



EVOLVERE PRESENTS

# PHOENIX

THIRD EDITION

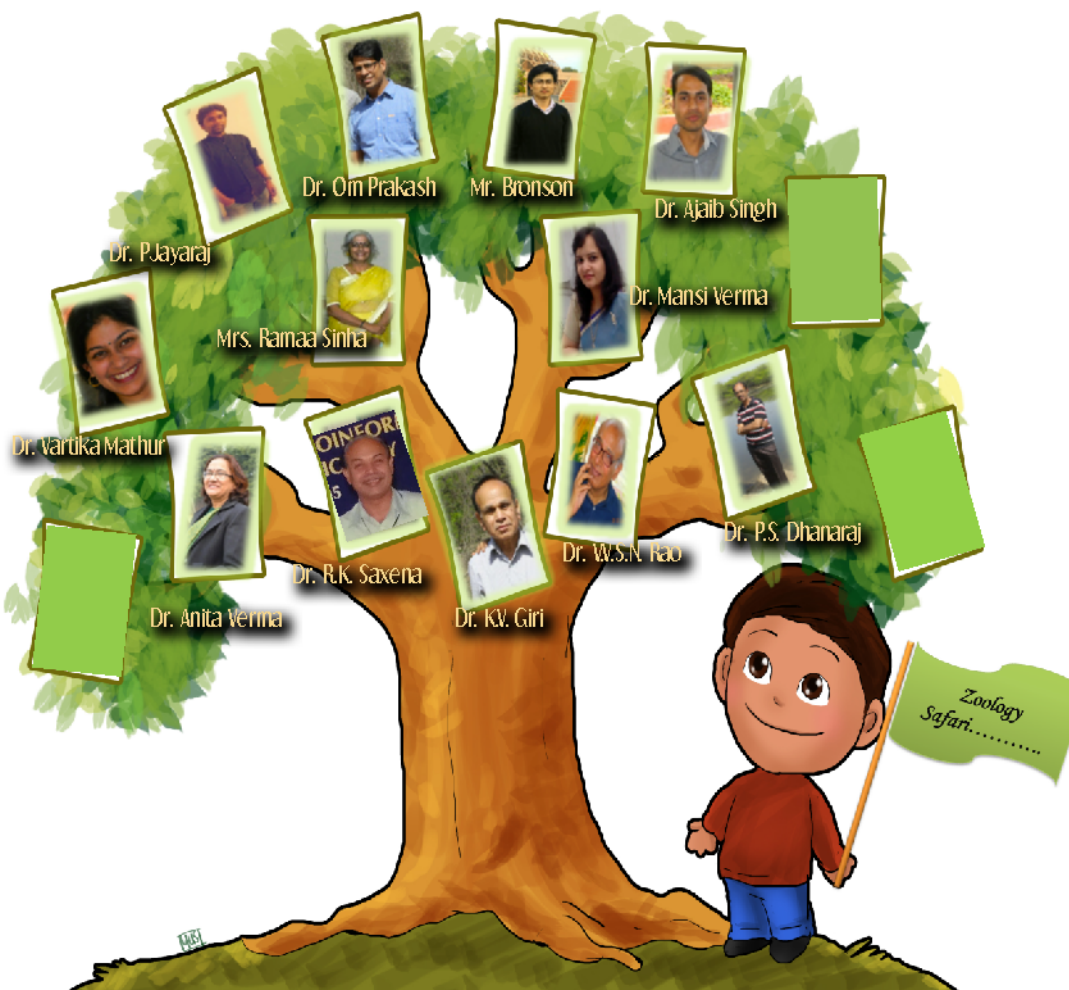
2014-2015



The known is finite, the unknown infinite; intellectually we stand on an islet in the midst of an illimitable ocean of inexplicability. Our business in every generation is to reclaim a little more land  
-T.H. Huxley



# The Zoology Department



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## The Zoological Society Evolvere

## From the Principal's Desk



## From the Convenor and Co-Convenor



Dr. Anita Verma  
Convenor



Dr. Mansi Verma  
Co-Convenor

Third glorious year of our Zoological Magazine 'Phoenix'! It gives us immense pleasure in releasing the annual magazine of our department for the year 2014-15. In the beginning of every academic session, this department initiates planning for its annual fest 'Evolvere' with full enthusiasm.

Zoology department is a family of 12 faculty, 12 lab staff, ..... Zoology Hons. students, ..... life sciences and ..... biological sciences students. 42 years since its establishment, our department has been evolving to nourish its students with love, concern and affection. Consistent in their work, the faculty focuses on all round development of the students in academics as well as extra curricular activities. Apart from teaching, students and faculty are involved in multifarious activities like research, organizing workshops, lectures, symposiums etc.

Our Zoological Society has been organizing annual Sarath Chandran Memorial Lecture series in the sweet memories of our beloved colleague, Late Dr. Sarath Chandran. Last year's memorial lecture was delivered by Dr. Rama Jayasunder, AIIMS on the topic "Systems Biology Approach of Ayurveda" which was followed by free health camp supported by Max Hospital. The success of our events has boosted our poise to continue this practice year after year and we feel delighted to release third edition of our magazine.



## From the Chief Editors

As we write this, we look at each other and laugh because we have no idea what to write. Everything we could say is already contained within. This magazine is heavier than it looks – it weighs more than the collected paper, ink and pixels it is made of. It bears the weight of scientific breakthroughs, new ideas that will change the way we look at the world around us, and above all, words that will, we hope, make you think.

“In biology, nothing is clear, everything is too complicated, everything is a mess, and just when you think you understand something, you peel off a layer and find deeper complications beneath. Nature is anything but simple.” – Richard Preston

This quote reflects a truth you learn during these three years of studying zoology. It was a lesson learned well during these past few months of gathering information, writing and editing articles. That said, we wouldn't trade this experience for anything else. Science gives you the freedom to be creative, inquisitive, and make new discoveries. No other field can satisfy the curiosity of the human mind quite as well.

With this, the Magazine Society presents to you the third edition of the Zoology Department's magazine, Phoenix. We hope you enjoy it!

– Bhavya Iyer & Tanaya Bhattacharya

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# Amazing Animals

*Mandeep Gulati, SZH*

## Rosy Lipped Batfish

This wonderful fish bears rosy lips & a bat-like face. Common to the waters of Costa Rica, these fish - *Ogcocephalus porrectus* - are poor swimmers. Their oddly shaped pectoral fins look more like legs, which allow them to walk along the ocean floor where they feed on small fish and crustaceans.



## Camel Spiders

Mostly inhabit deserts. Commonly known as camel spiders, wind spiders, or sun spiders because of their resemblance to camels in colour. They are omnivores, and feed on numerous types of small animals. Larger species have been known to feed on small snakes, lizards, and rodents. They can grow up to 5-6 inches in length (including the legs).



## Glass Frog

While their general color is green/lime green like most frogs, these frogs have a transparent and glasslike abdomen! Their internal organs and gastrointestinal tract are visible through their skin. First discovered in 1872, they were first placed with tree frogs in the genera *Hyella*. It wasn't until 1951 that the family *Centrolenidae* was created. That family is now host to over 50 species of glass frogs. Found in Central and South America, glass frogs are small - between 1.2 and 3.0 inches in length.



## Sea Pig

Thriving on the deepest ocean floors, the Sea Pig behaves much like slugs do on land. Though they appear to be some sort of slug/pig combination, sea pigs are scotoplanes, or sea cucumbers belonging to the genus of the deep sea *Holothurian*. They scavenge the ocean floor for any organic material using their tube feet to move them along and using their tentacles to push food into their mouth.

## Giraffe Weevil

Native to Madagascar, the *Trachelophorus giraffa* gets its name from its jointed extended neck that is similar to a Giraffe. The body is black with distinctive red patterns covering the wings. The extended neck assists with nest building and fighting. The Giraffe Weevil is the longest weevil in the world at around 2.5 cm.

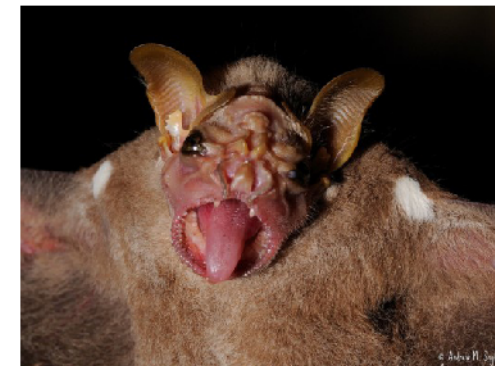


## Mata Mata

These freshwater turtles are found in South America. Distinctive due to their large flattened heads with many flaps of skin, these turtles grow to a length of about 18-20 inches and weigh around 30 pounds. Each foot has five webbed claws which is used along with its natural camouflage to catch fish and other food. The Mata Mata, while lying still in the water resembles a piece of wood or a pile of leaves.

## Wrinkle-Faced Bat

Distinctive because of their hairless faces with numerous outgrowths of skin, that are more pronounced in males of the species. The *Centurio senex*, or Wrinkle-Faced Bat is found in several South and Central America countries. Though they are mainly fruit eating bats, they are not classified as a fruit bat.



## Breaking the Ice.....Literally!



*Tanaya Bhattacharya, TZH*

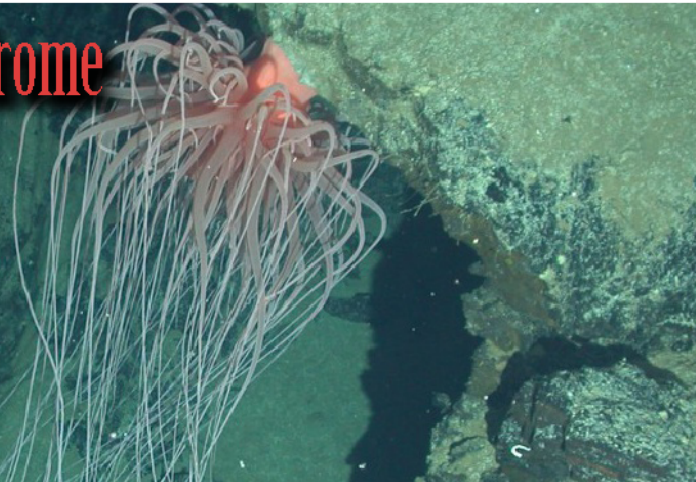
*Salamandrella keyserlingii*, the Siberian Salamander, can actually 'freeze' itself when exposed to conditions below freezing point. This is the only salamander species that lives in the Arctic Circle, an environment that is normally hostile to such organisms. Whenever facing dangerously low temperatures, it reportedly gradually replaces the water in its body with 'anti-freeze' chemicals. Even after being frozen for decades in the permafrost (soil at or below 0 degree Celsius for two or more years) the Siberian salamander can thaw out and bounce back to life.

"Sudden frost is a serious problem for the Siberian Salamander. It needs time to adapt to the cold in order to produce the 'antifreeze' chemicals that replace the water in blood and cells to protect tissues from damage by sharp ice crystals. Some animals use glucose, glycerol and related compounds to protect them from freezing in this way. The exact mechanism in the Siberian salamander is not known" says Eugene Potapov, a researcher working on the Siberian salamander.

Ancient science legends have assumed that these salamanders can survive in the frost for centuries, but so far, this has not been proven. Although frozen salamanders have been found in layers of ice 14 meters down, which were deposited nearly than 12,000 years ago, it is more likely that they probably fell to this depth much later, through deep cracks in the permafrost.

So the next time you visit China or Japan beware of the frozen whole salamanders you are offered in a 'heat and eat' packet; it might just pounce on you when thawed. Oh well... Salamander koftas anyone?

## Impostor Sydrome



*Anupama Nair, FZH*

*Relicanthus daphneae* (Latin; relictum; "covered"), formerly named *Bolocerooides daphneae*, is a pink-coloured cnidarian resembling a sea anemone, which occurs in the depths of the East Pacific Rise, was first described in 2006. Lurking deep in the ocean, peripheral to hydrothermal vents, it was documented as a sea anemone. However, the animal, which has tentacles measuring more than 2 meters long, isn't an anemone but actually the first known organism in a new order of animals.

A four-year study aimed to classify the known species of anemones based on their evolutionary relationships with one another. DNA and structural comparisons of more than 112 species worldwide revealed there are only two suborders of anemones. Also, when the DNA of *Bolocerooides daphneae* was examined, it was found that this species does not fit into the same category as sea anemones at all. Researchers have now renamed the species *Relicanthus daphneae*, placing it into a new order within the subclass Hexacorallia, which also includes anemones, black corals and stony corals.

Anemones are very simple animals. They are grouped together by their lack of characteristics — for example, the absence of a skeleton or the lack of colony-building, like you see in corals. So it wasn't a huge surprise for the researchers when they began to look at their molecular data and found that the traditional classifications of anemones were wrong. The similarity between anemones and *R. daphneae* is an example of convergent evolution. Research shows that sea anemones lost these characteristics over millions of years of evolution while *R. daphneae* never had them to begin with.

New research places this animal in a new order. "The discovery of this new order of Cnidaria — a phylum that includes jellyfish, corals, sea anemones and their relatives — is the equivalent to finding the first member of a group like primates or rodents," Estefanía Rodríguez, an assistant curator in the American Museum of Natural History, said in a statement. "This amazing finding tells us that we have so much more to learn and discover in the ocean," added Rodríguez, who led the research.

## Not So Bird-Brained After All



*Sameeksha Yadav, T'ZH*

Generally when you call someone a 'bird brain', you mean to insult them but here is a species of parrots, the African Grey, which is indeed so brainy that it will astonish you! The African Grey Parrot is thought to be the smartest of all parrot species. They may lack brilliant feather colors but they make up for it with their staggering verbal abilities and intelligence. Their extensive vocabulary demonstrates the intensity of their intelligence. They have the intelligence level of up to a five-year old and are known as the 'Einstein's' of the parrot world because of their incredible talking ability.

There are two types of African greys: the Timneh grey, which is a darker shade of grey, with maroon-colored tail feathers; and the Congo African grey, which is larger and lighter colored, with a red-colored tail. Greys are dusty-looking grey birds, so identical to pigeons that at first glance you will confuse them with pigeons but a beautiful crimson tail, creamish eyes, the characteristic parrot beak, and a stunning scalloped pattern to their plumage mark the difference. Young African greys can be discerned from adults by looking at its iris – they appear to have full, black eyes. As they mature, the iris turns lighter.

These birds are so sensitive that the slightest of change in their routine makes them unhappy, making them pluck and chew their feathers. These are highly social, demanding a lot of your time but they are not cuddle bugs. They may tolerate a little head scratching and patting but don't appreciate intense physical contact. They are famous for playing pranks, such as imitating their owner's voice to tell the family dog that it's time for a walk!

### Meet Alex, the smartest parrot in the world!

Alex, who sadly passed away prematurely in 2007 at the age of 30, proved himself to be one of the smartest birds to have ever been studied. Alex was in the care of animal psychologist Irene Pepperberg for 23 years. She conducted numerous tests on him in order to establish how smart he really was! Tests have shown that he was a mathematical genius, being able to add numbers correctly and distinguish textures apart. He was able to recognize quantities up to six, he could tell apart seven colors and even distinguish 5 shapes. He could understand the concepts of bigger or smaller, same or different and under or above. Even before his death, he proved his intelligence once again with his famous last words to Pepperberg - "You be good. See you tomorrow. I love you."



## Friendly Creepy Crawlies



*Mandeep Gulati, SZH*

Not all insects and other arthropods present on earth are out to get us – some are actually beneficial for us! These little ones aid in the pollination of crops, decomposition of the dead & decaying plants & devouring pests which are harmful for gardens. How can we attract these bugs for our benefit? We can offer them bait first to lure them in! For example – Mint, daisy (Shasta and Ox-eye), wild carrot (Queen Anne's lace), cosmos, marigold, clover. Another way is by offering them a 'bug bath'.

Aphids, a common nuisance in the garden, are extremely destructive to plants. They not only suck out the sap but spread disease as well. However, there are a number of good bugs that will take advantage of their presence by devouring the harmful pests. The aphid midge is just one of them.

