MES College of Arts, Commerce & Science
Malleswaram, Bengaluru – 03.

Department of Zoology

SPIRITUS

Inspired thoughts....

NEWS 'N' VIEWS

2016-2017

Preface

What began as a humble activity within the department in the year 2007, supported by the enthusiasm & contribution of students, has today transformed into a notable knowledge disseminating initiative.

We at the Department of Zoology take this opportunity to share with you readers a unique collection of articles under the name "SPIRITUS' meaning 'life' in Latin. These articles are authored by our students from I, II and III B.Sc. in the form of contributions to the bulletin board maintained by the department called News 'N' Views.

The bulletin board was envisaged as an ideal platform to share recent and intriguing developments, dialogues and discussions in the stream of life sciences. Any student of Zoology at the under – graduate level is welcome to contribute to the bulletin board. As a small token of appreciation & encouragement, the Department selects the top three articles at the end of every semester and awards them cash prize.

With this third edition of our e-newsletter "SPIRITUS", *inspired thoughts….*

We bring to our readers, 30 articles from the month of August 2016 to March, 2017.

We hope this small initiative grows into a mutually rewarding experience, for us at the Department, our students and you, dear readers!

Release of the Third edition of "SPIRITUS", e-newsletter of the Zoology Department

The release of the inaugural edition of "SPIRITUS" the e-newsletter of the Zoology Department, MES College, was held on 7th April, 2017. The newsletter is a consolidation of the contributions featuring on the Department bulletin board, "NEWS 'N' VIEWS".

During the programme, prizes were awarded to the best 3 articles and a consolation prize for the academic year 2016 - 17. The winners were –

- Rashmi .R – II Sec. 'H' ------- I prize
- Panchami. P – I B.Sc. 'B' ------- II prize
- Keerthi Prakash – III B.Sc. 'B' ------- II prize
- Sushmitha.S – III B.Sc. 'H' -------- III prize
- Rohan P Bhat – II B.Sc. 'H' -------- III prize
- Vishwas .S. Nairy – I B.Sc. 'i' ---------- Consolation prize
-

This third edition of "SPIRITUS" has 30 articles, written by students of life sciences of 1st, 2nd & 3rd year classes.

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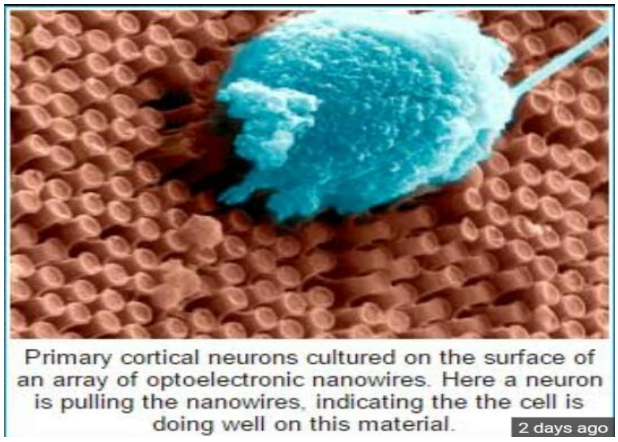
NANO EYE IMPLANT MAY RESTORE VISION

In Los Angeles, neuro scientists have developed a new eye implant that may help restore vision in millions of people worldwide suffering from neurodegenerative diseases that affect eyesight, including muscular degeneration, retinitis pigmentosa and loss of vision due to diabetes.

According to the researchers from university of California, San Diego and the US based startup Nano vision Biosciences, the implant has been made with the help of arrays of silicon nanowires that sense light and electrically stimulate the retina. The nanowires give the prosthesis higher resolution than anything achieved by other devices - closer to the dense spacing of photoreceptors in the human retina.

The other breakthrough, they said, is a wireless device that can transmit power and data to the nanowires over the same wireless link at record speed and energy efficiency.

One of the main differences between their prototype and existing retinal prosthesis is that the new system does not even require a vision sensor outside of the eye to capture a visual scene and then transform it into alternating signals to sequentially stimulate retinal neurons. How innovative it is right!!Thus hoping for a successive milestone in the development of the neuro field and a great need to the human race.



Primary cortical neurons cultured on the surface of an array of optoelectronic nanowires. Here a neuron is pulling the nanowires, indicating the the cell is doing well on this material. 2 days ago

Aiswaria. P
I B.Sc 'B' sec

THE BLOODLINE ON MARS

This Article was published in The Deccan Herald, dated 9 March 2017.

Mars is our next home planet. This is the powerful belief in every man here on Earth. Missions and drones are sent to Mars to confirm the stability of the environment for Earthly organisms. Many successful results have come up and one such is the presence of hard water on the poles of Mars. Our hopes on setting foot for a permanent life is just a century away. But none of us know the blood game on Mars waiting for us. A special note on this was put up and it said, radiation encountered in deep space travel may increase the risk of leukemia in humans say scientists who are studying how a three year space flight to Mars may affect astronauts. Researchers from NASA are using human stem cells to measure the effects of deep space radiations. Using mice transplanted with human stem cells, the research has been demonstrated that for the first time that the radiation encountered in deep space travel may increase the risk of leukemia in humans.

Our results are troubling because they show radiation exposure could potentially increase the risk of leukemia in two ways said "Christopher Porda associate professor at wake forest institute that for regenerative medicine in the U.S. Radiation exposure is believed to be the most dangerous aspects of travelling to mars. The average distance to the red planet is 140 million miles and a round trip could take three years. The goal of the study was to assess the direct effects of simulated solar energetic particles and galactic cosmic ray. For the study human H S C from healthy donors of typical astronauts were exposed to relevant doses of protons and iron ions that astronauts would be exposed to in deep space. Radiation exposure at these levels reduced the ability to produce blood cells were reduced by 60-80%. This would reduce the immunity of human beings during prolonged missions. However research on the field of genetics is going on to find better methods to reduce the radiation damages caused to make longer trips to study the environment.

Lalith Kumar. A
I B.Sc 'B' sec

ORGAN ON A CHIP MIMICS HEART'S BIO MECHANICAL FUNCTIONS

Washington, Feb 27 (PTI) Scientists have created a three-dimensional (3D) organ-on-a-chip that can mimic the hearts amazing biomechanical properties and could help in studying cardiac diseases, screening and development of drugs.

