalom Caspi and Terrie Moffitt. They genotyped over 1000 individuals in a community and assessed their levels of antisocial behavior in adulthood. They found a genotype conferring to low levels of the enzyme monoamine oxidase A

(MAOA), when combined with early child abuse, predisposed the individual to later antisocial behavior. Low MAOA has been linked to reduced volume in the amygdala while physical child abuse can damage the frontal part of the brain, resulting in a double hit.

The real question we face is very clear:

**“If early biological and genetic factors beyond the individual's control make him more likely to become violent offender than others, are these individuals fully blameworthy?”**



# AT A GLANCE

Life in the  
Zoology Department





# RANK HOLDERS



**DRISHTI MODI**  
1<sup>st</sup> Position



**RHYTHM**  
2<sup>nd</sup> Position



**ARCHITA**  
3<sup>rd</sup> Position

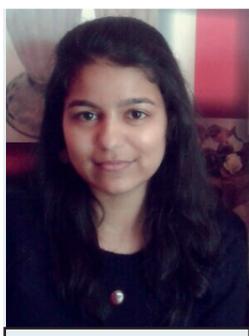
## III YEAR



**RINSHU**  
1<sup>st</sup> Position



**VISHAKHA**  
2<sup>nd</sup> Position



**DEEKSHA**  
3<sup>rd</sup> Position

## II YEAR



**ANANYA BANERJEE**  
1<sup>st</sup> Position



**SAIYAMI BHARDWAJ**  
2<sup>nd</sup> Position



**URJA KALYANI**  
2<sup>nd</sup> Position



**YUKTI TANEJA**  
3<sup>rd</sup> Position

## I YEAR

# ECA ACHIEVERS



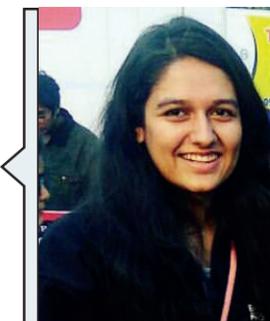
**PANKHURI JAIN, TZH**  
>Vice President,  
Parivartan, Social Service  
Society  
>Editor – in – chief,  
Phoenix, departmental  
magazine of Zoology.



**ANUPAMA NAIR, TZH**  
>Vice President,  
Parivartan, Social Service  
Society  
>President, Evolvere,  
departmental society of  
Zoology



**VIVEK KUMAR, SZH**  
Captain of the Volleyball  
Team  
>Won interdepartmental  
tournaments



**NIKITA GOYALA, FZH**  
Member, Effulgence, the  
Photography Society  
>Secured first position in  
Boomerang Competition  
in Maitreyi College



**APOORVA SODHI, FZH**  
Member, Nritya, the  
Choreography Society  
>Secured second position  
in St Stephen's College

# Highlights 2015-16

The Zoological Society has organized events and lectures with immense zeal and fervor every year since its inception. The year 2015-16 had witnessed the society in its prime.

Professor L. S. Shashidhara from IISER, Pune had delivered a gripping lecture on “*Evolution of Human Cognition and Consciousness*”. The interactive and innovative lecture also showed students the wondrous journeys of research.