Scary-sounding Parasitic Wasps are of great importance as they invade the bodies of various pests, lay eggs there and feed off them, eventually killing them off. Some of their victims include: tomato hornworms, aphids, beet armyworms, & cabbage worms. Creatures like centipedes and millipedes can outweigh their bad deeds by the good ones. Centipedes wipe out all sorts of soil-dwelling pests, such as slugs, while millipedes help break down organic matter. Assassin bugs do just as their name implies. These insects are a natural part of the garden and help suppress harmful bug populations by feeding on flies, harmful beetles, mosquitoes, and caterpillars.

Ladybugs are commonly known as ladybeetles. They are the natural enemies of soft-bodied insects,

aphids as well as their eggs. These attractive insects are tempted into the garden with flowering weeds and herbs that include dandelions, wild carrots, yarrow, dill, and angelica.

Pirate bugs attack many bad insects and are especially fond of thrips, spider mites, and small caterpillars. Plant some goldenrod, daisies, alfalfa, and yarrow to charm them.

Although most beetles are harmful to plants in the garden, ground beetles are not. They feed on cutworms, caterpillars, snails, slugs, and other soil-dwelling insects. Incorporating white clover into the garden entices this good bug. Commonly taking shelter beneath stone or wooden walkways are valuable decomposers called rove beetles. Besides feeding on organic matter, they also eat harmful insects such as snails, slugs, aphids, mites, and nematodes. The praying mantis is a popular garden friend. This insect will feed on virtually any type of bug including crickets, beetles, caterpillars, aphids, and leafhoppers.

Pillbugs, also known as sowbugs, feed on decaying organic matter and do not pose a threat within the garden unless overpopulation occurs. If this happens, marigolds can often take care of the problem. Hopefully these garden tips will help you befriend the more congenial crawlies and keep away the creepy ones!

# Whipping Down the Patriarchy

## No Males Required

Bhavya Iyer, TZH

In the Mahabharata, Karna was born to Kunti – the mother of the Pandavas – as a boon from the Sun god. In the Bible, Jesus was born to the Virgin Mary. Back then, such a birth was called a miracle. Today, we call it Parthenogenesis.

Parthenogenesis is a form of asexual reproduction in which growth and development of embryos occurs without fertilization. In animals, parthenogenesis means development of an embryo from an unfertilized egg cell. In other words, it's like nature's own way of cloning!

Despite what we are conventionally taught, it is possible for animals to reproduce without mating between males and females – and not just in lower animals. It has been documented in vertebrates like some fish (hammerhead sharks), amphibians (salamanders) and reptiles (boa constrictors, some lizards). Parthenogenesis has even been seen in turkeys!

One fascinating example is whiptail lizards. *Cnemidophorus* is a genus of lizards that belong to the family of Teiidae, which are commonly referred to as whiptail lizards or racerunners.

In some of the *Cnemidophorus* species, there are no males, and they reproduce through parthenogenesis. The Teiid genus contains at least 13 truly parthenogenetic species, which originate from hybridization events between sexual *Cnemidophorus* species. [1]

Occasionally, a mating between a female of one species and a male of another produces a parthenogen, a female that is able to produce viable eggs that are genetically identical to her own cells. The lizards that hatch from these eggs are thus also parthenogens that can again produce identical eggs, resulting in an asexual, clonal population. Parthenogenetic species re-

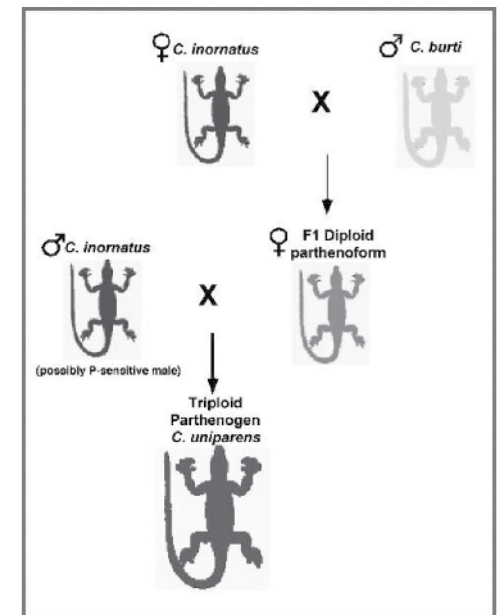


sulting from a single hybridization are diploid (that is, they have two sets of chromosomes just as sexual species do), but sometimes these females mate with other males, producing offspring which are triploid, i.e. having three sets of chromosomes instead of the usual two. These are rare in animals, especially vertebrates, though ongoing research on the subject may prove that it is not as rare as we may think. [2]

Parthenogenetic whiptails are unusual in that ovulation is often stimulated by "pseudo-courtship" among the females, with one non-ovulating female engaging in courting behavior normally seen in males while the ovulating female assumes the typical female role. The unfertilized eggs develop into hatchlings that are genetically identical to their mothers. [3]

A triploid parthenogenetic species in the genus *Aspidoscelis*, formerly part of *Cnemidophorus*, has been fertilized with sperm from a sexual species in the same genus to produce a new tetraploid parthenogenetic species in laboratory experiments. Such experiments provide evidence that even truly parthenogenetic species are still capable of incorporating

new genetic material and may therefore be capable of evolution. [4]  
The existence of these species is of great importance in genetics and developmental biology research, considering the rarity of polyploidy animals (polyploidy is common in plants; one example is the wheat we consume, *triticum aestivum*). It also has great implications in studies of cloning, and reproduction. Imagine a child born of only one biological (most probably female) parent? If women could reproduce alone, through cloning, males would be redundant! Hypothetically speaking, of course.





**Bornika Roy, TZH** (with input from Misha Bansal, Biochem(H) & Shakti Prajapati, TLS)

What would happen if an organism were completely exterminated? You can already picture environmental activists (or 'tree huggers') protesting against human atrocities, right? Now, what if I tell you that organism, that insect, is the pesky mosquito- the deadliest animal in the world (according to the WHO)?

Mosquitoes are a family of small, midge-like flies: the Culicidae that have been around for more than 30 million years. And it seems that, during those millions of years, mosquitoes have been honing their skills so that they are now experts at finding people to bite.

Mosquitoes have a battery of sensors designed to track their prey, including chemical, visual and heat sensors.

Something with that many sensors sounds more like a military aircraft than an insect. That's why mosquitoes are so good at finding and biting you. A bite results in an itchy red welt and possibly even a serious

illness. As you swat madly at a swarm buzzing around you, you may notice that others seem completely unfazed. Could it be that mosquitoes prefer to bite some people over others? The short answer is yes. Mosquitoes do exhibit blood-sucking preferences, say the experts. Apparently, one in 10 people are highly attractive to mosquitoes. But it's not dinner they're sucking out. Female mosquitoes - males do not bite people - need human blood to develop fertile eggs. And apparently, not just anyone's will do.

People with high concentrations of steroids, cholesterol or certain acids, such as uric or lactic acid, on their skin

surface attract more mosquitoes. These substances can trigger mosquitoes' sense of smell, luring them to land on unsuspecting victims. Mosquitoes can smell their dinner from an impressive distance of up to 50 meters! Any type of carbon dioxide is attractive, even over a long distance. Movement and heat also attract mosquitoes. And as everybody knows, mosquitoes spread malaria, dengue, encephalitis and West Nile fever. The parasites carried by mosquitoes are sort of like a James Bond villain who finds a secret lair from which he can carry out

his deadly plot, undetected; because many of the affected people don't show symptoms, yet they can spread the disease courtesy of mosquito bites. Mosquitoes affect population patterns on a grand scale: In many malarial zones, the disease drives people inland and away from the coast, where the climate is more welcoming to mosquitoes. Would it really be so bad if they were swatted off the face of the earth?

Mosquitoes have a variety of natural predators, from bats to fish to dragonflies. Scientists have studied what eats them in the wild, in hopes of finding enemies that can be introduced to get rid of mosquito problems near where people live. The gambusia fish (*Gambusia affinis*) is one of the most efficient predators of the mosquito larvae. These little fish are controversial because they're aggressive, also eating the eggs, larvae and young of native fish and amphibians and competing with them for other food. They're not always successful at controlling mosquitoes. Dragonflies are natural enemies of mosqui-



toes in all their stages of growth. Dragonfly larvae live in the water like mosquito larvae and feed on them, while adult dragonflies eat adult mosquitoes. An experiment in Yangon, Myanmar, showed that dragonfly larvae could be introduced to successfully control mosquitoes that were breeding in large containers of drinking water. But like gambusia, dragonfly larvae work best under specific conditions, such as small artificial ponds or other containers of water where there are few other insects to eat besides mosquito larvae, and no vegetation for the mosquitoes to hide in, and no competing fish or other wildlife.

So if the mosquitoes were exterminated, would the food chain collapse? Would their predators, and all higher trophic levels, also die off? Most organisms are a part of the food web, and the predators also eat other things. For example, when the mosquito population starts to get low, the dragonflies will choose other prey instead, leaving fewer mosquitoes than before, but this won't eliminate the problem of mosquito borne diseases.

Enter bio-tech companies!

like Oxitec, which breed sterile male mosquitoes for release in affected areas. As male mosquitoes always do, they'll find the females and mate with them - but because they're sterile, there will be no offspring. A potential drawback is that the sterile males may not be as fit as regular males. In other words, these males may be rejected by the females as regular males are faster and fitter. Also, such sterile Romeos are more effective for diseases like dengue because malaria is carried by so many different kinds of mosquitoes.

The idea of using genetically modified (GM) mosquitoes to help wipe out malaria has been around for a while. Theoretically, if you could create a "bet-

ter," stronger mosquito that happens to be unable to spread malaria parasites, and you were to release tens of thousands of those better mosquitoes into the wild, they would eventually win the survival game and replace the mosquitoes that are able to spread malaria. In this theoretical solution, once malaria is eradicated from a particular area, it wouldn't come back because the mosquitoes couldn't carry it back. But there has always been a glitch.

It's not difficult to activate a gene that makes a mosquito immune to any particular malaria parasite (there are a lot of them) and lose the ability to pass it on. It's a relatively cheap laboratory procedure. In this case, the scientists turn on a gene in the mosquito's gut that controls SM1 peptide, a type of protein that appears to stop the development of the malaria parasite while it's living in the mosquito, rendering it harmless. So making mosquitoes immune to malaria isn't the problem. It's the "better mosquito" qualification that has been eluding science. Genetically modifying a mosquito has always appeared to make it weaker. And a weaker, malaria-resistant mosquito won't win the survival game, so there's no point in releasing it into the wild. It'll just die off. Hence sterile mosquitoes work best in isolated areas, for example islands, where new mosquitoes don't keep coming in.

Meanwhile, researchers at Imperial College, London, are exploring another new approach: infecting mosquitoes with a virus in a process similar to vaccinations. When the mosquitoes later contract the disease virus, it will have no effect on them, and they won't spread it to humans.

So in answer to the original question, eliminating mosquitoes won't cause an ecological catastrophe. While we cannot, as of today, completely eliminate mosquitoes, hopefully, 10-20 years from now, Odomos will be out of business!

# Mother (Nature) Knows Best!

Bornika Roy, TZH

Wildlife is one of the most important natural resources, not just for its ecological, economic and aesthetic value, but also for the role it plays in inspiring humans in the form of the not-so-new science & art of biomimicry.

Biomimicry (from Greek *bios*, meaning life, and *mimesis*, meaning to imitate) is a science as well as an art, that involves studying nature's best ideas and then imitating these designs and processes to solve human problems. Instead of harvesting organisms, or domesticating them to accomplish a function for us, biomimicry differs from other 'bio-approaches' by consulting organisms & ecosystems and consciously emulating those underlying principles to our innovations.

Animals, plants and microbes provide elegant solutions to many challenges faced by us. After 3.8 billion years of evolution, Nature has learned what works, what lasts, what is appropriate, and most importantly, what solution is most space and resource-efficient, and thus provides a database of principles that could be the 'best fit' for a variety of problems. The transfer of technology between other life forms and human innovations is desirable because evolutionary pressure forces organisms to become highly optimized and resource efficient. With such a lot of diversity in the life forms on this planet, surely each organism must be best adapted at something, the most suitable candidate to fill a particular niche, and it is this that ensures its continued survival?

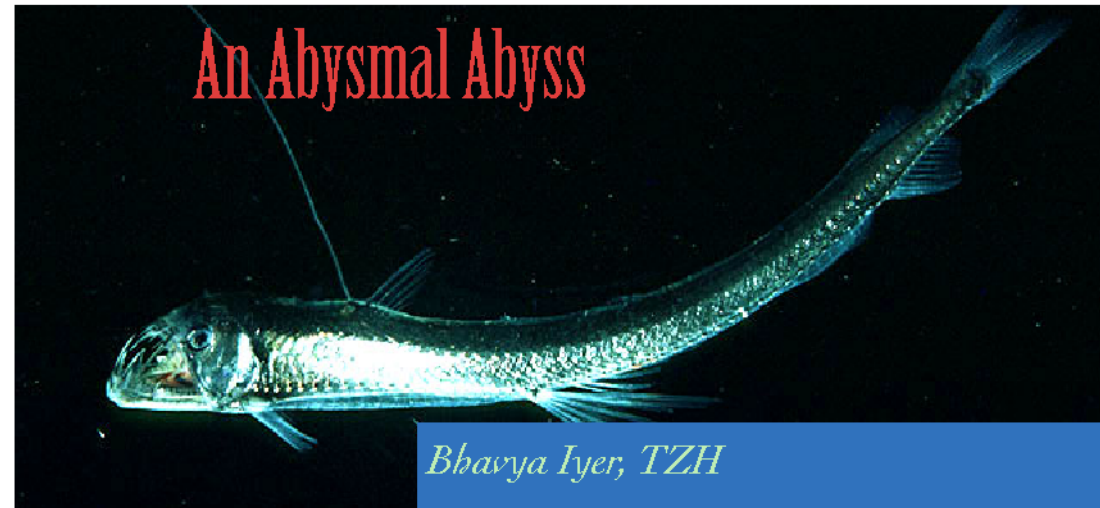
Some of the earliest documented examples of Biomimicry are found in Leonardo da Vinci's notebooks, in the form of prototypes of a 'flying machine'. From then on, biomimetics has found applications in nearly all walks of life- from helicopter blades inspired by sycamore seeds to green buildings based on termite mounds, to biomimetic fabrics that keep your microenvironment at an optimum temperature, and cars that look like boxfish! For further advances in this field, it is necessary we study and conserve the biodiversity on this planet, for how can we draw inspiration from a design, or apply a solution, that we haven't fully



studied and understood? The rapid loss of species we are seeing today is estimated by WWF to be between 1,000 and 10,000 times higher than the natural extinction rate. They calculate that between 0.01 and 0.1% of all species will become extinct each year. Imagine how many biomimetic solutions we have been unable to study and apply, all because of the destructive and selfish actions of our kind!

Though the Biomimicry research institute has already created a database of biomimetic solutions, a lot of work can be done to further expand our knowledge base. A multitude of biological processes, in conditions similar or completely different, have to be studied and modeled in order for us to do so. A team from Sri Venkateswara College, (comprised of Amaanat and I, and Deeksha from the Department of Botany) participated in the Biomimicry Student Design Challenge 2014. We modeled a speed trap camera based on insect ommatidia and the weak electromagnetic field emitted by some fish. Anita ma'am's notes from Biodiversity (Non-chordata & chordates) were extremely helpful to understand the basic working of our animal 'muses'! For everyone who cribbed about the sheer amount of information while studying for those papers, I recommend that you, too, participate in the Biomimicry Design Challenge (it's now open to both students AND professionals). It's a wonderful learning experience, and you'll get to find out the application of your first year subjects!

# An Abysmal Abyss



Bhavya Iyer, TZH

Only three humans have visited the deepest part of the world's oceans, the Mariana Trench, since its discovery in 1875 through sonar. Compare this to roughly 450 people who have travelled into space, and it gives you an idea of how little we know the deepest reaches of Earth's oceans.

The ocean is divided into about 5 zones or layers, from the uppermost Epipelagic layer, followed by Mesopelagic, Bathypelagic, Abyssopelagic, and finally, the Hadopelagic or Hadal Zone.