"We created the I-Wire Heart-on-a-Chip so that we can understand why cardiac cells behave the way they do by asking the cells questions, instead of just watching them," said Professor John Wikswo, from Vanderbilt University in the US.

"We believe it could prove invaluable in studying cardiac diseases, drug screening and drug development, and, in the future, in personalized medicine by identifying the cells taken from patients that can be used to patch damaged hearts effectively," said Wikswo.The device faithfully reproduces the response of cardiac cells to two different drugs that affect heart function in humans, initial experiments have demonstrated.

The unique aspect of the new device, which represents about two millionths of a human heart, is that it controls the mechanical force applied to cardiac cells.This allows the researchers to reproduce the mechanical conditions of the living heart, which is continually stretching and contracting, in addition to its electrical and biochemical environment.

"Heart tissue, along with muscle, skeletal and vascular tissue, represents a special class of mechanically active biomaterials," said Wikswo.

"Mechanical activity is an intrinsic property of these tissues so you can’t fully understand how they function and how they fail without taking this factor into account," he said. The I-Wire device consists of a thin thread of human cardiac cells 0.014 inches thick stretched between two perpendicular wire anchors.

The amount of tension on the fibre can be varied by moving the anchors in and out, and the tension is measured with a flexible probe that pushes against the side. The fibre is supported by wires and a frame in an optically clear well that is filled with liquid medium like that which surrounds cardiac cells in the body.The apparatus is mounted on the stage of a powerful optical microscope that records the fibers physical changes.The microscope also acts as a spectroscope that can provide information about the chemical changes taking place in the fibre. A floating microelectrode also measures the cells electrical activity.

According to the researchers, the I-Wire system can be used to characterize how cardiac cells respond to electrical stimulation and mechanical loads and can be implemented at low cost, small size and low fluid volumes, which make it suitable for screening drugs and toxins. Unlike other designs, I-Wire allows the researchers to grow cardiac cells under controlled, time-varying tension similar to what they experience in living hearts.

The heart cells in the fibre align themselves in alternating dark and light bands, called sarcomeres, which are characteristic of human muscle tissue.

The research was published in the journal Acta Biomaterialia. PTI SAR SAR

Dated: 28 Feb 2017
Source: Deccan Herald

Manjula. S
I B.Sc 'B' sec

A MASS CORAL BLEACHING AGAIN.

GREAT BARRIER REEF THREATENED BY HEAT WAVE FOR SECOND CONSECUTIVE YEAR.

This article was printed in **THE HINDU** dated March 11, 2017 (Saturday)

It has been observed by scientists that the Australia's Great Barrier Reef has been experiencing an unprecedented second year of massive coral bleaching, warning many species would struggle to fully recover.

The 2,300 km stretch of the coral reef has been experiencing coral bleaching for the past few years due to warming sea temperatures during the month of March and April.

Scientists have reported that this has been happening due to the constant rise in temperatures and other factors of global warming. The situation might get worsened if measures aren't taken.
The Great Barrier Reef Marine Park Authority has also reported that the bleaching has been taking place in the central part of the reef. The back-to -back occurrence of bleaching also means that there has been insufficient time for corals to fully recover, Neal Cantin from Australian Institute of Science said.
There has also been a drastic decrease in stress tolerance of the corals which is another reason for this bleaching.

Why does bleaching occur?
Bleaching occurs due to abnormal environmental conditions such as warmer sea temperatures, which causes corals to expel tiny photosynthetic algae, draining them of their color.
However, corals can recover if the water temperature drops and the algae are able to recolonize them.
The coral reefs that survive rapid bleaching fuelled by global warming will remain deeply damaged by little prospect of full recovery.
The Barrier Reef is already under pressure from farming run off, development, and the crowns of -thorns starfish has escaped minor damage after two other bleaching events in 1998 and 2002.

Scientists have been warning that without sufficient emissions reductions, we could expect annual mass bleaching of the Great Barrier Reef by 2050.
The reef scientists are planning to conduct further surveys over the next few weeks to determine the extent and severity of the bleaching.
According to scientists, nearly two -thirds of shallow water corals in a 700 km stretch of the reef's northern section were lost to last year's bleaching event.

Hence, it’s high time we look into the matter of loss of coral reefs due to bleaching as coral reefs make an integral part of an ecosystem.

Panchami P
I B.Sc ‘B’ sec
II Prize

BREAKING TABOO, SWEDISH SCIENTIST SEEKS TO EDIT DNA OF HEALTHY HUMAN EMBRYOS.

This article was published in the page **www.npr.org.**

A Swedish scientist has started to edit DNA in healthy human embryos. This step has been taken by developmental biologist Fredrik Lanner which makes him the first researcher trying to take an initiative to modify the genes in a human embryo. This had been considered a taboo for religious and ethical reasons. Lanner is attempting to edit genes in human embryos to learn more about how the genes regulate early in embryonic development. He hopes to create new ways to treat infertility and also prevent miscarriages .He also hopes to help scientists to learn more about embryonic stem cells so they can someday use them to treat many diseases.

Sometimes making changes in the gene pool can create an error leading to new diseases. Lanner plans to study the modified embryos for seven days and will not let them develop beyond fourteen days. Having children is considered to be a major part in human life. So this discovery might end up helping some parents and also help in preventing some genetic diseases says the scientist.

This discovery might further help in treating diabetes, Parkinson's, blindness and other diseases. Lanner is planning to methodically knock out a series of genes that he has identified through previous work as being crucial to normal embryonic development. He hopes that it will help him learn more about what the genes do and which ones cause infertility.

Lanner has now done experiments on at least a dozen embryos, but is still studying his results and refining his techniques. He remains unsure how well the editing is working so far. However, he is confident he'll be able to modify the individual genes in the embryos to determine their function.

Panchami P
I B.Sc ‘B’ sec

"UNDEAD" GENES COME ALIVE, AFTER LIFE ENDS

Article published by - Mitch Leslie on June 22 2016, in biology magazine

Does death really mean the end of our existence? Now, a study shows that at least one aspect of life continues: Genes remain alive days after animal die. Researchers are trying to make the best use of this post-mortem activity into better ways of preserving donated organs for transplantation.

Microbiologists, Peter Noble of the University of Washington, Seattle, and colleagues wanted to test a new method they had developed for calibrating gene activity after death. Their research took a drastic change and 2 years ago they published a paper on the abundance of microbes in different human organs after death and they decided to apply their method to post mortem samples.