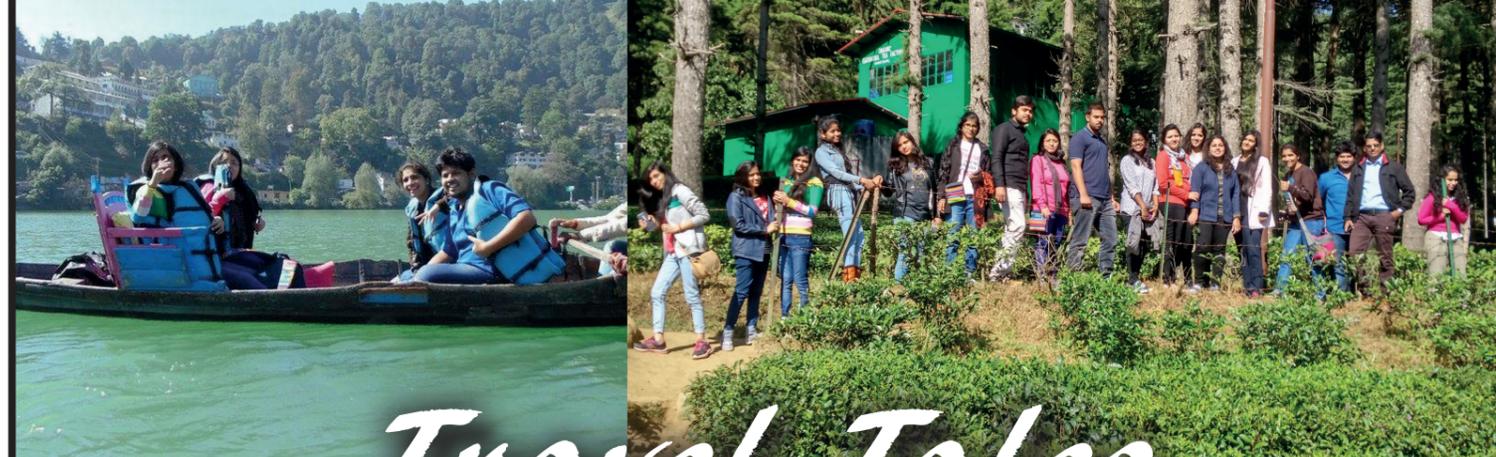


As true environmentalists, a signing campaign for the event of Earth Hour, in collaboration with WWF-India was conducted, to ensure maximum participation and outreach.

‘Phoenix’, the fourth edition of the annual magazine was released by Prof. L. S. Shashidhara, with scientific content, written by the students that would allow expansion of the mind, encourage one to think, and inculcate a naturally curious mind. The magazine carried themes from a variety of principles, including Physiology, Genetics, Evolution, etc.



To distract the mind; and to provide some relaxation from the daily humdrum, the society also organized a few entertaining activities. ‘Expressive Arts therapy’ as the name suggests, was a chance for the students as well as the teachers to release all frustrations and built up stress, through the art of dance. Another fun-filled activity, Mishran, was conducted by the students as an outdoor activity, in which various college students and professors participated.

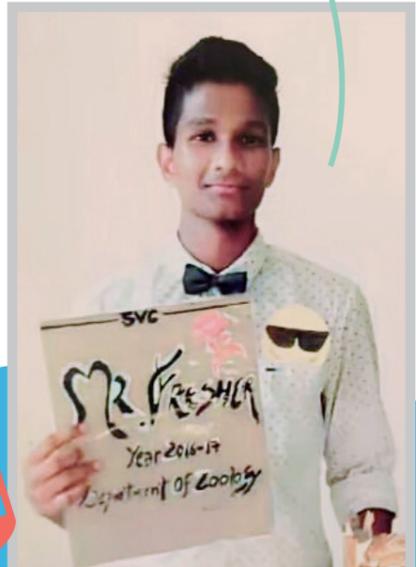


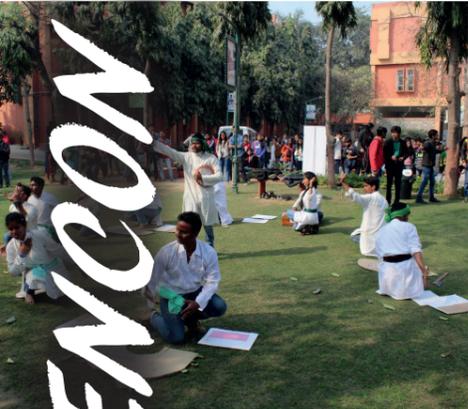
## Travel Tales



# Adieu / Welcome

*Farewell '16*      *Freshers '16*







*An Expression...*



...of Gratitude



# Dr. V.V.S.N. Rao

Any student of his would doubtlessly attest to the fact that Rao sir is one of the best teachers they have ever had. He has a way with his teaching, which somehow makes every old and new concept that he explains seem easily understandable and quite exciting. Nothing compares to how nervous we feel when he asks us to stand up and answer a question in his class, which is why we study his subject every day! The shining star of every batch he teaches Genetics to gets the prized title of 'Chacha/Chachi of Genetics', in compliance with his formidable sense of humour. And if we ever become complacent, his mischievous remarks about our performance motivate us to pull our socks back up and continue on an upward trajectory! He is still compelled to ask us sometimes, "How are you people honours students?"