The Abyssopelagic or Abyssal zone lies perpetually in darkness. It is from about 2000 metres to 6000 metres below sea level. The name comes from the word 'abyss', from the Greek word 'abyssos' meaning 'bottomless'. This region has near freezing water temperature. Few animals inhabit this region, mostly invertebrates like the giant squid and some fish which can withstand the tremendous pressure.

Even below the Abyssal zone is the Hadal zone, named for Hades, the underworld in Greek mythology. The Mariana Trench falls under this zone. The Hadal zone extends below 6000 metres (20,000 feet) deep, with the deepest known point extending to 10,911 metres (over 35,000 feet). Pressure at this point touches nearly 1100 atm or 16,000 psi (the weight of approximately 48 Boeing 747 Jets!)

Some of the few species that exist in the Hadal zone are jellyfish, sea cucumbers, tubeworms and viperfish. Viperfish are fierce predators that lure their prey close using light-emitting organs located at the end of their dorsal spines, called photophores.

How do animals survive such depths? Deep sea crea-

tures generally have reduced eyesight, with large eyes suited to viewing flashes of bioluminescence. Most life at these depths is believed to be maintained by the presence of thermal vents and 'marine snow' – a continuous shower of detritus falling from the upper layers of the ocean, composed mostly of organic matter like plankton, protists, sand, faecal matter, dust etc.

However, it's not just the Deep Sea that's underexplored. Less than 5% of the world's seas have been explored. A rather terrifying find is that of a recently discovered, mysterious species of virus that literally 'melts' starfish. In early 2013, dozens of species of sea star were found to be infected with a 'wasting disease' that turned them into ooze. It was found that shifting the animals to cooler water helped control the disease – nothing else seemed to work. A new study has found a possible culprit, a virus called Densovirus. What is interesting is that the virus, commonly associated with sea urchins, has been identified in museum species as far back as 1942.

So why is the virus suddenly affecting animals in this way? Researchers believe it is most likely due to environmental changes – namely, warming of oceans and seas. This represents a worrying facet of climate change – hitherto harmless organisms that suddenly have a harmful effect on their environment or surrounding species simply due to changes in environmental factors. New aquatic species are being discovered with every underwater expedition, from the vampire squid to the Greenland shark. The more we learn, the more we discover our own ignorance, the saying goes, and it holds true for research into our oceans and seas. It just goes to show, the oceans are a world of their own.



## Feather and Wind

*Amaanat Bedi, TZH*

Windfarms may not affect all birds, but what if they affect birds of prey disproportionately? Some of the reason why this might happen is genetic - certain species like vultures, for example, have blind spots in their visual field which mean they cannot see objects directly in front of them (like wind turbines) when flying.

Large birds like hen harriers, eagles and vultures are also slower to reproduce than other species and so their populations are more likely to be affected by a small number of deaths. There are specific locations elsewhere in the world where windfarms have caused impressive-sounding numbers of fatalities amongst birds of prey.

The high avian species-richness is being adversely affected as the wind turbines in states like Gujarat fall in the zone of migratory flyway of birds. The effects of a wind farm on birds depend on a wide variety of factors such as the characteristics and location of the wind farm, topography, habitat of the surrounding land and species present. The average number of collision fatalities in different European wind farms varies between a few birds per turbine per year up to 64 birds per turbine per year. Also within a wind farm the impact can strongly differ between individual turbines, indicating that 'site selection' can play an important role in limiting the number of collision fatalities.

There are major gaps in our knowledge with regard to impacts of Indian wind farms on birds. For example, it is not known to what extent each species is prone to wind farm development (collision, disturbance), which species are suffering collision fatalities, which routes are taken by migrants, how fixed these routes are in relation to varying weather conditions and time of travel and the extent to which each species is able to avoid collision with turbines.

The development of wind-energy is a vital component of the Indian renewable power production sector. It not only helps in reduction of our dependency on non-renewable sources like coal, but also indirectly helps the environment to function better as the greenhouse gasses are minimized and the air pollution mitigated.

However, wind energy production itself is not without its share of impacts on the environment. Considering the current pace and scale of wind power development proposals, combined with the poor understanding of their impacts, it is a major cause for concern. These concerns though not expressed directly, do have a way of showcasing in the form of habitat destruction.

One of the main areas of concern is the potential impact of wind farms on birds. Inappropriate location of a wind farm can adversely affect wild bird populations significantly. The potential implications of wind farms for birds are of even greater concern when considering the scale of current applications and the possibility of the effects of individual wind farms interacting to produce much larger cumulative impacts on bird populations. Hence there is a pressing need for a more detailed study of where to set up a wind plant with a proper estimate of how it might adversely affect the avian or mammalian populations.



## A Traffick(ing) Light That Must Stay Red

*Bhavya Iyer, TZH*

The most trafficked animal in the world is not the rhino, elephant, or tiger, but a small, ant-eating mammal, that rolls into a ball when threatened - the pangolin. There are eight different species that exist across Asia and Africa, of which six are classified as 'endangered' or 'near extinction' due to the illegal wildlife trade.

In 2013, about 8,125 of these creatures were confiscated across 13 countries, in 49 instances of illegal trade. Annamiticus, an NGO working to stop the economic exploitation of endangered species, estimates that this is only 10 to 20 percent of the actual illegal wildlife trade volume, suggesting that approximately 40,625 to 81,250 pangolins were killed in just one year. A majority of the animals and their scales are sourced from Southeast Asia, with the China-Vietnam border something of a wildlife trafficking 'hotspot'. Other countries from where pangolins are sourced include Pakistan, Qatar, and Equatorial Guinea.

Why are they trafficked? In China and Vietnam, pangolins are eaten as a delicacy, as a status symbol of the rich. Their scales are used in Chinese traditional medicine - though they're made of keratin, the same thing as human fingernails, hair, fur, horse hooves, and rhino horns. Their blood is also seen as a healing tonic. In Vietnam, at high end restaurants, pangolins are sold for about \$350 per kilogram. The hunter who poached the animals gets \$22.5 per kilo. That's a huge profit, and the main reason pangolins are so close to extinction.

Why should we care about pangolins? Besides the fact that all animals should have the right to live out their lives in the wild without human interference, wildlife trafficking is often conducted by large crime organizations, with ties to drug and arms smuggling. Extinction of a species - which is inevitable if nothing is done to protect it - means less diversity in the world. Simply put, the world becomes less interesting. Would we find Africa as fascinating if not for the diverse cultures and numerous animal species that populate it? Or for that matter, Asia?

So how can we help? Don't buy pangolin products. Support organizations working towards pangolin conservation - TRAFFIC, Conservation International-Cambodia, WWF, IUCN-SSC Pangolin Specialist Group, etc. Participate in World Pangolin Day. Spread the word. Even the simple things help.

### WILDLIFE TRAFFICKING ESTIMATES (PER YEAR)

200 TIGERS

1,000 RHINOS

10,000

PANGOLINS

# Lost in Translation

Pankhuri Jain, FZH

Since animals do not have articulate language skills, they communicate through various other primitive or elaborate methods that play a critical role in their lives. Animal communication is classically defined as occurring when the action or cue given by one organism [the sender] is perceived by and thus alters the pattern of behavior in another organism [the receiver], intentionally, for purposes of mating or unintentionally, as a prey detecting the smell of a predator or vice-versa. Communication signals are often critical for allowing animals to relocate and identify their own young. In species where the young must be fed, adults regularly leave their offspring to forage. Upon returning, adults must identify their offspring. Fairy-wrens (pictured) have a way of telling their chicks apart from cuckoos. Mothers sing a special tune to their eggs before they've hatched. This "incubation call" contains a special note that acts like a familial password. The embryonic chicks learn it, and when they hatch, they incorporate it into their begging calls. Horsfield's bronze-cuckoos (brood parasites) lay their eggs too late in the breeding cycle for their chicks to pick up the same notes. They can't learn the password in time, and their identities can be rumpled.

## SIGNAL PRODUCTION

Animals use various sensory channels or signals to communicate. The signal may be sounds, colour patterns, posture, movement, electrical discharge, touch or pheromones.

1) **Visual:** Signals of sight may be gestures and display, facial grimaces, body posture or mimicry. The attitude of the tail when two wolves meet indicates which of the two the superior is. The tail held be-

tween the legs is a submissive gesture while the tail raised confidently upright denotes dominance. The facial expressions of mice during increments of increasing pain were studied; there were five recognizable facial expressions; like nose and cheek bulge. At another level animals may communicate through the art of mimicry. The roundels on the wings of the peacock butterfly look like large eyes to a potential predator. Many caterpillars and millipedes through their colouration appear poisonous or toxic in order to deter their enemies.

2) **Olfactory:** Smell is probably the most basic means of animal communication, with even the most primitive animals reacting to odours given off by their own or other species. In comparison, chemical signals travel much more slowly through the environment since they move by diffusion. Yet they can be transmitted over long distances and fade slowly once produced. Bees, wasps, ants, moths and other insects rely largely upon pheromones as a means of communication. The antennae of some male moths are so sensitive that they can detect the presence of a female from two miles away. Sharks have an extraordinarily efficient sense of smell and some species can detect drops of blood in the ocean from a mile off. Snakes possess a specialized structure – Jacobson's organ – as means to detect scents. The snake's forked tongue collects chemicals from the air, which it pulls in and holds against the organ, located at the roof of its mouth.

3) **Auditory:** Animals of all kinds rely to a great extent on their hearing ability in order to succeed and survive. When it comes to sound, not every member of a species is alike. Animals from different

Examples of Animal Communication			
<b>Visual</b>	<b>Auditory</b>	<b>Tactile</b>	<b>Chemical</b>
Fireflies glow to attract mates.	Elephants use their trunks to talk to other herds over long distances.	Dogs lick their paws to bond, clean and stimulate their dewclaws.	Cats rub against objects to mark them with their scent.
Peacocks use their elaborate tails during courtship rituals.	Male whales use their song to communicate with females.	Baboons use touch to show affection and groom each other.	Ants use pheromone trails to follow each other.
Crows inflate their head to scare other predators.	Whales blow to call to other whales in the pod.	Sharks kick other horses to establish dominance.	Sharks use their signature smell to deter predators.

regions have been heard sounding off in different 'dialects'. A study found that blue whales produce different patterns of pulses, tones and pitches depending on where they're from.

A species of American tree frog provides an excellent example of the complex nature of communication among animals. This frog gives a two-part call which humans hear in full. But the male frogs hear only the first part of the call, which warns them of the presence of a male intruder, while the females hear only the second part, which informs them of the presence of a potential mate.

## HONESTY AND DECEIT

Senders and receivers may have conflicting interests in the accurate exchange of information. Lying can sometimes benefit senders. Conflict of interest is greatest when two equal competitors both desire the same resource. Each would like the other to back down without a fight, and each would benefit from persuading the other that it is the better fighter by any means possible, including bluffing. In the mate-attraction context, both male and female benefit from mating with the correct species and therefore agree about the accurate transmission of species information. But females may want to mate only with a high-quality male, which puts pressure on low-quality males to exaggerate their quality. An offspring in a multiple brood may exaggerate its need for food to the parent in order to garner a larger share of the food for itself.

## HUMAN – ANIMAL COMMUNICATION

Humans and animals communicate in various situations, where the animal may not understand each word, but understands the message behind it. Studies have shown that parrots are able to use words meaningfully in linguistic tasks. Fictional portrayals of talking parrots are common in children's fiction, including in The Lion King and Aladdin. Achieving a deeper level of communication between animals and humans has long been a goal of science. Perhaps the most famous example of recent decades has been Koko, a gorilla who is supposedly able to communicate with humans using a system based on American Sign Language. Human-animal communication has existed in culture in various forms. In the Harry Potter series of books, Harry is a parselmouth (able to speak with snakes in their own language, parseltongue, which

sounds like hissing and spitting to the ears of those without this hereditary skill). Doctor Dolittle, subject of a series of books by Hugh Lofting, is a doctor whose ability to speak with animals makes him successful in dealing with animals but closes him off from most humans. In Herge's The Adventures of Tintin, Tintin's dog Snowy is sentient and able to "think".

Human behaviours resemble animal communication, some of our bodily features – eyebrows, beards and moustaches, deep adult male voices – strongly resemble adaptations to producing signals. Humans also often seek to mimic animals' communicative signals in order to interact with them.

Overall, studying communication not only gives us insight into the inner worlds of animals, but also allows us to better answer important evolutionary questions. When two isolated populations exhibit divergence over time in the structure of signals used to attract mates, reproductive isolation can occur, the distinct differences in critical communication signals may cause individuals to only select mates from their own population. For example, three species of lacewings that are closely related and look identical are actually reproductively isolated due to differences in the low-frequency songs produced by males; females respond much more readily to songs from their own species compared to songs from other species.

A thorough understanding of animal communication systems can also be critical for making effective decisions about conservation of threatened and endangered species. Recent research has focused on understanding how human-generated noise can impact communication in a variety of animals. Since the field of animal communication continues to expand, we are learning more about information exchange in a wide variety of species and understand the fantastic variety of signals we see animals produce in nature.





It is known to all that the Ellora caves situated in the Deccan Plateau of India are a series of 34 resplendent rock-cut temples that date from the 2nd century BCE to about 650 CE. But what people seldom know is that there is solid evidence about a secret underground area that is hidden under these caves. A tunnel that is over 40 feet deep proceeds underground but nobody can say what's inside because there after, the tunnel becomes too narrow for humans to get through it. This gives rise to many questions: Where do these mysterious tunnels lead? How can one carve such narrow passages if human beings cannot even get through them? Was it carved by humans at all? Who could have used such narrow passages?

One group of researchers say these tunnels were used by 'humanoids' who had an appearance resembling human beings but were smaller in size. Evidence that indicates its possibility is the Vishvakarma cave (cave 10) that has carvings of Hindu and Buddhist figures as well as a lively scene of dancing dwarfs. These dwarfs might have been the humanoids.

"There is an ancient legend among the Hindus of India that tells of a civilization of immense beauty beneath central Asia. Several underground cities are said to be located north of the Himalayan Mountains, possibly in Afghanistan, or under the Hindu Kush. This subterranean Shangri-la is inhabited by a race of golden people who seldom

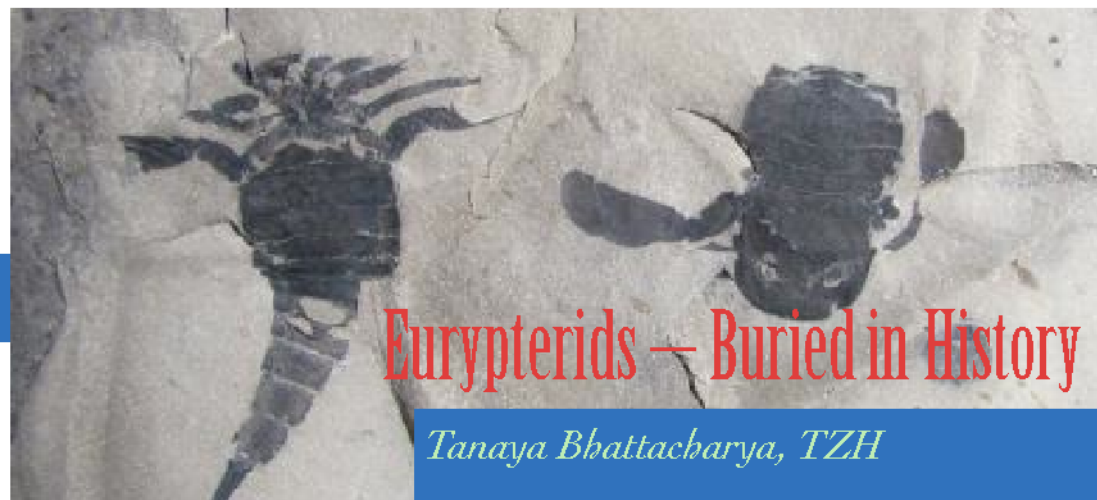
## An Underground City of Mystery

*Tanaya Bhattacharya, TZH*

communicate with the surface world. From time to time, they travel into our land through tunnels that stretch in many directions. Entrances to the tunnels are believed to be hidden in several of the ancient cities of the Orient. Tunnel entrances are said to be in Ellora and the Ajanta caverns in the Chandore Mountain range of India," said Eric Norman which he later mentioned in his book "The Hollow Earth".