Scientist Peter Noble says it is an experiment of curiosity to see what happens when you die. The team measured which of these genes functioning in tissues from recently diseased mice and zebra fish tracking changes.

At first, the researcher's assumed that genes would shut down shortly after death what they found instead was that hundreds of genes ramped up. In the fish the genes remained active 4days after death. Many of these post mortem genes are beneficial emergencies; they perform tasks such as surring inflammation, firing up the immune system, and counter acting stress. The developmental genes are also turned on after death, Nobel says. These genes normally help sculpt the embryo, but they aren't needed after birth.

One possible explanation for gene reawakening the researcher's say, is that cellular conditions in newly dead corpses resemble those in embryos. The team also found that several genes that promote cancer became more active. That result could explain why people who receive transplant from the recently diseased have a higher risk of cancer.

Nobel and other two colleagues demonstrated another possible use for gene activity measurements, showing that they can provide accurate estimate of the time of death. Time of death estimate is crucial for many criminal investigations.

These results impressed the forensic scientists David Carter of Chaminade University of Honolulu, he said that technique established by Noble and his colleagues was a great deal of potential to help death investigations.
Image attached below.

Although this rat is dead, its genes may still be functioning, a new study reveals.

Sahana J.K
I B.Sc 'B' sec

LET'S USE HUMANOID ROBOTS TO GROW TRANSPLANT ORGANS

Bio-hybrid robots could make better lab-grown tissues

By Sarah Fecht March 2, 2017

Scientists are already growing muscles, bones, and mini-organs in the lab. But these tissues are generally small, simple, and kinda wimpy. That's partly because a Petri dish is no match for the human body.

Take, for example, skeletal muscle. Bioreactors typically warm, moist vats where cells are grown might induce some simple movements in lab-grown muscles, but it's nothing like the multidirectional bending and stretching of the human body, which helps our muscles grow and get stronger. That's why two scientists from Oxford University are proposing that we use humanoid robots to grow engineered tissues instead. Their article was published Wednesday in Science Robotics.

"There is no better bioreactor than the human body itself," says study co-author and tissue engineer Pierre Mouthuy, "so the better we can copy that environment, the better our chances to obtain functional engineered tissues are going to be."

Robots like Kenshiro and Eccerobot replicate human anatomy in intricate detail, and the authors write that we might be able to use them to grow better tissue grafts that can be transplanted into ailing humans.

For tendons, ligaments, bone, and cartilage, humanoid robots could simulate lifelike architecture and movements of various types and directions. This could help more cells to develop and differentiate into complex tissues.

What might these bioreactors look like? Perhaps scientists could immerse the robotic body parts in a bioreactor's nutrient broth—but then you risk corroding the machine's metals or ruining its electronics, says Mouthuy. Another solution may be to encase the engineered tissue in a membrane or artificial skin, so that the developing tissue can have all the moisture and nutrients it needs, while the robot stays dry. Mouthuy and study co-author Andrew Carr are already working on some prototypes, and hope to soon find out whether the humanoid bioreactor concept is actually feasible. If they work, humanoid bioreactors might eventually be able to nurture more complex tissues and organs, such as lab-grown hearts. Plus, they might lead to robots that are safer for humans to be around, the authors note, as well as other robots advances—such as "biohybrid humanoids," whose movements are controlled by cells instead of machinery.

Sudhakar Rao M.V
I Bsc ‘B’ sec

SWEET SPOT
WHY HUMANS CAN RECOGNISE FACES AND READ?

By Pallava Bagla

Ever wondered why humans can read? A team led by Kolkata-born scientists has found that a special sweet spot in the eye called 'fovea' plays a crucial role in humans being able to focus on computer screens and also read, an ability which is unique to Homosapiens.

The findings decipher the mechanism that lets humans reading this text, recognising faces, enjoying colours, say the scientists.
Raunak Sinha and Mrinalini Hoon describe themselves as a 'scientific couple' who push the frontiers neuroscience to better understand vision.

Sinha says this "recent breakthrough in understanding how the most important aspects of our vision work at a cellular level. This work illustrates the physiological basis of how our central vision, mediated by the region in the eye called fovea, works at a cellular level and how it differs in its operation from the region that mediates our peripheral vision".

Vision scientists have uncovered some of the reasons behind the unusual perceptual properties of the eye's fovea. Among mammals, only humans and other primates have this dimple-like structure in their retinas. Owls, some other predatory birds, and some reptiles have a similar structure. The fovea is responsible for our visual experiences that are rich in colourful spatial detail.

Figuring out how the fovea functions is essential to the search for strategies to correct central vision loss, including efforts to design visual prosthetics. Diseases such as macular degeneration are much more debilitating than deficits in peripheral eyesight because of the importance of the fovea to everyday vision, "says Sinha of the Department of physiology and Biophysics at the University of Washington's School of Medicine. The fovea is a specialised region that dominates our visual perception, he explains. It provides more than half of the input from the eyes to the visual cortex of the brain.

"When you look at a scene an arm's length away, "he says, "the fovea subtends a field only about the size of your thumbnail. Our eyes undergo rapid movements to direct the fovea to various parts of the scene."

The absence of a fovea in most mammals, he says, and technical challenges associated with recording from the primate fovea, led to a paucity of information about how the fovea operates at the level of cellular circuits.Using advanced techniques, Sinha helped lead a study that revealed that the computational architecture and basic visual processing of the fovea are distinct from other regions of the retina.

The results help explain why central and peripheral vision have different qualities, he says.
Located near the optic nerve, the fovea is at its best for fine tasks like reading, Compared to the peripheral retina, however, the fovea is less able to process rapidly changing visual signals.

This low sensitivity is what makes us see motion in flipbooks and movies. It's also what prevents us from seeing flicker when a computer or TV Screen refreshes, unless we glance at the screen (especially the old-fashioned CRT monitors) from the corner of our eye, Sinha explains. Past recordings of foveal output signals in the living eye had demonstrated that the perceptual specialisations of foveal vision originated largely in the retina itself, rather than in subsequent brain circuits.

Nonetheless, Sinha says, little was known about the cellular and circuitry basis of these functional specialisations due to a lack of intracellular recording from foveal neurons. The team from the Howard Hughes Medical Centre research team recently made one of the first direct comparisons of the physiological properties of foveal and peripheral retinal neurons and among the first correlations between structure and function in the fovea.

Publishing their work in the journal CELL, their experiments revealed how differences in the cellular and circuit mechanisms of foveal and peripheral retina can account for the well-established differences in their perceptual sensitivities.