It is rare to encounter a man so involved and proficient in his trade. If there was a 100% attendance award for teachers, Rao sir would be its first recipient. We have always felt as though we owe it to him and his love for teaching to be as sincere as we possibly can, if not to avoid his sassy digs at our cluelessness. Rao sir has made our department proud in countless ways, serving not only the department as Head of Department multiple times but also the college administration as bursar. His presence and sly smile bring a wonderful sense of comfort to our department, making us feel at home in spite of being in college. Truth be told, words do not seem sufficient to describe the strikingly witty, magnanimous and evergreen man that is our beloved Rao sir.

Dhanaraj sir is perhaps the most famous professor of our college, known as the 24/7 helpline by humanities, commerce and science departments alike. Not once has he turned down a student in need of any kind of help, regardless of their sincerity and academic performance. He is our department's very own magician, as he can make anything happen! "Theek hai, ho jaega," he says, and you know that the job will be done! It is never a surprise when any student, or even a faculty member, of our college says that Dhanaraj sir is their favourite. Very few of us would have had the chance to know someone as sympathetic and humane as him. His humility and joie de vivre are legendary, to say the least. And his ability to relate and empathise with us is so wondrous that we often forget that he is a senior professor, and not a close friend; when in fact, he is a beautiful combination of both.

As a teacher, he is as practical as ever. He gives us an entire question bank to find answers to and submit and, needless to say, these assignments have saved us from losing plenty of marks during our final exams. He makes sure that every minute of his class is spent productively. Dhanaraj sir has also been involved in college administration, filling in as the acting principal for almost an entire semester, apart from also having been Head of Department. One could attempt to enlist all the people Dhanaraj sir has helped in all sorts of ways, but such a list would never end! Countless people have depended and continue to depend on our dearest Dhanaraj sir, and their trust truly lies in the best of hands.

# Dr. P.S. Dhanaraj

# Creative Corner

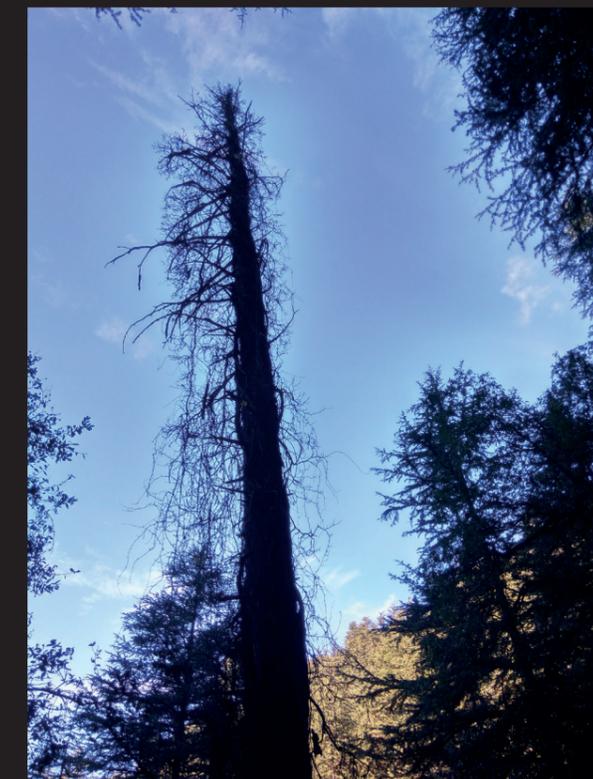
>Urja Kalyani, SZH



>Urja Kalyani, SZH



Ajn Vats, TZH <



>Uma Sharma, TZH



^Yukti Taneja, SZH



Uma Sharma, TZH <

>Anwesa Mukhopadhyay, TZH



# Research at the Department of Zoology, SVC



The department of Zoology promotes undergraduate research and originality in ideas and thoughts. The Professors are involved in the Innovation Project scheme of Delhi University, and also conduct independent research. This is an attempt to inculcate the culture and methodologies that are imperative in understanding and conducting research.

This also allows the students to experience an inter-disciplinary atmosphere, equips them with the tools required for successful implementation of what they learn.

Moving beyond the curriculum bound by a discipline based syllabus, this introduces and trains a research sensibility in undergraduate students with the able mentorship of teachers.

Current research is being conducted in various domains, including Cancer, Genomics and Immunology. Research on environmental concerns and antibiotics is also being undertaken by the department.

The department would strive to work towards ground-breaking discovery and innovation, and we hope that the outcome of these projects may build prototypes for problem solving in the community.



# BIRD SEARCH



Find 20 species of birds hidden in the grid below.

For solutions, scan the QR code on the bottom right corner of this page.

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



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Phoenix

Evolvere