Another group of researchers believe reptilian creatures to be the users of these tunnels. Archaeologists have shown that the Bodhisattva Avalokteshvara, outside cave 29 is seated on a Lotus, the stalk of which is held by the 'Naga' people. There is a legend that says, the Naga were a reptilian race of beings. In Tibet, the Naga was equated with spirits that dwell in lakes or underground streams and guard treasure. Varuna, the Vedic "Sky God" and god of the underworld, is viewed as the King of the Nagas. Nagas were said to live in 'Patala', the seventh of the 'nether' dimensions or realms. At the Ajanta Caves is an image of Lord Shiva with Goddess Parvati, behind him is the seven-headed Naga serpent that represents the seven races within Naga society. Some people believe that there was a conflict between these reptiles and humans in the ancient times which in due course of evolution drove the reptilian civilization deep into the inner earth.

Yet another conglomerate of explorers believe these tunnels to be bases of extra-terrestrial beings, though there are no evidences to support their view. Some are even trying to draw parallels between these tunnels and those that have been found in Derinkuyu, Turkey. With increasing curiosity among researchers, there are various ongoing studies about these tunnels. But nothing can be ascertained till we have more concrete evidences. And so this mystery is yet to be unraveled.



## Eurypterids — Buried in History

*Tanaya Bhattacharya, TZH*

"Sea Scorpions" or Eurypterids are an order of arthropods that lived for at least 210 million years in the Paleozoic era. They belong to the superclass Chelicerata, a class that also includes horseshoe crabs, scorpions, and arachnids. Contrary to their common name these were not real scorpions, but were called "Sea Scorpions" due to the scorpion-like tail found on many of them. These appalling creatures appeared in the Ordovician period (~460 million year ago), reached their peak in the Silurian and became extinct in the great Permian mass extinction.

Most Eurypterids inhabited very shallow brackish and fresh water environments, and some may have been able to walk on land. Their bodies were segmented with jointed appendages and also had characteristically flat, keeled telson (posterior) that tapered to a spine or sometimes a paddle. Many species also had a grossly enlarged first limb pair, probably used as a grasping claw when hunting. Their head had a pair of compound eyes. Jason Dunlop of the University of Manchester has reported finding slit-like structures and book lungs on some eurypterid fossils. Such structures are today known only in arachnids. They were mostly less than 10 inches in length, but some genera, such as Pterygotus and Jaekelopterus could reach lengths of over 8 feet, and may have been the largest arthropods to inhabit this planet. All eurypterids were predators that were pretty high up on the food chain, eating animals such as trilobites and even the contemporaneous placoderms. The most well known Eurypterid is probably Eurypterus rempise, the state fossil of New York.

Eurypterids have a nearly global distribution, but are rare as complete fossils. The first eurypterid fossils were discovered in 1818 by S. L. Mitchell in Silurian rocks of New York state which he initially mistook as a catfish fossil. Most eurypterid fossils are found in Europe and the USA, and there is a current debate as to whether this represents a true biogeographic distribution as presence of these fossils have also been recorded in

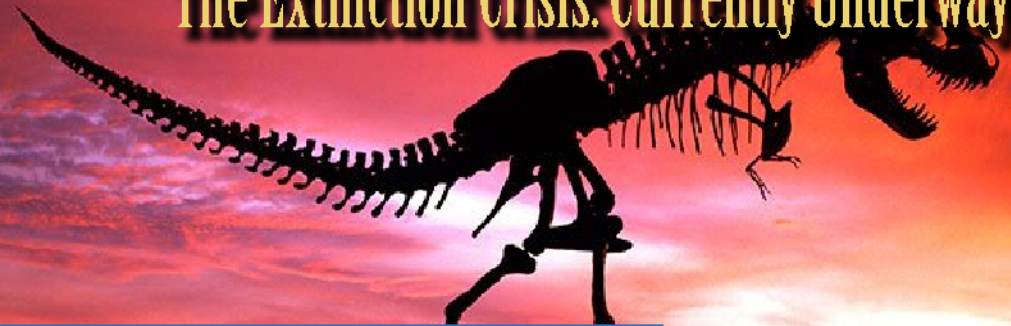
South Africa and Australia. South Africa and Australia were part of Gondwana that was far away from Laurentia (Europe, USA) at the time, which emphasizes the need to dig around in other places across the globe.

There are only a few places on Earth like the Upper Silurian rock unit in New York and Ontario of North America where whole Eurypterid Fossils can be regularly found. This rock unit is called the Bertie group. In this group, there are several Eurypterid "colonies" or "pools" where fossil Eurypterids are common and exquisitely preserved. One of these is the Herkimer Pool where by far, the best Eurypterid fossils on Earth have been discovered.

These Eurypterid pools were thought to be either shallow salt flats or tidal flats, where bodies and/or molts of Eurypterids living nearby washed up. These molts naturally accumulated in shallow depressions, called windrows, in the tidal flats. To find Eurypterids, one must find natural fractures running through the conchoidal depressions and correctly break them open to reveal the windrows. Usually the Eurypterids are centered neatly in the windrow.

There are more than 300 species of sea scorpions known. These have been classified into more than 60 genera and about 20 families. The fossils need to have intact appendages and ventral structures else it is not possible to always identify them to species. Eurypterids are fairly easily recognizable when relatively complete and undistorted fossils are found. The most recent complete revision of eurypterid classification was done by V.P. Tollerton, Jr., in 1989. He recognized a dozen superfamilies based on the morphology of the legs. Today, the Eurypterids are among the best studied groups of fossils and its external features are known as well as any other living organism in the animal kingdom. Pretty impressive for an animal dead over 250 million years!

# The Extinction Crisis: Currently Underway



Anupama Nair, FZH

The history of life on Earth dates all the way back to 3.5 billion years ago, fossilized evidence of which confirms the existence of single-celled organisms. Since then, life on Earth has seen the rise and fall of groups of organisms. Anaerobic prokaryotes originated, flourished and then declined as oxygen content of the atmosphere rose. Billions of years later, the first tetrapods emerged from the sea, giving rise to amphibians that went on to dominate land for 100 million years—until other tetrapods replaced them as dominant terrestrial vertebrates. These and other major changes in life on Earth have been influenced by large-scale processes such as continental drift, mass extinctions and adaptive radiations.

Although extinction occurs on a regular basis, at times disruptive global environmental changes increase the rate of extinction drastically and result in widespread mass extinction. Five mass extinctions are documented in fossil record over the past 500 million years, and they usually separate the various eras and epochs that the history of life on Earth is divided into. The most recent and famous example is that of the Cretaceous mass extinction which occurred about 65 million years ago, perhaps caused by the fall of a meteorite, that wiped out all the dinosaurs along with over half of all marine species and many other terrestrial animals and plants.

Is the biosphere today on the verge of anything like

the mass extinctions of the geological past?

It is frightening but true that our planet is now in the midst of its sixth mass extinction of animals and plants. Called the Holocene extinction, unlike past mass extinctions, caused by events like asteroid strikes, volcanic eruptions, and natural climate shifts, it is almost entirely caused by us — humans. In fact, 99% of currently threatened species are at risk from human activities, primarily those driving habitat loss, introduction of exotic species, and global warming. Because the rate of change in our biosphere is increasing, and because every species' extinction potentially leads to the extinction of others bound to that species in a complex ecological web, numbers of extinctions are likely to shoot up in the coming decades as ecosystems unravel.

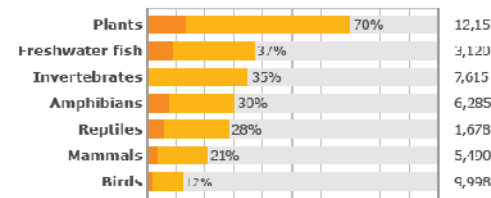
The background level of extinction known from the fossil record is about one species per million species per year, or between 10 and 100 species per year counting all organisms. In contrast, estimates based on the rate at which the area of tropical forests is being reduced, and their large numbers of specialized species, are that we may now be losing 27,000 species per year to extinction from those habitats alone. Therein lies the concern biologists have for many of today's species. While the number of actual documented extinctions may not seem that high, we know that there are populations so critically small that they have little hope of survival. Other species are among the "living dead"

## Species under threat globally

% of species assessed so far that are threatened:

Critically Endangered where known      Endangered or vulnerable

Number of species assessed



Source: IUCN

because of their interrelationships — for example, the loss of a pollinator can doom the plant it pollinates, and a prey species can take its predator with it into extinction. By some estimates, as much as 30% of the world's animals and plants could be on a path to extinction within 100 years. These losses are likely to be unevenly distributed, as some geographic areas and some groups of organisms are more vulnerable to extinction than others.

Humanity's main impact on the extinction rate is landscape modification, an impact greatly increased by the burgeoning human population. In terms of how humans have contributed to this mass extinction, three major factors include: the increased global concentration of greenhouse gases, affecting the global climate; oceanic devastation, such as through overfishing and contamination; and the modification and destruction of vast tracts of land and river systems around the world to meet solely human-centred ends, thus ruining the local ecosystems. Other related human causes of the extinction event include deforestation, hunting, pollution, the introduction in various regions of non-native species, and the rampant transmission of infectious diseases.

Trying to reverse the impact that we have on this mass extinction involves the general environmentally-conscious methods we have already begun to implement. Species diversity ensures ecosystem resilience, giving ecological communities the scope they need to withstand stress. Thus while conservationists often justifiably focus their efforts on species-rich ecosystems like rainforests and coral reefs—which have a lot to lose—a comprehensive strategy for saving biodiversity must also include habitat types with fewer species, like grasslands, tundra, and polar seas—for which any loss could be irreversibly devastating. And while much concern over extinction focuses on global-

ly lost species, most of biodiversity's benefits take place at a local level, and conserving local populations is the only way to ensure genetic diversity critical for a species' long-term survival.

Some organisms do well under the conditions we've created. They tend to cope well with change, tolerate a broad range of habitats, disperse widely and reproduce rapidly, and they can quickly crowd out more specialized local species. City pigeons, zebra mussels, rats, and tamarisk trees—these are examples of what biologists call "weedy" species, both animals and plants. Many weedy species will probably survive, and even thrive, in the face of the current mass extinction. But thousands of others, many never known to science, are likely to perish.

And what is the fate of our own species likely to be, if we really are in the midst of a sixth mass extinction? One possibility is that as diversity and abundance wither, the species causing it all—Homo sapiens, the most dominant species in history—could also be on the road to oblivion. But another possibility is that Homo sapiens, which have proved to be a very effective weedy species itself, will persist. And while the fossil record tells us that biodiversity has always recovered, it also tells us that the recovery will be unbearably slow in human terms—5 to 10 million years after the mass extinctions of the past. That's more than 200,000 generations of humankind before levels of biodiversity comparable to those we inherited might be restored.

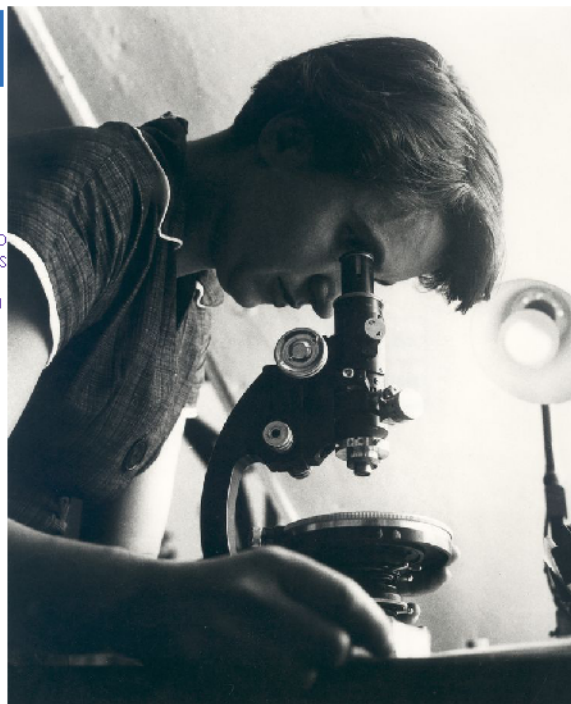
# Shattering the Glass Ceiling of Science

Bhavya Iyer, TZH

It's 2015 and you would think that the battle for equality of the genders was won long ago, but surprisingly – or not so surprisingly, if you ask most women – this is not so. The world of Science, Technology, Engineering and Mathematics (STEM) has proven to be particularly resistant to accepting men and women as equal in terms of placements, salaries, and prospects. While women have made great strides in what was once considered a man's domain, there is still far to go.

Despite being 50% of the world population, women make up only a fraction of the STEM workforce, even now. According to US Census Bureau statistics, in 2011 it was 26%. While a great improvement from 7% in 1970, that's still a long way to go to 50%. (Even this is far higher than the paltry 13% women make up in fields like engineering). These figures are for the USA.<sup>1</sup> Even though one of every four scientists in India is a woman (Sur, 2001), the majority of them remain at relatively lower positions in the field. Even in the Biological Sciences, which have a higher proportion of women, they are limited at junior faculty positions, where their proportion ranges from 18-33 % (Bal, 2005).

Many might argue that this lack of women in STEM is purely due to a disinclination for science and related subjects, but there is no proof that women lack the aptitude or IQ for these subjects. Indeed, it is the opposite – studies show that girls tend to do as well as boys in science and maths at the school level. The problem isn't a lack of interested girls, but the pervasiveness of bias against women, lack of female role models in male-dominated spaces, sexual harassment at the workplace, and pressure to be the sole caregivers in a family with children that leads to the number of women in science to drop at higher levels. A study by the Indian Academy of Sciences and the National Indian Academy of Sciences in 2010 showed that women who had research positions cited several organisational factors for dropping out. These included the lack of flexible timings, daycare facilities, accommodation and



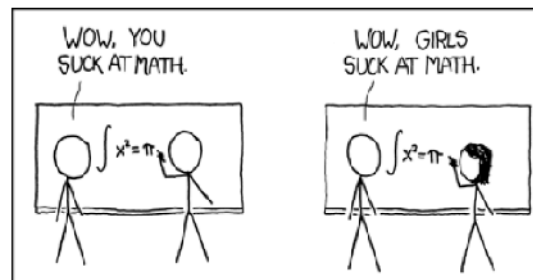
transport.

In a study carried out by Corinne Moss-Racusin of Yale<sup>3</sup>, identical resumes were sent out to 127 participants – professors of both sexes at biology, chemistry and physics departments in 6 leading research universities – for the position of lab manager. Half the resumes had 'John' as the name of the applicant, the other half 'Jennifer'. The faculty members were asked to rate John or Jennifer on several parameters such as competence, hireability, how much the professor would be willing to mentor the student, and the salary range they would be willing to pay. On average, John was rated half a point higher than Jennifer on all parameters – this despite the resumes being identical other than the name (and therefore implied gender) of the applicant. Moreover, 'John' was offered an average starting salary of \$30,238 against \$26,508 for 'Jennifer'. This shows a startling trend of institutional bias. Other studies have shown similar results, with mothers being rated less competent while fathers were given bonuses. (Correll, Benard & Paik, 2007)

This is enough evidence to prove the preva-

lence of sexism in academia. To those who might be apt to believe this is a phenomenon exclusive to Western countries, data from the Monster Salary Index India IT Sector Report 2014 shows that only 30% of India's total IT sector workforce is female, and there is a very large gender pay gap of 29%<sup>4</sup>. Furthermore, a wide gender pay gap is demonstrated across occupations and level of education. It has been noted that as the education level increases, so does the gender pay gap, by as much as 40% at the master's level, 28% at the PhD level, 44% more for CA/CS or equivalent, according to a report by Wageindicator.org.

In India women face many struggles, even from before birth, with high female foeticide resulting in worrying sex ratios across India (Delhi has one of the worst child sex ratios, at 834 girls for every 1000 boys), to girls being denied education or forced to leave school once they reach puberty, to being forbidden from working before or after marriage. The inequalities demonstrated in STEM academia only adds to the injustices many have to face.