The latest study provides on of the first glimpses into how the fovea works at a cellular and circuit level. It turns out to be very different from how other regions of the retina operate. The finding suggests that the perceptual differences originate in the cone photoreceptors themselves.

The novelty of this study is bolstered by a comprehensive structure function analyses, lacking in previous work on the fovea, using techniques such as particle mediated gene transfer to study protein expression in a diverse array of ganglion cells, "says Hoon, an acting instructor in biological structure at the UW School of Medicine who contributed on the recent research. These approaches open the door to a wide range of transient manipulations that will allow scientists to explore properties of other cell types in the fovea.

"Determining the cellular origin of human perception is an important, but rarely realised, goal in neuroscience and biology, "Sinha says.

"Our results provide a simple explanation for a salient perceptual observation."
Sinha says the results are important since there is a huge amount of effort underway globally to restore central vision in humans in diseases but our understanding of how the fovea functions is largely missing.

This is a big step forward in not only our fundamental understanding of fovea function but also for devising therapeutic strategies including designing visual prosthetics to restore deficits in central vision in diseases such as macular degeneration and others."

Vinutha. S Anudi
I B.Sc 'B' sec

CELEBES CRESTED MACAQUE

This is naruto the monkey who stole a photographer's camera in an Indonesian park and snapped a selfie; crested black macaques might still be languishing in obscurity.

The photo later went viral, and Macaca nigra (commonly called as yaki) suddenly had millions of online fans just as the International Union for Conservation of Nature, which sets the conservation status of animals, was working toward listing the punk-haired, amber-eyed species as among the world's 25 most endangered primates.

In 2015 Naruto's selfie sparked a copyright lawsuit including the animal welfare group People for the Ethical Treatment of Animals which could push the boundaries of animal rights. But Naruto's renown hasn't earned him special credentials with his fellow macaques in the confined forests of the Tangkoko-Batuangus-Duasaudara Nature Reserve, near Bitung, on the island of Sulawesi.

Even the tiniest yaki youngsters in Tangkoko have a lot of freedom to play in and explore the forest, but they don't stray far from their mothers. If hunters take a mother for meat, they may also capture her offspring for the pet trade

Mother macaques bear one baby every 20 months or so and do most of the parenting. Wee ones nurse for less than a year but stick close for several more. Young males eventually leave to vie for position in another group.

The researchers are teasing out fine details of the yaki's private life. "One exciting discovery is that males with certain personality traits—being self-confident and part of a big, diverse social network—are more likely to reach a high rank and thus sire more offspring," Engelhardt said. "So it's not your

social status that affects your personality, but your personality affects your social status." The principle is true for humans too, with personality influencing social "rank" and sexual opportunities. But exactly which traits bring benefits "might be very specific," she said. "What works for male macaques might not work for men."

Left: This mother macaque carried her newborn for days after it died of unknown causes. Such behavior is rarely documented in the wild.

Yaki have just one natural predator, the reticulated python, but they have many enemies the local pet trade thrives on captured or orphaned baby macaques—often malnourished and kept in tight quarters. But the bigger threat is that people in Sulawesi have been eating macaque meat for centuries. Today it goes for about two dollars a pound (an adult macaque weighs 18 to 23 pounds) some farmers trap macaques on purpose to keep the monkeys from raiding crops. Monkeys also get caught in traps set for pigs, birds, or rats, which can mean quick cash for a trapper "macaques that escape traps may lose a limb to loss of circulation." By all these human activities the rare species is under extinction. Research by Jenniffer S Holand and Antje Engelhard.

Amruth Mon V
I B.sc 'I' sec

PEST LAID PLANTS

This article was appeared in "THE HINDU" (Metro Plus Health), Monday, March 13th 2017 written by Priya Gopalan.

How to keep the earthworms, ady birds, spiders and aphids out of your garden.

Along with the birds and the bees, a thriving garden is a natural habitat for pests. The idea then is to invite in the 'good guests' – the earthworms, the lady bugs, spiders, ants and to keep the uninvited ones – the mealy bugs, aphids, spider mites. The philosophy is simple: everything that files or crawls into your garden needn't be removed, Just the ones that wreak havoc. Usually plants have in built immunity systems, much like our own bodies, so intervene when to feel the things are out of hand. Here are few tried and tested pest management tips from farmers and gardeners without using any chemicals.

- **Early does t**

  Our plants, like our children, need attention. We need to spot the signs of oncoming tantrums and trouble before they grow into a full blown problem. Look under the leaves, watch for subtle changes in your plant health (yellowing, drooping, holes). Search for the reason and "nip it in the bud", that is to suppress or destroy something at an early stage.

- **First Aid Matters**

  Keep plants clean. Usually a strong jet of water or a toothbrush dipped in water is helpful to clean the affected parts, especially the stem. The next step is to help the plant keep the pests off, with a disinfectant. Use a dilution of 1 part of soapnut or shikakai to 20 parts water. The soapiness combined with the natural properties of soapnut, helps keep pests at bay. Repeating the treatment every 3 days will help the plant continue to fight off pests. A small drop of neem oil can be added to the soapnut or shikakai solution against more resistant pests

- **Predators have power**

  Most garden pests have natural predators. If the infestation is big enough, nature will usually take action. For instance, if you leave your aphid infestation alone for some time, lady birds will come to suck them up

- **Biological Controls**

  This is the use of nature's own armory of predators, parasites, and pathogens to control pests. They are of most use where they can be released into a protected environment, such as a greenhouse. Some nematodes, as used to control slugs and vine weevil, can also be used outdoors, but only when soil temperatures are at or above 41 degrees F. Accurate and early identification is essential to ensure the correct control is used and at the right time of year. If in any doubt, seek advice. In some cases, chemical control may be the only option when you have an infestation, but only apply according to the instructions, especially when spraying edible crops. Be aware that the use of insecticides is likely to kill biological controls and beneficial insects.

- **Pruning call-out**

  The best advice on pest control received by her was from a natueco farmer in the Aurobindo Ashram. He said "If a plant is covered In pests, its message to you is that it's time to prune." Remember to discard the pruned parts far from your garden.

- **Immunity grown**

  Like we build the human body's resistance to bugs with immune boosting food, so also we can build a plants immunity. Bio-fertilizers like panchagavyam do precisely that. Same with the magic brew from your Bokashi Bin.