For those who aren't convinced, there are even more reasons to bring more women into science – according to reports from National Geographic, gender bias has affected research outcomes and damaged women's health. It has long been a routine procedural bias to ignore sex as a variable in scientific research. As a result, many diseases where women display symptoms differently from men go undiagnosed in women, even diseases like cardiovascular diseases which if detected early on can be easily treated.

According to National Geographic, 'It's now widely acknowledged that countless women with heart disease have been misdiagnosed in emergency rooms and sent home, possibly to die from heart attacks, because for decades what we know now wasn't known: that they can exhibit different symptoms from men for cardiovascular disease. Women also have suffered disproportionately more side effects from various medications, from statins to sleep aids, because the recommended doses were based on clinical trials that focused largely on average-size men.'<sup>1</sup> Similarly, in studies of mental disabilities like Autism, where males are at higher risk for autism, mostly girls go undiagnosed, as the disease tends to have different symptoms in females, which are under-studied.

As if all of this wasn't enough, even when a woman

beat the odds to reach the top, and performed groundbreaking research, the credit would often go to her husband or male colleagues. A famous example is Rosalind Franklin (pictured). Because of her x-ray diffraction images of DNA, which they were shown without Franklin's knowledge, Watson and Crick were able to deduce the structure of DNA, for which they won a Nobel Prize in 1962. Franklin had passed away four years before. Another example is Nettie Stevens, who first performed studies crucial in determining that an organism's sex was dictated by its chromosomes rather than environmental or other factors. However, Thomas Hunt Morgan, a prominent geneticist, who corresponded with Stevens extensively, is often credited with discovering the genetic basis for sex determination.

What can we do to realize a more equal environment for women in STEM? To begin with, we need to eliminate bias at an early stage that may discourage young girls from choosing particular career paths because they are 'boy subjects'. According to Virginia Valian of Hunter College, in her paper 'Interests, Gender and Science'<sup>8</sup>, women's interest in math and science will increase if they have a feeling of belonging and an expectation of success. In addition, it is extremely important to do away with the subtle biases against women that dog their careers – as evidenced by the Yale study. We can start by providing women a safe, nondiscriminatory workplace environment so they can focus on achieving excellence. We can take inspiration from Geraldine Ferraro – the first woman to be nominated as Vice President of the United States – once said, "We've chosen the path of equality, don't let them turn us around."

# The Nobel Prize

Alice Sinha, TZH

Every year, we hear of eminent people from diverse field belonging to different nations receiving the most prestigious and acclaimed award – The Nobel Prize. This esteemed award is cherished by all scientists, who put in as much as an entire lifetime to contribute to the welfare of the world in their own way. This award is given to recognize the hard work, innovation, determination, courage, and all the effort taken to bring a naïve idea into real practical purpose.

The story behind the Nobel Prize dates back to the early 1800s, where a man named Alfred Nobel was born in Sweden. This man grew up to become a renowned chemist, engineer and an inventor. He was known for his inventions like smokeless bombs – especially dynamite. One fine day, he was astonished to read his own obituary in a French newspaper (it was actually his brother who had died) which read “The merchant of death is dead.” This lead a bewildered and perplexed Nobel to wonder how he would be remembered posthumously. This incident inspired him to change and use the fortune he had amassed to create a series of prizes for those who work for “the greatest benefit to mankind” in the fields of physics, chemistry, peace, physiology or medicine, and literature. Nobel bequeathed 94% of



The Winners of 2014:  
O'Keefe, Moser & Moser

his total assets – 31 million SEK(US\$186million) – to establish the five Nobel prizes. This led to the establishment of The Nobel Foundation on 29 June 1900, which is responsible for maintenance and administration of Noble prizes till today.

Here is the list of the people who have contributed immensely in the field of physiology or medicine and were acknowledged by the Noble prizes in the last decade.

Year	Scientists	Contribution
2004	Richard Axel, Linda Buck	Discovered odorant receptors and the organization of the olfactory system.
2005	Barry Marshall; Robin Warren	Discovered the bacterium <i>Helicobacter pylori</i> and its role in gastritis and peptic ulcer disease.
2006	Andrew Fire; Craig Mello	discovered RNA interference - gene silencing by double-stranded RNA.
2007	Mario Capecchi; Martin Evans; Oliver Smithies	Discovered the principles for introducing specific gene modifications in mice by the use of embryonic stem cells.
2008	Harald zur Hausen; Françoise Barré-Sinoussi; Luc Montagnier	Harald zur Hausen discovered human papilloma viruses that causes cervical cancer”, and Françoise Barré-Sinoussi and Luc Montagnier discovered human immunodeficiency virus”.
2009	Elizabeth Blackburn; Carol W. Greider; Jack W. Szostak	Discovered of how chromosomes are protected by telomeres and the enzyme telomerase”.
2010	Robert G. Edwards	Developed in vitro fertilization.
2011	Bruce Beutler; Jules A. Hoffmann; Ralph M. Steinman	Bruce A. Beutler and Jules A. HoffmannMade discoveries concerning the activation of innate immunity and Ralph M. Steinman for his discovery of the dendritic cell and its role in adaptive immunity
2012	John B. Gurdon; Shinya Yamanaka	discovered that mature cells can be reprogrammed to become pluripotent.
2013	James E. Rothman; Randy W. Schekman; Thomas C. Südhof	Discovered the machinery of regulating vesicle traffic, a major transport system in our cells.
2014	John O'Keefe; May-Britt Moser; Edvard Moser	Discovered the networks of cells that form the brain's navigational system. This fundamental work in neuroscience could have applications in Alzheimer's and other diseases.

# Revolting Researchers

*Pankhuri Jain, FZH*



Cerberus, the three-headed mutt of Hades.

A similar experiment was done by Vladimir Demikhov - and he also attached the head, shoulders and front legs of a puppy to a dog.

## **Kellogg's Chimpanzee Daughter and Human Son**

Somebody got really influenced by Tarzan. In an attempt to 'humanize the apes', Vernon Kellogg adopted a seven-month old chimpanzee, Gua, and raised her alongside his own ten-month old son Donald as a human. However, Gua grew faster than Donald and even learned some behaviors more quickly. Gua seemed more dependent on human interaction and support than Donald. In an interesting twist, nine months into the project, Donald began to imitate Gua's "food bark" to signal his hunger instead of using words. Kellogg cut his experiment short, and Gua was sent back to the primate center from which she came.

## **Duncan MacDougall and the weight of the soul**

Duncan MacDougall was quite the shady scientist. This man wanted to prove that the human soul had mass, and was actually measurable. MacDougall conducted this experiment on six dying patients who were placed on specially made Fairbanks weight scales just prior to their deaths. The intention was to weigh each body before and after death to determine any differences measured by the delicate scales.

"Suddenly, coincident with death, the beam end dropped with an audible stroke hitting against the lower limiting bar and remaining there with no rebound. The loss was ascertained to be three-fourths of an ounce. The instant life ceased the opposite scale pan fell with a suddenness that was astonishing - as if something had been suddenly lifted from the body. Immediately all the usual deductions were made for physical loss of weight, and it was discovered that there was still a full ounce of weight unaccounted for."

Following the experiment, it was determined that the average weight loss of each person was  $\frac{3}{4}$  of an ounce. MacDougall concluded that a human soul weighed 21 grams. MacDougall conducted the same experiment on 15 dogs, showing no change in weight following their death. He concluded that this may signify only humans have souls.

So, to conclude, there was absolutely no shortage of crazies back then. But, one of the most evil and horrible experiments have been performed by Nazi physician Josef Mengele, especially his work on twins. What's also terrifying is how useful this information was to medical science. A large amount of our knowledge about how hypothermia and cold affect humans is based on this data. Many have raised questions about the morality of using data gathered under such horrific circumstances. He has been rightly called the 'Angel Of Death' by the metal band Slayer.



Since Mary Shelley's "Frankenstein", the popular imagination has been alive with stories about crazy scientists and even much crazier experiments. But, sometimes the reality is much worse than fiction. History is full of experiments which neither were sane nor sensible. And, much like the "Frankenstein", most of these didn't have a very happy ending.

## **Charles Guthrie and the two-headed dog**

Guthrie was considered a genius for developing the modern day transplant practices. He was also probably the first man to sew the head of one dog onto another.

And, just to clarify, it wasn't a head replacement, but an addition. It seemed more of an insane attempt towards creating



# Biotech Gets Colour-Coded! But With Shades of Grey

*Amaanat Bedi, TZH*

Biotechnology is essentially the use of technology to make biological processes benefit mankind. Biotechnology has its applications in four major industrial areas, including health care (medical), crop production and agriculture, non-food (industrial) uses of crops and other products (e.g. biodegradable plastics, vegetable oil, biofuels), and environmental uses. A series of derived terms have been coined to identify several branches of biotechnology:

- Blue biotechnology is a term that has been used to describe the marine and aquatic applications of biotechnology, but its use is relatively rare.
- Green biotechnology is biotechnology applied to agricultural processes. An example would be the selection and domestication of plants via micro-propagation. Another example is the designing of transgenic plants to grow under specific environments in the presence (or absence) of chemicals.
- Red biotechnology is applied to medical processes. Some examples are the designing of organisms to produce antibiotics, and the engineering of genetic cures through genetic manipulation.
- White biotechnology, also known as industrial biotechnology, is biotechnology applied to industrial processes. An example is the designing of an organism to produce a useful chemical. Another example is the using of enzymes as industrial catalysts to either produce valuable chemicals or destroy hazardous/polluting chemicals. White biotechnology tends to consume less in resources than traditional processes used to produce industrial goods.
- Besides the above, there are two more branches of biotechnology:
  - Environmental biotechnology can simply be described as the optimal use of nature, in the form of plants, animals, bacteria, fungi and algae, to produce renewable energy, food and nutrients in a synergistic integrated cycle of profit making processes where the waste of each process becomes the feedstock for another process.
  - Bioinformatics is an interdisciplinary field which addresses biological problems using computational techniques, and makes the rapid organ-

ization and analysis of biological data possible. The field may also be referred to as computational biology, and can be defined as, "conceptualizing biology in terms of molecules and then applying informatics techniques to understand and organize the information associated with these molecules, on a large scale." Bioinformatics plays a key role in various areas, such as functional genomics, structural genomics, and proteomics, and forms a key component in the biotechnology and pharmaceutical sector.

But it still has Streaks of Grey...

Since the very beginning, biotechnology has been surrounded by ethical and moral issues regarding cloning and the effect this has on the society. Besides, there are many instances that forces one to think about the repercussions of the techniques used in biotechnology. One such instance is stated below:

In India where livestock are left to graze on post-harvest cotton, thousands of livestock deaths have been recorded in different villages across central India where Bt cotton is grown. Shepherds' own observations and post-mortem analysis carried out in the laboratory revealed abnormal liver, enlarged bile ducts and black patches in the intestine. The shepherds said that the sheep became "dull/depressed" after 2-3 days of grazing, started coughing with nasal discharge and developed red lesions in the mouth, became bloated and suffered blackish diarrhoea, and sometimes passed red urine. Death occurred within 5-7 days of grazing. Sheep from young lambs to adults of 1.5-2 years were affected. One shepherd reported getting diarrhoea from eating the meat of an affected sheep. The vets declared that the toxicity could be due to the Bt toxin but this could not be proven as results were confounded by additional pesticides used on the fields. The shepherds were however, advised against letting the sheep graze on any more Bt cotton plants.

# Marathon of the GMO Foods

Sandhya Singh, TZH

*"Eleven major Indian farmer unions urge Supreme court to stop GM crop field trials"  
"Objection against Bt cotton speculative and confusing, says Indian Agricultural Minister"  
"Resistance sprouts against Bt maize in Punjab (India)"  
"Coming a cropper- Even Brazil and China have embraced GM crops, India must not dither"*

The above headlines in the leading newspapers of the country have forced us to help ourselves. Yes, we, the Genetically Modified plants are now going to spread awareness in the country of our potential benefits over the traditional crops. For this, the first move decided by us is to run a marathon under the aegis of the Universal Federation of GM crops, supported by renowned scientist from all over the world. The start point is a beautiful village in the southern part of Kolkata, West Bengal where the prime occupation of the villagers is farming.

And now the runners! I am the lead runner Brisky Brinjal. With me here are Peppy Papaya, Flav'r Savr, Bunky Banana, Uncle Melon, Nutty Peas, Applex Apple, Goldy Rice, and corn-nel. The shot has just been fired and we have set out on one of the biggest challenges of our lives. All of us are holding flags with each of our benefits written on them.

Just then Nutty Peas shouted, 'Hey Sir, I have a fungus resistant gene inserted in me. You can try me out. No more of pesticides. Please take a sample.'

"Well done girl," I said. This instilled some confidence in the others. We had crossed two kilometres to find a lush green potato field. "Hey, what are you guys up to? I am Picky, the potato," shouted the potato crop from the field.

"I am Brisky, a genetically modified Brinjal. All of us here are genetically modified." "What is genetically modified," asked Picky.

"Scientists have modified our DNA in such a way that each of one of us has some benefit or the other, like improved shelf life, stress resistance, herbicide resistance, or even pathogen resistance."

Picky agreed and this was motivating enough for us. "Can I get resistant to late blights?" Picky asked.



"Yes, of course. In fact, scientists are working on it," Uncle Melon replied. Picky now wanted to join our cause by taking us to some of the farmers. Looks like, we are now getting down to serious business.

Just as we ran another two kilometres, Applex tumbled over the slippery roads next to the fresh water pond. He bruised himself. Picky said, "Oops, be careful. You'll brown yourself."

Applex smiled, "I am a non-browning apple. I have a synthetic gene that sharply reduces production of polyphenol oxidase, an enzyme responsible for browning."

Picky said, "Wow, so now we can have apple wedges, just like potato wedges in McDonalds."

"But no oil, only healthy wedges, Picky," said Applex. Everybody agreed.

We now came across a bunch of school kids. Flav'r Savr handed each one of them a pamphlet about GMO and a bottle of GMO tomato ketchup. She shouted as she ran, "If you want more, ask your parents to grow us." Picky tastes a little ketchup and finds a better taste. "GMOs are really astounding," he said.

Just then a group of farmers came near us and read the information displayed on our flags. Goldy Rice started, "WHO survey says about 30% of the world population suffers from iron deficiency. To help you all come out of such health issues, scientists have modified me to increase my iron content. In addition to that, I can act as a great vitamin A substitute. So why do you want to have medicines which have side effects for your iron and vitamin deficiencies when you can curb them by having merely rice without absolutely no side effects?"

Bunky Banana said, "Yeah, he is right. I too injected with genes containing loads of iron and pro vitamin A. Am tasty and more over healthiest for a pregnant lady."

Corn-nel added, "Most farmers use a toxic chemical called Furadan to save their corn plants from insects. It kills leaf-eating, soil-inhabiting insects, wildlife, farm animals and you, if you drink it. So why do you guys want to use conventional methods of farming when you have non toxic genetically modified insect resistant corns?"

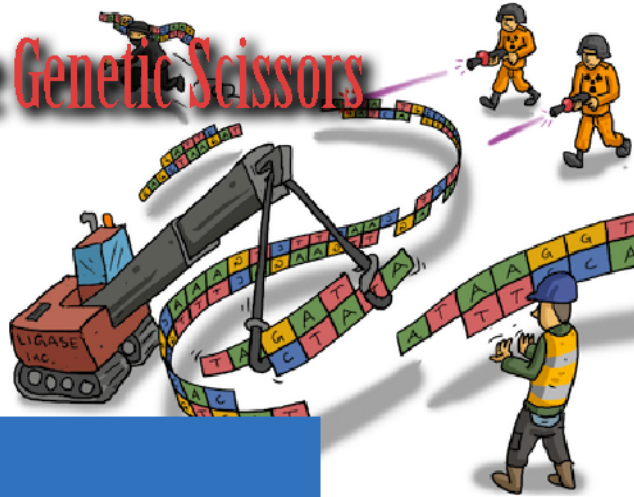
I too politely forwarded my points to the farmers, "Sir, our country's population is increasing but at the same time our cultivable land is not. Hence, to meet the ever increasing demands of food crops in limited area and challenging climatic conditions, we must all resort to some smart and contemporary methods of farming. We have higher nutritional values. Just give us a chance to prove our potential. I am sure none of us would disappoint you."