- **Sometimes, Sacrifice**

  When all else fails, discard the plant to ensure the rest of the garden stays healthy and you are on your way to discovering your health philosophy for your garden.

- Priya Gopalan is co-founder,
  The Magic Bean and runs work
  Shops on Gardening

Vishwas. S. Nairy
I B.Sc 'I' sec
Consolation prize

GENE EDITING

An article was published in "The Times of India" on 18 Feb '17 relevant to Gene Editing to cure cancer and age-related macular degradation [AMD]. Cancer is one of the most common disease with an increased threat to human life due to lack of complete cure of tumours in most of the patients. Almost 80% of cancer is inherited because of which it cannot be cured easily as it involves treatment at the gene level which is expensive and not accessible to most of the people.

However scientists have applied the technique of Gene Editing to cure cancer and AMD. Gene editing with engineered nucleases[GEEN] s a type of genetic engineering in which DNA is inserted, deleted or replaced in the genome of a living organism using engineered nucleases or "molecular scissors" such as Mega-nucleases, Zincfinger-nucleases [ZFNs], transcription activator like effector-based nucleases[TALEN],and the CRISPR-Cas system. Similarly a new study from South Korea has claimed that the gene editing tool CRISPR-Cas 9[Clustered Regularly Interspaced Palandromic Repeats Cas 9] may be directly delivered in to the eye to treat age-related macular degradation [AMD] and all inherited diseases including Malignant Tumour. CRISPR-Cas 9 is a type of molecular scissors that selectively trim away unwanted parts of the genome and replace it with new stretches of DNA.

AMD is one of the most common Retinophasies that results in loss of vision which is caused due to abnormally high levels of the Vascular Endothelial Growth Factor[VEGF], a protein that promotes the growth of new blood vessels are secreted. Injections of anti-VEGF is the most common treatment against AMD but scientist at the Institute For Basic Sciences[IBS] in South Korea have used CRISPR-Cas 9 to perform "gene surgery" that edits the VEGF gene, to achieve long term cure. Modifying human embryos, albeit to prevent babies from acquiring genes known to cause "serious disease disabilities" is also a part of gene editing programs in US Science Advisory Group.

Gene Editing will become important and we will see it being used to cure all inherited diseases, to cure cancers, to restore sight to people by tans-planting genes.

Kavya. S
II BSc 'B'sec

BLAME THE GENES IF YOU'RE UNHAPPY

Source: THE NEW SUNDAY EXPRESS
Dated: March 19th, 2017 Sunday

BLAME THE GENES IF YOU'RE UNHAPPY

Scientists have found that parents who have suffered from depression can pass on the traits to their children and grandchildren, and it's more prevalent in females

By ADITI RAY

Ever imagined what sorrow looks like or how a depressed person feels from inside? One might look happy from outside but deep down the story may be is different. In India depression is considered to be a contingent mental illness, often treated as a taboo. However, it's not accidental at all.

Scientists in Australia have found that parents who are stressed can pass on depression to their children and grandchildren. The study published in the journal 'Translational Psychiatry', based on experiments with mice, which were fed stress hormones, examined the behaviour of the first and second generations of offspring. It found that the later generations showed signs of depression. Such behaviour may be passed on via molecules called "microRNAs", which affect genetic outcomes.

It is difficult for a lot of people to talk about depression. But those who go through these issues often point to family members with similar problems. Dr Jitendra Nagpal, Director of Moolchand Medcity, Delhi, says, "There are 20 to 30 per cent chances that a child develops symptoms of depression if one of the parents is suffering from it. However, if both parents suffer from depression, then the chances are almost 50 per cent."

Research on the heredity of depression within families shows that some individuals are more likely to develop the illness than others. If you have a parent or sibling who has had major depression, you may be 1.5 to 3 times more likely to develop the condition. You would also have a higher chance of developing bipolar disorder as close relatives of those with clinical depression are vulnerable to developing the condition themselves.

Dr Nagpal adds, "When a child shows symptoms of continuous denial of food, lack of sleep, consistent crying, lethargic attitude, it's time to consult a doctor. There are also chances that later on they become victims of drug abuse. They might also suffer from excessive mood swings."

"When a child shows symptoms of denial of food, lack of sleep, consistent crying, lethargic attitude, it's time to consult a doctor."
DR JITENDRA NAGPAL, *Director of Moolchand Medcity*

Both environmental and genetic factors are behind depression and a combination is also a possibility. Researchers in the US say they have identified 17 genetic variations that increase the risk of a person developing depression. Roy Perlis of Massachusetts General Hospital, USA, says, "Depression is about biology and I think that will be helpful for some people in reducing the stigma around it." Of the 3,00,000 people studied, 75,607 self-reported clinical diagnosis of depression or were receiving treatment for it.

Director of Fortis Hospital, Delhi, Dr Samir Parikh, says, "Women are more prone to depression. One woman in every four suffers from depression, whereas, one man in every 10 has it. However, this is not a panic situation as good medical care is available if a child is diagnosed and treated in time."

One can work on the environmental area to avoid depression. Dr Koushik Sinha Deb, Assistant Professor, Department of Psychiatry, AIIMS, Delhi says, "Physical activities such as running, swimming, and doing yoga help in dealing with stress better, which escalates depression. Eating and sleeping on time and avoiding substance abuse also go a long way." Eating leafy green vegetables, walnuts, tomatoes and apples has been found to help.

WHAT IS DEPRESSION?

It is a state of low mood and aversion to activity that can affect a person's thoughts, behaviour, feelings, and sense of well-being.

THE SYMPTOMS

- Feeling sad, anxious, empty, hopeless or guilty
- Not enjoying things you used to enjoy
- Trouble with concentration, memory, or making decisions
- Sleeping too much or too little
- Appetite changes and gaining or losing weight
- Feeling restless or irritable
- Thoughts of suicide or death
- Fatigue and decreased energy
- Persistent aches or pains, headaches, cramps, or digestive problems

FOODS THAT BEAT DEPRESSION

Dark Leafy greens, walnuts, avocado, berries, mushrooms, onions, tomatoes, beans, seeds, apples

"Depression is state of low mood and aversion to activity that can affect a person's thoughts, behavior, feelings and sense of well-being. Some of the symptoms of depression are feeling sad or disappointed, weight loss, insomnia etc.

Scientists in Australia have found that parents who are stressed can pass on the depression traits to their children and grandchildren. This experiment was done on mice, which were fed with stress hormones, the behavior of first and second generations of offsprings also showed lethargic behavior or depression. According to scientists, such behavior might have been passed through generations via small molecules called "microRNA" which affects genetic

outcomes. Dr Jitendra Nagpal, Director of Moolchand Medcity, Delhi says "There are 20-30% chances that a child develops symptoms of depression if one of the parents is suffering from depression. However, if both parents suffer from depression, then the chances are almost 50%".

I agree, that depression can be a genetically inherited by parents. But I also believe that depression is caused due to the situations a child is exposed to. As we know, that house is a place where child feels safe, happy and spends more than half a day in his/her house only. If there are many quarrels in house, no understanding between child and parents or lack of a positive and nurturing environment. The children automatically start getting depressed.

Some other depressing situations can even be outside the house like in schools, colleges etc.

So we can conclude that, though depression traits is passed parents to their children even the situations that makes them sad or disappointed can cause children to undergo depression. So we safely say that, children when exposed to depressing environments, children with depression traits are likely to get depressed when compared to children without the depression traits.

Karthik G. S
II B.Sc 'H' sec

SOON, YOU COULD DRINK PROTEIN-RICH SILKWORM SOUP?

Imagine starting your mornings with a bowl of silkworm soup! Researchers at the College of Sericulture in Chintamani taluk of Chikkaballapura district are working on just that. This article was published in the Times of India dated 15/03/17.

Very soon, Karnataka markets will have food and beauty products created using silkworm pupae and cocoon as researchers of the College Of Sericulture, Chintamani in Chikkaballapura district is working on developing a range of products using these as the primary ingredient. The researchers are claiming that the food products made with low cholesterol silkworms are good for those who have diabetes and heart ailments, reported a leading national daily.

In the North-eastern states of India, silkworm pupae are considered protein-rich and are sold in weekly markets. The researchers are also working on edibles from pupae in powder form or solvent for consumption, the Times of India quoted an assistant professor of by product utilisation, College of Sericulture, **Chandrashekar S Kallimani**, as saying.

The team has already created poultry feed from silkworm pupae powder that has received a positive response, and they are in conversation with veterinarians for standardising the product having essential nutrient additions, he added.
For this team of researchers, the next move is standardising the products for human consumption to be made available as soup or nutrient drinks and this will take another two to three months. Apart from edibles, the team is also developing soap from silkworm cocoons, and within a month this product will be ready.

Although the thought of eating insects for breakfast is met with a lot of skepticism(me included), I also feel this is an interesting approach and that insects might be the key to the looming global food crisis(the food supply has to double by 2050 to feed a projected population of 9 billion.)
Research shows one of the main health benefits behind edible insects are the large amounts of protein found in these small creatures.

Caterpillars contain 280g of protein per 1 kg. That's 20g more than salmon, 30g more than pork, and 263g more than tofu.

As global food prices have risen, the cost of animal feed has weighed down farmers and driven up meat prices. Because they are cold-blooded, insects require less energy to stay warm and are therefore more efficient at converting feed into protein (crickets, for example, need 12 times less feed than cattle, four times less than sheep, and half as much as pigs and broiler chickens to produce the same amount of protein).

If one has any type of health condition that involves inflammation, such as arthritis, sinus problems or blockage of the arteries, the proteolytic enzyme called **serrapeptase** may be able to help them.

This is an enzyme derived from silkworms, and it has helped people with a surprising number of health problems. It works by dissolving non-living protein and tissue, which can cause harm in the body, and leaving living tissue undisturbed.Best of all, it's a natural and relatively inexpensive supplement that's easy to find. Unlike many prescription drugs, it has few reported side effects.During his study trip to Thailand a few years ago, Chandrashekar discovered that byproducts of silkworm are extensively used as beauty products like body lotion, lipstick and facial cream.

"A protein called **sericin**, a by-product of silk, has anti-ageing qualities and we are trying to develop beauty products out of it. In foreign countries, there is also a practice of dipping cocoons in hot water and using them to remove dark spots from the skin through scrubbing. Whilst a lot of evidence points towards the benefits of **entomophagy**, there are also some risks to be considered.

Firstly there is the risk of **allergens.** The described allergic reactions include a few cases of anaphylactic shock following the consumption of the Mopane caterpillar (Africa) and silkworm pupae (China), it is suggested that the later is caused by the allergen arginine kinase as published by Rumpold & Schluter in 2012.

Some insects produce **toxins** as a form of chemical defense which can bring about nausea or vomiting (Rumpold & Schluter 2012) and therefore it is important to be able to appropriately identify toxic and non-toxic species.

One particular toxic substance is steroids produced by beetles, which if ingested in high quantities can cause retardation, infertility, masculinisation, and liver cancer.

To conclude, I feel that turning to insects to meet our dietary nutrient requirements, specifically our protein needs, in India where 9 out of 10 people are low-protein eaters could be an interesting direction to take in the coming future. I personally feel the pros outweigh the cons, which is clearly evident from the above facts. I also feel turning to insects as part of our daily diet can relieve pressure on the meat industry, dairy industry and reduce animal cruelty (cows in dairy industry particularly, which are tortured to provide an endless supply of milk and milk products), animal slaughter.

Though, logically speaking silkworm food products are clearly a good health choice, the problem with this is rather a psychological one and it will definitely take time for people to accept this.

Rohan P Bhat
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III Prize

NEANDERTHAL USED 'ASPIRIN' FOR TOOTH PAIN.

This article was published in 'DECCAN HERALD" newspaper on March 10, 2017, Friday.

It says nearly 50,000 years ago, before the invention of PenIcillin, Neanderthal suffering from a dental abscess or swelling ate greenery which contained a pain killer or natural antibiotic.Researchers said that the male, who lived in EI Sidron (Spain) ate an antibiotic fungus called Pencillium and chewed on the bits of Poplar tree containing Salicylic acid, the active ingredient of modern day "Aspirin".

We know that the Neanderthals are the ancestors of the Homosapiens. The Neanderthal and the modern human share 99.7% of their DNA and hence they are closely related (except for people from Africa where the Neanderthal never lived).The researchers took the fossil jawbone which had a severe damage of dental abscess and his dental plaque contained the small quantity of an intestinal parasite, causing acute diarrhoea.

As we know that, DNA of the Neanderthal and the humans match 99.7%, the Neanderthals' intelligence slightly matches with humans. So, apparently the Neanderthal possessed a good knowledge and wisdom of medicinal plants and their properties.
He used to self-medicate himself. Lot of people think that "aspirin" is a modern day medicine but our ancestors used it since many years ago.