Picky too pleaded. The farmers nodded their heads and said they would love to try growing genetically modified crops. We continued the marathon to finally reach the finish point. We were surprised to find journals, village women, kids, and researchers standing near the finish point, with constant recital, "We want GMOs! We want GMOs!"

This was the moment that made all of feel winners. We felt elated and energised enough to run a Marathon once again! So sing along everybody...

*Kadam kadam badhaye ja,  
Khushi ke geet gaaye ja,  
Ye zindagi hai kaun ki,  
Isliye to GM crops ugaye ja..*

## CRISPRs - The Genetic Scissors



*Kritika Chugh, TZH*

CRISPRs stand for CLUSTERED REGULARLY INTERSPACED SHORT PALINDROM REPEATS.

Although this gene editing technology was first described in 1987 in bacterium *E.coli*, its function remained a mystery for a long time. Scientists believe it might be part of a primitive Bacterial Immune System - this is astounding, as it has long been believed that only higher animals possess defense mechanisms in the form of immune systems.

CRISPR modifies the DNA sequence by cutting the mutated genes. It refers to a succession of base pair sequences of DNA called Direct Repeats (DRs) separated by sequences of similar lengths (spacers). Each repetition contains a series of base pairs followed by the same series in reverse.

The main feature of CRISPRs is that they consist of two components viz. a short RNA strand, that matches a particular spot in the genome, and a protein Cas9, that snips the DNA at that location. Thus CRISPRs-Cas system functions as an immune system and makes it user friendly. Recent studies reveal their use in genomic surgery and how it fixes a genetic mutation that causes cystic fibrosis, insulin resistance etc. As it is cheaper, faster and far more accurate than other techniques, it is greatly used in research to test medicine for a wide range of diseases that affect humans. Remarkably, researchers named them as mobile elements as they consist of multiple chromosomal CRISPR loci, thus resulting in a smart way to target harmful bugs!

## HIV Vaccine - How Near Are We?



*Ashmita Tamta, SZH*

Thirty five million people including 3.2 million children (>15 years) are currently living with AIDS. Majority of affected people are in the low and middle income countries. Recently, the Canadian researchers who were developing the world's first HIV vaccine cleared a significant obstacle. Initial results from a Phase I trial held by scientists at Western University have shown no adverse effects while significantly boosting immunity. The vaccine is based on a genetically modified dead virus, can now progress to the next stage of testing. The vaccine could be commercially made available in about five years if all goes well.

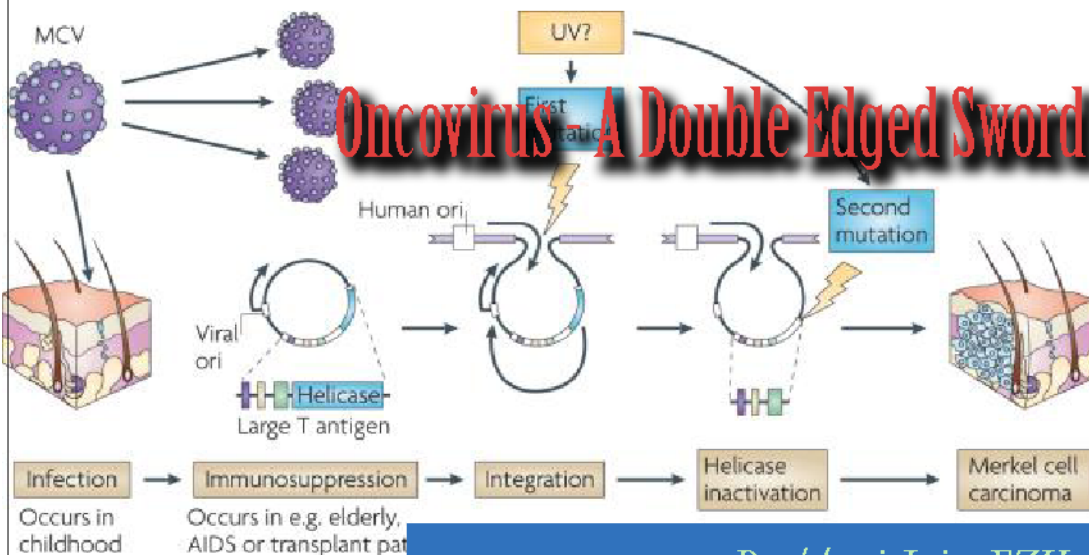
Dr. Chil-Yong Kang and his team at Western's Schulich School of Medicine and Dentistry with the support of Sumagen Canada are working on developing a vaccine, SAV001-H. The now completed first-phase trial involved several infected men and women aged 18 to 50.

The result was deemed positive since no patient experienced any major adverse effect viz no local reactions from the injections or any signs, symptoms, or reactions to potential toxicities. Now they are ready to embark upon the next phase of clinical trials to study the vaccine's immunity and effectiveness.

Dr. Dong Joon Kim said in the official release "We have proven that there is no safety concern of SAV001-H in human administration and we are now prepared to take the next steps towards Phase II and Phase III clinical trials." "We are delighted to be one step closer to the first commercialized HIV vaccine."

Interestingly, the vaccine is one of a kind as it uses a killed whole HIV-a -- much like the killed whole virus vaccines used to treat polio, influenza, rabies and hepatitis A. A killed vaccine is made from a formerly virulent or infectious agent which are first inactivated or killed by radiation, heat or chemicals. In this case, the HIV-1 was genetically engineered so that it is non-pathogenic and can be generated in large quantities.

# Oncovirus - A Double Edged Sword



Pankhuri Jain, FZH

Cancer or a malignant tumour, is a class of diseases involving abnormal growth of cells which can metastasize to different regions of the body. Cancer can occur due to genetic factors, lifestyle factors like use of tobacco, environmental factors like sun or UV exposure, etc. However, a sizeable percentage of cancer cases are attributed to viruses. A cancer causing virus is called as an oncovirus. These viruses can cause cancers, but a large number of them have shown a great potential towards the treatment of some types of cancers.

## DISCOVERY

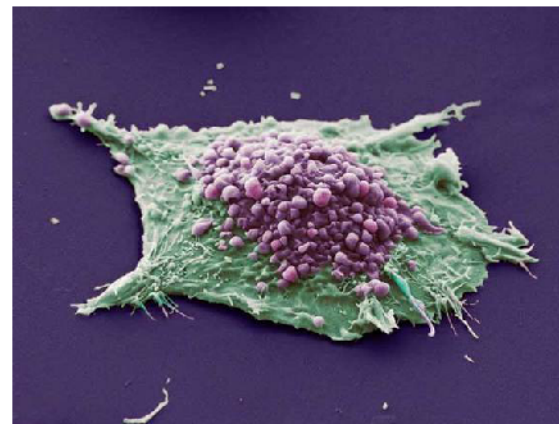
The year 2011 marks the centenary of Francis Peyton Rous's landmark experiments on an avian cancer virus. Rous had shown that cancer could be transmitted through cell-free tumour extracts and thus must be caused by a small transmissible agent, probably a virus. The first human tumor virus was discovered in the middle of the last century by Epstein, Achong and Barr in African pediatric patients with lymphoma. To date, seven viruses have been consistently linked to different types of human cancer, and are estimated to account for up to 20% of all cancer cases worldwide, and infection is one of the most important risk factor for cancer development, after tobacco.

## THE HOW

While viruses can cause cancer in a variety of ways, they can't be caught like an infection. The mechanisms fall into two broad categories. In the direct method, oncoviruses infect normal cells and slip some of their genes into the cells' DNA, causing the cells to produce a few abnormal proteins. If the cells acquire additional gene mutations, or if the individual has a weakened immune system, the cells can begin to behave cancerously. Cancers occur when the cell's DNA develops mutations that cause the cell to divide uncontrollably. These mutations sometimes arise when the DNA is damaged. However,

viruses can have effects similar to these mutations when they insert themselves into the DNA, and the end result is the same – uncontrolled cell growth. In the indirect method, viral infection can cause tissue to become inflamed as the immune system tries to quell the infection. Such inflammation, persisting for years, increases the chances that tissue will become cancerous.

However, many people can be infected with an oncovirus and never get cancer. The virus only causes cancer in certain situations. Cells have several defense mechanisms to prevent tumor growth. Sometimes cells with certain mutations will self-destruct so they don't turn cancerous. But viruses can interfere with these defenses. Viruses don't set out



known for causing infectious mononucleosis, often called the "kissing disease." In addition to kissing, EBV can be passed on by coughing, sneezing, or by sharing drinking or eating utensils. There is no medicine or other treatments to get rid of EBV, nor are there vaccines to help prevent it, but EBV infection doesn't cause serious problems in most people. EBV infection increases a person's risk of getting nasopharyngeal cancer and certain types of fast-growing lymphomas.

Human Immunodeficiency Virus (HIV) HIV, the virus that causes acquired immune deficiency syndrome (AIDS), doesn't appear to cause cancers directly. But HIV infection increases a person's risk of getting several types of cancer, like anal cancer, Hodgkin's lymphoma, some types of skin cancers, lung cancer, cancers of the mouth and throat and liver cancer.

to cause cancer, but their replication uses all the same functions, so they tend to inhibit all these protective mechanisms. In a way, they are the ideal agents for causing cancer.

The "hit and run" hypotheses proposes that a virus can cause cancer without integrating itself into the cell's DNA. In this case, a cell develops a genetic mutation, but the virus present in the cell overrides the defense mechanisms and allows the cell to continue to live. Over time, more and more mutations develop, and the cell turns cancerous. However, by the time the cancer is discovered, the virus has been eliminated by the immune system, leaving no "fingerprints".

## SOME TYPES OF VIRAL CANCERS

### Human Papilloma Virus (HPV)

These viruses are named such because they may cause papillomas (warts) and can grow in skin or in mucous membrane. HPVs can be spread through contact. HPV infections are very common; however their cancers are not. Many people may be infected, but not develop a cancer. A few types of HPV are the main causes of cervical cancer. Completely avoiding contact of the areas of your body that can become infected with genital HPV (like the mouth, anus, and genitals) with those of another person may be the only way to keep from becoming infected with HPV.

There's no treatment for the virus itself. However, two vaccines, Gardasil and Cervarix, are available to help protect against infection from the main cancer-causing HPV types. The vaccines are approved for use in females aged 9 or 10 and into their mid-20's. Gardasil has also been approved for use in men.

### Epstein-Barr Virus

EBV is a type of herpes virus. It is probably best

### Merkel's cell polyomavirus

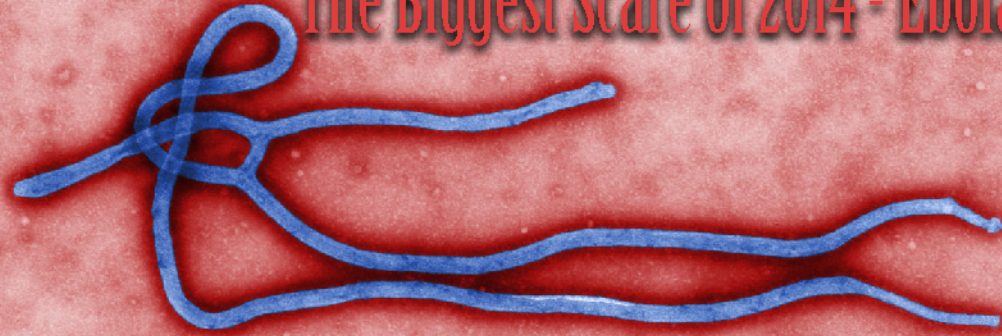
Most people are infected with MCV at some point, and it usually causes no symptoms. But in a few people with this infection, the virus can affect the DNA inside cells, which can lead to Merkel cell cancer. Nearly all Merkel cell cancers are now thought to be linked to this infection.

If there is a "bright side" to such cancers, it's that they can sometimes be prevented by vaccines, or other treatments that target the causative virus. A hepatitis B vaccine, for example, is used to prevent liver cancer.

Most of these cancers can't be prevented, although some have vaccines. However, some scientists claim that consumption of "super foods" or cancer-slaying foods like cruciferous vegetables, vegetables rich in beta-carotene (carrots, tomatoes, etc.), and rich sources of vitamin C can help in treatment.

The revelation that cancer can be caused by infectious agents such as viruses opened new avenues for cancer prevention, detection and treatment. Extensive studies have revealed numerous strategies adopted by viruses for hijacking host cellular pathways, crucial for the onset and progression of the disease and may help in designing effective targeted therapies for cancers. Further, studies targeted at interference with the viral-host interfaces should lead to futuristic first line of therapeutics.

# The Biggest Scare of 2014 - Ebola



Anupama Nair, FZH

Ebola virus disease, or simply Ebola, is a disease of humans and other primates caused by ebolaviruses. The Ebola virus causes an acute, serious illness which is often fatal if untreated. Ebola first appeared in 1976 in 2 simultaneous outbreaks, one in Nzara, Sudan, and the other in Yambuku, Democratic Republic of Congo. The latter occurred in a village near the Ebola River, from which the disease takes its name.

The current outbreak in West Africa, (first cases notified in March 2014), is the largest and most complex Ebola outbreak since the Ebola virus was first discovered in 1976. There have been more cases and deaths in this outbreak than all others combined. It has also spread between countries starting in Guinea then spreading across land borders to Sierra Leone and Liberia, by air (1 traveller only) to Nigeria, and by land (1 traveller) to Senegal.

The virus family Filoviridae includes 3 genera: Cuevavirus, Marburgvirus, and Ebolavirus. There are 5 species that have been identified: Zaire, Bundibugyo, Sudan, Reston and Tai Forest. The first 3 have been associated with large outbreaks in Africa. The virus causing the 2014 West African outbreak belongs to the Zaire spe-

cies, the most dangerous.

It is thought that fruit bats of the Pteropodidae family are natural Ebola virus hosts. Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest. It then spreads through human-to-human transmission via direct contact with the blood, secretions, organs or other bodily fluids of infected people, and with surfaces and materials contaminated with these fluids. People remain infectious as long as their blood and body fluids, including semen and breast milk, contain the virus. Men who have recovered from the disease can still transmit the virus through their semen for up to 7 weeks after recovery from illness.

Ebolaviruses contain single-stranded, non-infectious RNA genomes. As all filoviruses, ebolavirions are filamentous particles that may appear in the shape of a shepherd's crook, of a "U" or of a "6," and they may be coiled, toroid or branched. In general, ebolavirions are 80 nm in width and may be as long as 14,000 nm.

Their life cycle is thought to begin with a virion attaching to specific cell-surface receptors. The virions taken up by the cell then travel to endosomes and lysosomes where the viral envelope glycoprotein is cleaved. This processing appears to allow the virus to bind to cellular proteins enabling it to fuse with internal cellular membranes and release the viral nucleocapsid. The viral RNA polymerase partially uncoats the nucleocapsid and transcribes the genes into positive-strand mRNAs, which are then translated into structural and nonstructural proteins. Newly synthesized structural proteins and genomes self-assemble and accumulate near the inside of the cell membrane. Virions bud off from the cell, gaining their envelopes from the cellular membrane from which they bud from. The mature progeny particles then infect other cells to repeat the cycle. The genetics of the Ebola virus are difficult to study because of ebolavirions's virulent characteristics.

Similar to other filoviridae, ebolavirion replicates very efficiently in many cells, producing large amounts of virus in monocytes, macrophages, dendritic cells and other cells. Macrophages are the first cells infected with the virus, and this infection results in programmed cell death. Other types of white blood cells, such as lymphocytes, also undergo programmed cell death leading to an abnormally low concentration of lymphocytes in the blood. This contributes to the weakened immune response seen in those infected. Within 3 to 4 days of infection, the endothelial cells also get infected resulting in rapid and widespread damages to the entire body which can be observed as symptoms.

The incubation period of the disease is 2 to 21

days. Humans are not infectious until they develop symptoms. First symptoms are the sudden onset of fever fatigue, muscle pain, headache and sore throat. This is followed by vomiting, diarrhoea, rash, symptoms of impaired kidney and liver function, and in some cases, both internal and external bleeding. It is difficult to differentiate between the symptoms of Ebola and those of malaria, typhoid and meningitis. Special diagnostic tests such as antibody-capture enzyme-linked immunosorbent assay (ELISA), antigen-capture detection tests, reverse transcriptase polymerase chain reaction (RT-PCR) assay, electron microscopy and virus isolation by cell culture, are employed to confirm diagnosis.