"Aspirin" is a medicine that relieve pain and reduces fever, the source of which is a "Salicylic acid" present in many trees.Therefore the intelligence of the modern day Homo sapiens comes from their ancestors.We know that the humans are evolved from apes (Dryopithecus, Ramapithecus, Astralopithecus, Homohabilus, Homoerectus), like how the external appearence, behaviour, body angle etc., evolved, the DNA has also evolved.

Like the same way, intelligence has also evolved(meaning the evolution of human skull from Dryopithecus to Homo sapiens) because the increase in brain size became an added advantage and complex infolding of the outer cortical tissue increased the surface area providing greater capacity for abstract thought. Thus, the highly developed brain resulted in development of skills such as making of tools, hunting and communicating with each other and using plants to self-medicate as above mentioned.

Genes-Chromosomes-DNA-Nucleus-Cell, as the evolution takes place at cellular level, genes -the carriers of the hereditary traits pass on intelligence, external appearence, behaviour and many such characters from one generation to other.

Sanjana Harish
II B.Sc ‘H’ sec

OLDEST HUMAN ANCESTOR HAD NO ANUS

The article posted in the newspaper i.e Indian express Bangalore edition released on 1st Feb 2017. Got my interest because of the name of the species starts with the letter 'S' same as my name..,

But on serious note this article got the interest deeply because of the reason of the age of the species which is estimated to the age of evolution...

So coming to the talk on why this post got my interest is, this is a microorganism vertebrate that too found in the beginning of the era and this species is so peculiar that the organism has no anus and amusingly just one big opening for intake and excretion. And a vertebrate too. Which gets me thinking that the very origin of our race or the vertebrates, living creatures of any sort has a different ancestor or the origin of evolution. And we are in an illusion a mirage of the wrong concept of origin itself.

I am not against anyone... I have great regards to my fore fathers who have researched and given us so much... But as advancement in science and technology we can add on the ground or modify what they have given us.

Oldest human ancestor had no anus

Saccorhytus is the earliest step yet discovered on the evolutionary path that led to humans: Study

LONDON: A microscopic, bag-like sea creature with a large mouth and no anus, which lived about 540 million years ago, could be our earliest known ancestor, say researchers. Named Saccorhytus, after the sack-like features created by its elliptical body and large mouth, the species is new to science and was identified from microfossils found in China.

According to a study, published in the journal *Nature*, Saccorhytus was the common ancestor of a huge range of species, and the earliest step yet discovered on the evolutionary path that eventually led to humans, hundreds of millions of years later. Saccorhytus was about a millimetre in size, and *probably lived between grains of sand on the seabed. It is thought to be the most primitive example of a so-called "deuterostome"* -- a broad biological category that encompasses a number of sub-groups, including the vertebrates.

Location

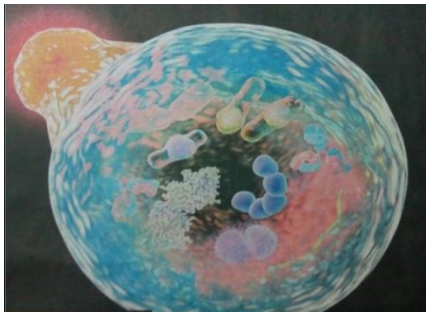
The Saccorhytus microfossils were found in Shaanxi Province, in central China, and pre-date all other known deuterostomes.

"We think that as an early deuterostome, this may represent the primitive beginnings of a very diverse range of species, including ourselves," said one of the researchers Simon Conway Morris, Professor of Evolutionary Palaeobiology at University of Cambridge. "To the naked eye, the fossils we studied look like tiny black grains, but under the microscope the level of detail is jaw-dropping. All deuterostomes had a common ancestor, and we think that is what we are looking at here," Conway Morris added.

Most other early deuterostome groups are from about 510 to 520 million years ago, when they had *already begun to diversify into not just the vertebrates, but the* sea squirts, echinoderms (animals such as starfish and sea urchins) and hemichordates (a group including things like acorn worms).

Suhaas. R
II B.Sc 'H' sec

THE SELF - SNACKING BEHAVIOUR OF CELLS.



Autophagy in progress

This article that appeared in the "Spectrum" section of Deccan Herald, dated March 14, 2017, gave detailed information about "Autophagy".

Can you imagine being so hungry that you have to eat your own body parts??
Autophagy is the process of the body devouring unnecessary and dysfunctional amino acids and nutrients to produce energy and perform basic functions when the living cells experience a severe shortage in nutrient supply. A lot of molecular mechanism occurs in this process.

Autophagy keeps the cells and organisms healthy by removing damaged organelles and misfolded proteins. Presently, Autophagy is the current topic of research that is being studied widely. This topic was awarded Nobel Prize in 2016 in Physiology to a Japanese cell biologist Dr.Yoshinori Ohsumi. The interest of scientists in autophagy began with the discovery of lysozomes, a cell organelle that contains lyric enzymes for breakdown of molecules. A vesicle carries foreign bodies to lysosomes called Phagosome.

On further studies, it was shown that the double membrane bound organelles fused with the lysosome under stressed conditions. The term autophagy was coined to refer to this mode of delivery of cytoplasmic materials to lysosome for degradation.
Yeast has over 15 autophagy deficient mutants. Dr.Yoshinori developed a yeast strain that lacked 3lysosomaal enzymes. This led to the accumulation of non-degradable material in it lysosome.

Autophagy is of 3 types:

- Macroautophagy
- Microautophagy
- Chaperone-mediated autophagy

Earlier, only macro autophagy was known, partly because it was the major type of autophagy that occurred frequently. The actual degradation of unwanted nutrients occur within sac-like autophagosomes. However, in Micro autophagy, such structures are not involved.

My opinion is that autophagy is a very important process that must occur in every organism's bodies. Autophagy can also be induced artificially. Researchers are designing a new drug that can enhance autophagy as well as inhibit it. As of now, this process is thought of as the reason for some practices like fasting in the ancient period.

Fasting was known previously to promote good health and an active lifestyle. Fasting for every fortnight is thought to reduce the occurrence of many lifestyle disorders and cancer. However, no one really managed to answer why such practices like fasting has so much importance.
Fasting is one way of naturally inducing autophagy. We are, in fact, forcing the body to use up its reserve nutrients and thus, supply energy to us. There are artificial methods of inducing autophagy, like using certain drugs.