*"The current outbreak in West Africa is the largest and most complex Ebola outbreak since the Ebola virus was first discovered in 1976"*

While the most recent outbreak of Ebola caused widespread fear, it does not impose that big a threat primarily because it spreads only through exchange of body fluids and the time between infection and death is less than a month, which does not allow much

time for an infected person to spread the disease. However, there is as yet no proven treatment available. A range of potential treatments including blood products, immune therapies and drug therapies are currently being evaluated. It is known that supportive care-rehydration with oral or intravenous fluids- and treatment of specific symptoms improves survival.

Good outbreak control relies on applying a package of interventions, namely case management, surveillance and contact tracing, a good laboratory service, safe burials and social mobilisation. Community engagement is must to successfully controlling outbreaks. Raising awareness of risk factors for Ebola infection and protective measures that individuals can take is an effective way to reduce human transmission.

## Forest Pharmaceuticals, Pvt. LTD.



*Tanaya Bhattacharya, TZH*

Camping in a forest, watching animals in their natural habitat, making a tent and sleeping near the camp fire....sounds interesting right? Well, in reality forests come with the threat of encountering many health problems and diseases. It is not feasible or even possible to carry medicines for all probable illnesses or ailments all the time. Many of our own fellow Zoology students have been in such a situation. In such cases the forest itself can act as your personal pharmacy. Given below are some natural remedies that could be used in emergency situations when camping in a forest:

- **Antiseptics:** Used to cleanse wounds, sores, or rashes. Extracts from the juice of wild onion or garlic, a decoction of mallow leaves, roots, or white oak bark could be used as antiseptics. All these medications are however for external use only.
- **Fevers:** Fever could be treated with tea made from willow bark, and decoction of the flowers or fruit of the Elder tree.
- **Aches, pains, and sprains:** Treat with externally applied poultices (crushed plant parts, possibly heated) of chickweed, willow bark, garlic, or sorrel.
- **Itching:** Relieve the itch from insect bites, sunburn, or plant poisoning rashes by applying a poultice of jewelweed (*Impatiens biflora*) or witch hazel leaves (*Hamamelis virginiana*). The jewelweed juice will help when applied to poison ivy rashes or insect stings. It works on sunburn just as well as aloe vera.
- **Sedative:** Brew (tea) made from mint leaves or passionflower leaves could be used as a help in falling asleep.
- **Worms or intestinal parasites:** A moderate infestation could be treated with tea made from wild carrot leaves.
- **Gas or stomach cramps:** Drink tea made from carrot seeds or mint leaves to settle the stomach.
- **Antifungal washes:** Make a decoction of walnut leaves or oak bark or acorns to treat ringworm and athlete's foot. Apply frequently to the site, alternating with exposure to direct sunlight.

*Note: While this article is meant to help, the writer and editors take no responsibility for the health of readers travelling to exotic locations. Please take all precautions, including speaking to an actual, qualified medical professional, before you go.*

## When Half a Brain Is Better Than A Whole One!

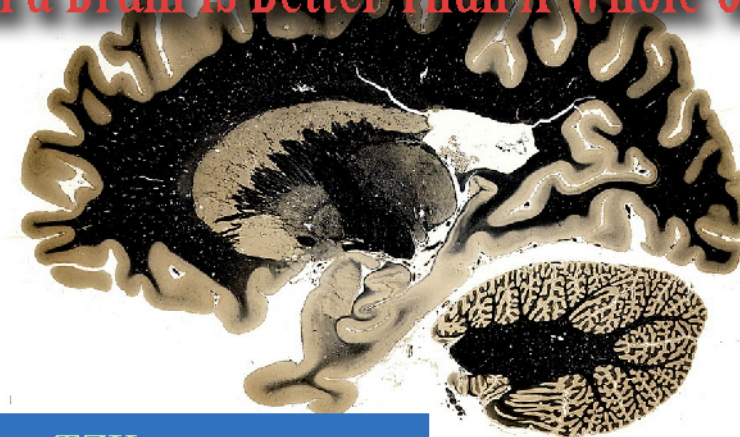


Figure 1

*Sameeksha Yadav, TZH*

The surgery known as hemispherectomy, the first known one performed on a dog in 1888 by German physiologist Friedrich Goltz, is where half the brain is removed. It sounds too radical to even consider; much lesser to perform. But unbelievably, the surgery has no apparent effect on personality or memory. It is indeed one of the most drastic kinds of surgeries of the brain. It is performed on patients who suffer dozens of seizures every day that resist the medications, and which are due to conditions that mostly afflict one hemisphere. These disorders are progressive and damage the rest of the brain if not treated. But indeed, it is performed only when the alternatives are worse.

Anatomical hemispherectomies involve the removal of the entire hemisphere, whereas functional hemispherectomies only take out parts of a hemisphere, as well as severing the corpus callosum, the fiber bundle that connects the two halves of the brain. The evacuated cavity is left empty, which is later filled in with cerebrospinal fluid in a day or so. The strength of anatomical hemispherectomies lies in the fact that leaving even a little bit of brain behind can lead

seizures to return. On the other hand, functional hemispherectomies lead to less blood loss. Most hemispherectomy patients are five to 10 years old. Astonishingly, memory and personality develop normally. A recent study found that 86 percent of the 111 children who underwent hemispherectomy are either seizure-free or have non disabling seizures that do not require medication. The patients who still suffer seizures usually have congenital defects or developmental abnormalities, where brain damage is often not confined to just one hemisphere.

Of course, the operation has its downside, patient can walk, run; some may dance or skip but may lose use of the hand opposite of the hemisphere that was removed. They have little function in that arm and vision on that side is lost. The younger a person is when they undergo hemispherectomy, the less disability they have in talking. Still, having half a brain—and therefore only the use of one hand and half a field of vision in each eye—is a condition most would prefer to avoid!!

## Less Sleep = More Dreams

*Sameeksha Yadav, TZH*

Dreams are amazingly persistent. If we miss a few from lack of sleep then brain keeps score, forcing payback soon after eyelids close. When someone is sleep deprived, we see greater sleep intensity, meaning greater brain activity during sleep; dreaming is definitely increased and likely more vivid. The phenomenon is called REM rebound. REM refers to "rapid eye movement," the darting of the eyes under closed lids. In this state we dream the most and our brain activity increases. Yet our muscles go slack as we lie paralyzed.

Sleep is divided into REM and four stages of non-REM; each has a distinct brain wave frequency. Stage one of non-REM is the nodding off period where one is between waking and sleeping. In stage two the brain slows with only a few bursts of activity. Then the brain practically shuts off in stages three and four and shifts into slow-wave sleep, where heart and breathing rates drop dramatically. Only after 70 minutes of non-REM sleep do we experience our first period of REM, and it lasts only five minutes. A total non-REM-REM cycle is 90 minutes; this pattern repeats about five times over the course of a night. As the night progresses, however, non-REM stages shorten and the REM periods grow, giving us a 40-minute dreamscape just before waking. The only way scientists can study REM deprivation is by torturous sleep deprivation. The electroencephalo-

gram is traced and then when the subject seems to move into REM, he is woken up and pressure builds for him to go back into REM. Sometimes subject might be woken up 40 times in one night because he goes directly into REM as soon as he sleeps. Of course there is non-REM rebound as well, but the brain gives priority to the slow-wave sleep and then to REM. Recently a study showed that losing 30 minutes of REM one night can lead to a 35 percent REM increase the next night—subjects jumped from 74 minutes of REM to a rebound of 100 minutes. And also dream intensity increases with REM deprivation whereas Alcohol, blood pressure drugs, antidepressants and nicotine repress REM.

REM is nonexistent in some big-brained mammals, such as dolphins and whales. But dying of REM deprivation has never been shown in any species other than rats. Some theories suggest that REM helps regulate body temperature and neurotransmitter levels. And there is also evidence that dreaming helps us assimilate memories. Fetuses and babies spend 75 percent of their sleeping time in REM. Then again, platypuses experience more REM than any other animal. The dream content is tied to our anxieties, based on a higher level of brain activity, which likely means more action-packed dreams.

## Propolis - The New Ambrosia

*Kritika Chugh, TZH*

PROPOLIS is a Greek word, which means "defense in the city". It is a sticky resin which is collected and metabolized by bees to seal their hives. It is rich in amino acids, bioflavonoids, minerals and vitamins whose active compounds help in fighting fungal and bacterial invasions. The best thing is that it works against harmful bacteria without destroying the friendly bacteria the body needs.

Propolis has been found to be of great help in conditions like anemia, respiratory problems, energy boosting, liver protection and oral care in dermatology (skin regeneration, skin ulcers, lesions, wounds). In natural medicine industry, propolis is called the 'great healer' as, in acne treatment, it has an excellent healing property. Thanks to its antibacterial and antifungal activities and acceleration of tissue regeneration, it is especially used in cosmetics.

Scientists doing research on this compound have recently proven its role in hair growth. They applied propolis to the skin of the mice that have been waxed or shaved and found that due to proliferation of keratinocytes, the mice on which propolis is tested regrew fur faster than untreated animals. And hence they successfully concluded that propolis promote growth of keratinocytes (cells involved in the production of hair shaft and hair follicle structures).

With all of these diverse uses and properties, could bee propolis be akin to a natural, real life ambrosia - the all-powerful, immortality-granting food of the Gods in Greek Mythology?

## Going Up In Smoke



*Ashmita Tamta, SZH*

Nowadays E-cigarettes are gaining popularity among smokers as well as those who have never smoked. The perception that e-cigarettes pose little health risk has established so much that some smokers including those with chronic obstructive pulmonary disease (COPD) are switching from cigarettes to e-cigarettes. People tend to ignore the fact that both cigarettes and e-cigarettes consist of nicotine. E-cigarettes contain less nicotine than cigarettes.

E-cigarettes were introduced to the U.S. market in 2007. Since then they have given rise to a debate as to their risk in general and relative to cigarettes. E-cigarettes is made up of a battery, an atomizer and a cartridge, producing a vapour inhaled and then exhaled by the smoker. Previous analyses of e-cigarette vapour have toxic and carcinogenic chemicals including particulates formaldehyde and volatile organic compounds but at quite lower levels than cigarette smoke. Another advantage of e-cigarettes is that they don't combust the way regular cigarettes do, limiting some of the chemicals released in cigarette smoke.

E-cigarette vapour consists of toxins found in cigarette smoke and air pollution. They are highly reactive agents which harm the DNA or other molecules within cells resulting in apoptosis. Cigarette smoke contains 1014 free radicals per puff which is much lesser than cigarette smoke but still their presence in e-cigarettes still suggests potential health risks. The findings were published on Feb. 4 in the journal PLOS ONE

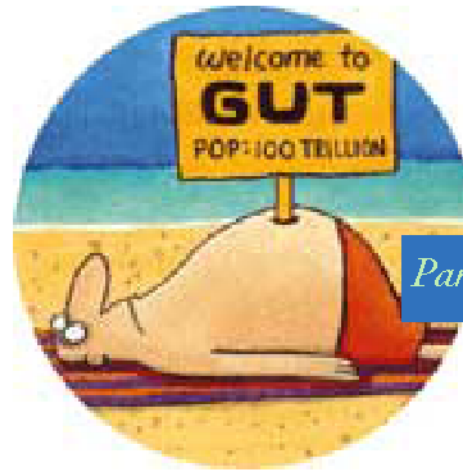
Senior author Shyam Biswal, PhD, a professor in the Department of Environmental Health Sciences at the Bloomberg School, was quoted saying "Our findings suggest that e-cigarettes are not neutral in

terms of the effects on the lungs. We have observed that they increase the susceptibility to respiratory infections in the mouse models. This warrants further study in susceptible individuals, such as COPD patients who have switched from cigarettes to e-cigarettes or to new users of e-cigarettes who may have never used cigarettes."

In a study, the mice were divided into two groups: one group was exposed to air while the other group was exposed to e-cigarette vapour in an inhalation chamber in quantity that approximated actual human e-cigarette inhalation over two weeks. Then each group was divided into three subgroups. One received nasal drops containing *Streptococcus pneumoniae*, a bacteria responsible for pneumonia and sinusitis in humans. A second received nasal drops of the virus Influenza A, and the third subgroup did not receive either virus or bacteria.

It was found that the mice exposed to e-cigarette vapour were developed certain immune responses to both the virus and the bacteria which in some cases killed the mice.

The U.S. Food and Drug Administration last spring declared to commence the regulation of e-cigarettes. E-cigarette sales are expected to overtake cigarette sales in the next decade. According to the U.S. Centre for Disease Control and Prevention, more than one-quarter million teenagers who never smoked a cigarette were reported using e-cigarettes in 2013.



## The Gut Almighty

*Pankhuri Jain, FZH*

Many scientists understand the human body as an amalgamation of microbe and human parts: the microbes in our body outnumber our own cells by 10 to 1. Many of these microbes play a pivotal role in keeping the human body healthy and functional, often fending off infections and are located throughout the body, from the scalp and forearms to the gut which is the biggest microbial habitat. It has been attempted several times to manipulate gut bacteria to improve human health.

According to new research, it has been claimed that gut bacteria really might influence our minds and that the connections between brain regions differed depending on which species of bacteria dominated a person's gut. That suggests that the specific mix of microbes in our guts might help determine what kinds of brains we have — how our brain circuits develop and how they're wired. Hence, the idea of "gut feeling" isn't so scientifically inaccurate!

The microbes could determine if a person would develop diseases like colon cancer, diabetes and/or obesity.

Dr. Emeran Mayer, a professor of medicine and psychiatry at the University of California, Los Angeles thinks that the bacteria in our digestive systems may help mold brain structure as we're growing up, and might even influence our moods, behavior and feelings when we're adults. "It opens up a completely new way of looking at brain function and health and disease," he says.

However, this does not imply that the microbes can result in major changes in the brain structure and function. Researchers have tried to find a possible connection by studying and understanding the gut microbes in mice. One such study involved replacing the gut bacteria of anxious mice with that of from fearless mice and vice-versa. Their behaviors seemed to have been reversed. Scientists also have been working on a long-standing question — how the gut microbes could talk to the brain.

A major nerve known as the vagus, which runs all the way from the brain to the abdomen, was a prime suspect. And when researchers cut the vagus in mice, they no longer saw the brain respond to changes in the gut. Gut microbes may also communicate with the brain in other ways: by modulating the immune system or by producing their own versions of neurotransmitters.

This raises the possibility that scientists could someday create drugs that mimic the signals being sent from the gut to the brain, or just give people the good bacteria — probiotics — to prevent or treat problems involving the brain.

## Crime-Fighting Bacteria

*Sameeksha Yadav, TZH*

Until now, the community of bacteria and viruses that live on and inside the human body, collectively known as microbiome, have been a great area of research contributing to health, obesity and certain diseases. Now, researchers believe that the microbes that are present on pubic hair could help solve sexual crimes.

Forensic investigators often prefer hair that were actively growing and those with roots still attached for investigating crime scenes in order to get the best DNA evidence. Unfortunately, most hair on crime scenes is dead and shed naturally, leaving the DNA in those hairs degraded and thus worsening the situation. To counter this, studies have been done to investigate personally identifiable microbes on a strand of hair.

In a study, different individuals were asked to trim and submit samples of their scalp and pubic hair at distinct points in time. Researchers processed the DNA in the samples in order to study their microbiome. Scalp hair were found to have roughly 50 microbial strains while the pubic hair harbored over 70 distinct microbe types. It was found that each volunteer's microbiome was so personalized that researchers could actually identify the individuals. But the basic microbial community was seen to be individually consistent even in studies at different points of time. Surprisingly, microbes on the pubic hair of a couple who had had an intercourse a day before were found to be different from either's, directing to a conclusion that humans swap external microbes during intercourse, suggesting that the microbiome could be useful in forensic analysis on sexual assault cases.

Though it is a promising technique, but tracking the microbes in case of large sample size may not be very efficient. Yet indeed, in near future, along with DNA analysis, this idea may be implemented to solve the assaults more effectively than ever before.

## All Creatures Great and Small

*Archita Rai, SZH*

While I was staying with my family I used to go to drop my brother to the stop where his van used to come to pick him up for school. Being a residential area, there were many buildings close to the stop. We, being the punctual ones had to generally wait for 10 minutes for the van. At the main gate of one of the buildings, a dog, the breed I have no idea of, used to be tied. It was white with orange-brown patches over its body. Whenever it saw anyone going across that building, it tried its best to break through its chains. It used to strain so hard against them that it ended up standing on two feet. Because life often succumbs to barriers, I observed this for months and always wondered - "What is this animal thinking? Is it expecting someone to free it? Or is it cursing each passerby?"

Days passed. I was going there every day, watching the dog. The kids who were earlier afraid of it, now teased it, because once we know someone's weakness we make sure to exploit it. Some banged its head unnecessarily. The dog did not even bark. It resembled a victim of domestic violence. I am not a fan of dogs. But this, one dog and its daily debacle disturbed me. I had never seen its owner.

One fine day, when I went there with my brother, it wasn't tied to the gate. It was running all around. It was running around like a child who finally got his favourite toy after waiting forever. It was running to feel alive. I thought only humans speak through their eyes but I could definitely read its eyes that morning. The kids who used to torture it were passing by. They were scared as it went close to them. It just went and then came back. They were relieved. I could almost hear the dog say - "Yes, I can hurt you, but thank god I am not human".

That day onwards, it was seen free, running

around. Just going close to people, and running away. Scared? Maybe. The face of humanity it saw while in chains would have certainly scared it.

But my heart wants to believe that the little speechless animal slapped us in our faces by not hurting. The chains did not make it aggressive. Its forgiveness was not our victory. It just asks us - "What does it mean, to be Human?" And we certainly have no answers.

Meanwhile as I narrated this to my mother, she rendered me stupid by explaining - "Dogs do not bite unless you hurt them or provoke them too much." So maybe, that is why it never bites anyone when it was free.

I have only one simple question to ask you, my fellow Homo sapiens - if a dog does not bite without cause, why do, we hurt it without a reason?

As zoologists, we must ensure that no animal is harmed unnecessarily. We rank the highest among the craniates. This makes us responsible for the planet and its life in all forms.

Some of the NGOs working for sterilization and immunization of stray dogs, under MCD are:-

- 1) Sanjay Gandhi Animal Care Centre (Raja Garden)
- 2) Friendlicoes- Seca (Defence Colony)
- 3) Sonali Charitable Trust (Najafgarh)
- 4) Jeevashram Foundation (Rajokari)
- 5) Circle Of Animal lovers (Neb Sarai)

Get in touch with them and be a responsible Zoologist!

# A Protist Love Story

*Ms. Ramaa Sinha*

A certain Mr. Amoeba once fell in love with the Lady Paramecium. He was simply besotted by her shapely figure (SLIPPER SHAPED AND STREAMLINED) and the way she carried her fine furry mink coat (CILIA ALL OVER THE BODY) daintily like a society lady. "What a beautiful sight she is indeed, and what class!" thought our lovelorn Mr. Amoeba. She dazzled with some sort of radiant jewellery that seemed to go bling bling! (CONTRACTILE VACUOLE WITH RADIAL CANALS). Oh! The beautifully shaped lips coyly tucked in (Peristome and funnel shaped cytostome) were to die for. Oh! sighed he... How seductive were her gliding movements, swaying and spiralling from side to side! (HELICAL PATTERN OF LOCOMOTION CAUSED BY METACHRONOUS WAVED OF CILIAR BEATS).

Mr. Amoeba could not stop serenading his lady love, and soon enough, she too fell in love with him. She began soaking in all the attention and adoration she got. Mr. Amoeba had his protective hands all around her (PSEUDOPODIA/ LOBOPODIA). He humoured and flattered her and asked her out for a date. One fine night they went out to dine and dance at a gala protist party.

The banquet hall was all aglitter with bioluminescent Noctiluca. A colony of Volvox was playing a band. Stentors lined the hallway swaying in welcome and blowing their trumpets (TRUMPET SHAPED CELLS) in honour of the guests. Beautiful chandeliers made of Heliozoa and Radiolaria hung from the tall ceiling. Euglenas were busy guiding the guests to their tables. There were several well known personalities like Cretium, Stylonychia, Chlamydomonas, and Euplotes to name a few. Others like Trichomonas, Giardia and Trypanosoma could not make it to the banquet due to pressing issues (ALL BEING PARASITES UNABLE TO LEAVE THEIR HOSTS). Nyctotherus, Opalina and Balantidium were guests elsewhere (ENTOCOMMENSALS IN THE RECTUS OF FROGS) and therefore were unable to attend too.

The guests were seated and soon served drinks. And who do you think were the bartenders? They were none other than Vorticella. You see, they did not have to leave the bar to serve the drinks at the tables... all they had to do was to stretch their long coiled stalks to reach out to the guests in all directions carrying wine in the chalices (CHALICE SHAPED BODY WITH A LONG STALK)!

Soon the guests took to the dance floor. Ensembles of Epistylis, Campanella and Opercularia (ALL ARE COLONIAL FORMS), were playing merry foot tapping numbers. 'Foot' (LOCOMOTORY ORGANS) after all is of social importance and the basis of castes in the Protist world (LOCOMOTORY ORGANS ARE THE BASIS OF

CLASSIFICATION). Flagella, Cilia, Pseudopodia were lashing, waving, gliding on the dance floor. Our lady Paramecium indeed was the dancing queen of the party. Mr. Amoeba was no match for her fleeting steps. While she moved like a ballerina, he could merely glide, throwing his steps slowly one way or the other (PSEUDOPODIA TAKE TIME TO FORM AND DO FORM IN ANY DIRECTION). So he resigned himself to sit and watch others dance.

Now, our Mr. Amoeba was no gent; he was a cad, an idler and a vagabond who pretended to belong to a high social rank. He made his 'living' by latching on to some socialite or other until he met his lady love. While our dancing queen was setting the dance floor on fire with her lightning quick moves to the rising tempo of music, Mr. Amoeba got thinking and began making plans for a comfortable future. Rather, he had ulterior motives. Seeing her dance thus, he decided to make her a professional performer so that he could live off her stage shows after marrying her.

The dancing scene soon took an ugly turn. Drunken and unruly fellows like Didinium started making advances (DIDINIUM PREYS ON PARAMECIUM). Naturally our damsel in distress expected some chivalry from Mr. Amoeba to shield her from the goons. However, the guy was so deep in thought and revelling in his well laid plans that he was totally oblivious to what pained our lady. He paid no attention to her anguished gestures. Worse still, he was busy picking food off the floor and feeding himself greedily. His pseudopodia were slurping and drooling in all directions.

Our lady Paramecium grew sickened with thought. She realized that he was a slob who lacked class. "Oh! How could I fall for a creature like him," she thought, "he has no table manners, no style, no grace, no sophistication, nor even an iota of chivalry... I certainly can't spend the rest of my life with him." So, lady Paramecium decided to exit not only the party but also from Mr. Amoeba's company for ever.

A ring of four or five Didiniums hungrily closed in upon her. All of a sudden a smoke screen appeared leaving the marauders dazed. "Was it pepper spray?" they wondered. Our lady Paramecium had cleverly used her defences (DISCHARGED TRICHOCYSTS) to make her escape. A commotion ensued and Mr. Amoeba, now woken from his reverie, saw her gliding away. He soon made chase, but obviously his speed could not match hers (PSEUDOPODIAL MEANS OF LOCOMOTION IS SLOWER THAN CILIARY MEANS OF LOCOMOTION).

Days went by uneventfully. Our lady, forlorn for a while, soon met her soul-mate from the gentry, a genteel and well-bred Lord Paramecium. She soon settled down to a life of conjugal bliss (CONJUGATION IS A PROCESS OF REPRODUCTION IN PARAMECIUM).

And so, my dear readers, the protist saga ended on a happy note with a message. Nature after all favours only intra-specific unions and prevents interspecific pairings. Evolutionists refer to them as ISOLATING MECHANISMS to preserve species identity. Paramecium and Amoeba were never made for each other after all!

## An Ode to a Gentleman

### Farewell, Saxena Sir!

Dr. R.K Saxena is the first person in the department who has worked as the teacher-in charge for 3 times.

As a teacher, he is very confident in teaching and very sincere in taking classes. As a zoologist, he has very good skill in demonstration of dissection. He gives such instructions and advice to first year students which will be sufficient enough for them to follow in the subsequent years.

As a person, he is very helpful to the colleagues and students. He is a very strict teacher during class. However, during leisure hours he is very jolly and humorous.

Not only as a teacher, he contributed good service for the corporate life of college. He worked as a staff council secretary, staff-adviser and proctor and conducted various student activities like Nexus, students elections successfully.

We wish him good luck for the forthcoming retired life.

-Dr. K.V. Giri



As a student we are taught by several teachers in our lifetime. Only a few have the ability to etch a special place in our lives, Saxena sir is certainly one of them. He is a man who defines perfectionism. I still remember attending his first class, thereon I was compelled to attend all his classes, such is the charisma of his teaching. His command over the subject, the capacity to convey it and elucidate it with apt analogies is impeccable. His teaching isn't limited to book but far beyond that. He urges us to contemplate whatever we study and understand the rationale behind it.

Sir has a wide array of knowledge, irrespective of the subject boundaries. Be it any query, it is answered with great ease by him. The methodologies with which he teaches us dissections are illuminating, intricate and helps us internalize the concept so that we can produce it well in our examinations. Such is the fine skill inherent in him. He not only mentors us to excel in our subject, but also encourages us to empower ourselves in all arena to become an accomplished person like him. We are privileged and fortunate to be taught by a fine man like him.

Thank you sir! For enlightening us and so many others. Thank you for your immense and inestimable contribution to this college, department and the zoology society.

We aspire to become an inspiration like you!



## Academic Year 2013-2014 Third Year



*Anjali Mishra*  
1st SVC/ 3rd DU



*Indu Malik*  
2nd SVC



*Neha Chauhan*  
3rd SVC

## Second Year



*Pooja Mittal*  
1st SVC



*Alice Sinha*  
2nd SVC



*Khushboo Yadav*  
3rd SVC

## First Year



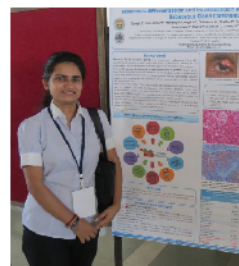
*Drishti Modi*  
1st SVC



*Rhythm Phutela*  
2nd SVC



*Archita Rai*  
3rd SVC



### **Tanaya Bhattacharya, TZH**

- Represented Innovation project SVC 206 at the '5th International Conference on Stem Cells and Cancer : Proliferation, Differentiation, and Apoptosis' held at JNU, New Delhi where she won the 'Best Poster' Award

### **Bornika Roy, TZH**

- Participated in the 2014 Biomimicry Student Design Challenge as a part of Team BioSol that represented India.  
- Was ISEED's Idea Champion for innovative business ideation at iCube-The National Youth Ideas Challenge 2013, shortlisted in the top 500.  
- Volunteer for Project Black Kites - Tiger of the sky



### **Amaanat Bedi, TZH**

- Vice-president, Parivartan  
- Executive, Equal Opportunity Cell  
- Volunteer, Black kite project  
- Delhi Head for Deeksha, an environmental NGO  
- Participated in 2014 Biomimicry student design challenge as a part of team BioSol that represented India.

### **Rahul Tomar, TZH**

- Captain, Athletics team  
- Research assistant on Tiger Project in NSTR  
- Bronze medal, 100 m, SRCC athletics meet  
- 6th position, 800m, DU Athletics meet



### **Archita Rai, SZH**

- 2nd place in debate organized by Shivaji College,  
Topic- Riots: Religious trauma or political gimmicks

### **Asmita Kalra, FZH**

- Member of Nritya, Choreography Society, won:  
- 3rd Place - Waves 2014, BITS Goa  
- 2nd Place - Chaos, IIM Ahmedabad



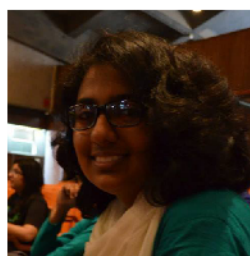
## Anupama Nair, FZH

-Member of English Verbum, Dramatic Society, won:  
-1st Place - Rangmanch, BITS Goa 2014  
-3rd Place - National Rajpal Memorial One Act Play Competition, St. Stephen's College, 2015



## Siddhartha Yaddanapudi, FZH

-Member of Conquistadors, Quiz Society, won:  
-1st Place - St. Stephen's College Fresher's Quiz  
-3rd place - Hans Raj College Fresher's Quiz



## Niharika Mukherjee, FZH

-Member of Alaap, Indian Music Society, won:  
-2nd Place - IIT Delhi  
-1st Place - DDU College and Bhaskaracharya College of Applied Sciences Culture Council, 'Songs of India'

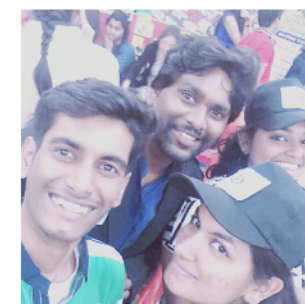
## DU Innovation Project SVC-202



All organisms have to encounter some rhythmic environmental fluctuations due to rotation of the Earth on its axis, thus causing rhythmic changes in behavior, physiology and metabolism of the organism. Medicinal plants play an important role in the healthcare of people across the world especially in the developing countries. HPLC tests will be done to check the change in concentration of secondary metabolites in various medicinal plants found in Delhi. The data obtained may be used to corroborate available traditional information and on this basis the local community could be educated to make the best use of medicinal plants. Industrially, the results may increase the yield of many products that are derived from secondary metabolites.

The project is done under the expert guidance of Dr. Om Prakash. Two second year students from Zoology Department, Ashmita and Himanshu are active members of the same.

## DU Innovation Project SVC-206

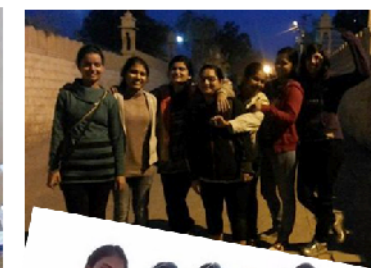


Sebaceous gland carcinoma (SGC) is a malignancy associated with the hair follicle unit and occurs at ocular and non-ocular sites. The aim is to study the role of PPAR $\alpha$  and COX-2 in eyelid SGC. An increased cytoplasmic expression of COX-2 and strong nuclear PPAR $\alpha$  positivity was seen in majority of the cases which also correlated with poor prognosis of the patients of SGC. This project has given an excellent opportunity to identify novel drug targets (COX-2 and PPAR $\alpha$ ) for the first time in eyelid SGC. The project is done under the supervision of Dr. P. Jayaraj, Dr. P.S. Dhanraj, Dr. Kameshwar Sharma and Dr. Mansi Verma. Following students from the Zoology Department are involved in this project: Tanaya, Sameeksha, Mandeep, Varsha, Rhythm, Christeena, Megha and Ankita.

## DU Innovation Project SVC-208



The project provides a broad perspective on the development of Chalcones/Coumarin as potent anti tumour drugs where a range of underlying mechanisms of action have been reported which is in contrast to most other drugs that target one particular cellular pathway. Chalcone, a class of polyphenols (flavonoids) has multifunctional roles as it can be used in synergism with present chemotherapeutics or can be developed as a new class of anti tumour drugs. The identification of novel compounds with certain structural additions via a molecular hybridization approach is a promising field in the production of potent anti cancer drugs. Despite their natural abundance, their simple synthesis and ease of chemical modification can give rise to a wide permutation and combination of highly potent anti cancer compounds. The synthesized chalcones are being screened for anticancer properties using MTT assay. Developing cost effective and highly potent yet selective cancer drugs is the need of the hour. A review article entitled 'Recent developments in antitumor activity of Chalcones' has been sent for publishing in a reputed journal. The abstract has been approved and acceptance of the review is awaited.



Jaisa trip, 2014



Teacher's Day



Antardhvani, 2015



SG Enterprises full pg ad

Three other ads



The Phoenix Team

The Evolvere Team