I also feel that defects in autophagy can lead to several neurodegenerative diseases and hamper efficient immune response. In cells with longer lifespan and lesser regeneration capacity like neurons, autophagy becomes all the more vital. This process, thus, is linked directly to maintenance of cellular equilibrium. Thus, it comes as a surprise that autophagy can also prevent the onset of cancer in some individuals.

Thus, it is no coincidence that defects in autophagy lead to onset of many neurodegenerative disorders like Parkinson's disease. With advanced techniques, we can tap into the enormous potential of cell-snacking.

Rashmi. R
III BSc 'H' sec
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CREATING EFFECTIVE ZIKA VIRUS VACCINE

(Article from Deccan Herald)

Zika virus is a mosquito borne flavi virus that was first identified in Uganda in 1947 in monkey through a network that monitored yellow fever.it is primarily caused by Aedes mosquito. People with Zika virus disease can have symptoms including mild fever, skin rash, conjunctivitis, muscle and joint pain, malaise or headache. These symptoms last for 2-7 days. There is scientific consensus that Zika virus is a cause of microcephaly.

Recently a study was conducted by Brouch and colleague at Beth Israel Deaconess Medical Center in Boston where scientists have edged closer to an effective Zika virus vaccination. This was found after demonstrating that three different formulations can protect monkeys from the disease. The tests conducted on 16 animals found that all three experimental vaccines offered complete protection against Zika virus and they hope the protection would last longer.

The Zika virus has swept through Latin America and left behind a trial of birth defects, such as microcephaly which causes children to be born with small head (microcephaly is medical condition in which the brain does not develop properly resulting in a smaller than normal head).

Among the three Zika virus vaccination the most conventional and ready for development is a whole, killed Zika virus. The other two vaccines are more novel. In one a single and harmless Zika virus gene is stitched into a loop of DNA. When injected in body the host cells takes up this DNA loop and Zika proteins are produced from it, this triggers immune response against them in the body. The third vaccination adds the Zika virus gene to a harmless adenovirus, this behaves like a Trojan horse and smuggles the DNA into cells, which then produces antibodies to wipe out the whole virus.

No DNA or adenovirus can be used on human beings but clinical trials are underway. The results were positive early steps towards formulating the effective vaccination for Zika virus. But there are many hurdles in it as a recent study by Screaton's group found that exposure to dengue virus could make Zika virus more severe and serious. And the other way could also be true as both the Zika and Dengue virus fall under category of flaviviruses as they are so similar at genetic level.

Some researchers feel before these vaccinations are produced there are some really important questions should be answered. In India the prevalence of microcephaly affected births (total number of babies including both live born and still birth with microcephaly per 10,000 births) through systematic review and meta- analysis of several studies have found a prevalence rate of 2.30 per 10,000 births among 97155 births.

P. Padma Sri Lekha
II BSc 'I' sec

THE SELF - SNACKING BEHAVIOR OF CELLS

This article was published by an author who works in Gubbi labs, a Bengaluru based research collective, in DECCAN HEARLD newspaper on 14th March 2017. The article is based on the concept of "AUTOPHAGY" which is a normal physiological process in the body that deals with destruction of cells in the body. It maintains homeostasis or normal functioning by protein degradation & turnover of the destroyed cell organells for new cell formation. During cellular stress the process of autophagy is upscaled and increased. Cellular stress is caused when there is deprevation of nutrients and / or growth factors. This may provide an alternate source of intracellular building blocks and substrates that may germinate energy to enable continuous cell survivals.

There are several types of autophagy, they are:

- MICROAUTOPHAGY - in this process the cytosolic components are directly taken up by the lysosome itself through the lysosomal membranes.
- MACROAUOPHAGY - this involves the delivary of cytoplasmic cargo of the lysosome through the intermediary of a double membrane-bound vesicle. This is called autophagosome that fuses with the lysosome to form an autolysosome .
- CHAPERONE-MEDIATED AUTOPHAGY – in this process the targeted proteins are translocated across the lysosomal membrane in a complex with chaperone proteins (such as HSC-70).
- MICRO & MACROPEXOPHAGY
- PIECEMEAL MICROAUTOPHAGY OF THE NUCLEUS
- CYTOPLASM TO VACUOLE TARGETING (cvt)

AUTOPHAGY PROCESS –

The process of autophagy has been conserved over a time among all living organisms. The process is similar in single cellular organism like yeast to multi-cellular organisms like humans. The process is a dynamic one but can be divided into some basic steps:

- INDUCTION – Autophagy is induced when the cell put under stress on there is depletion of growth factors &nutrients in the media where the cell resides.
- CARGO SELECTION AND PACKAGING – There are usually intracellular stimuli and signals that induce autophagy. As the signals for autophagy are in place and there is induction of the process, the next step is to select the material that is to be removed. This is termed cargo; it is selectively separated & is packaged inside vacuoles.
- VESICLE NUCLEATION – The step of the process is formation of the requested vesicle. This is the main site that assembles and organizes the autophagy machinery.
- VESICLE EXPANSION & COMPLETION – The membrane expands to completely enclose the cargo, which give rise to autophagosomes , where proteins play an important role .
- RETRIVAL – In this step the proteins that were involved must dissociate to form autophagosome.
- TARGETING, DOCKING & FUSION of the vesicle with the lysosome / vacuole.
- BREAKDOWN OF THE VESICLE & ITS CONTENTS: The final step is breakdown of vesicle & release of its cargo. Opening of the vesicle by breaking down of the membrane releases the contents to the lumen.

Functions of autophagy in the body can be outlined as:

- HOUSEKEEPING ROLES – These roles involves removal of aggregated and erroneously folded or formed proteins & removal and clearance of damaged organelles or cell components.
- HOST DEFENCE MECHANISM – Autophagy helps kill ells that are infected or involved by foreign pathogens. Thus it helps contain the infection & may act as part of immunity of the cellular organisms.
- ROLE IN CELLULAR STRESS – Autophagy is a response to cellular stress. It regulates the process that occurs when there is nutrient deprivation and cellular stress.
- EMBRYONIC DEVELOPMENT – Autophagy plays an important role in development of the embryo by maintaining a critical balance of energy levels & source.
- Autophagy plays an important role in cancer – both in protecting against cancer as well as potentially contributing to the growth of cancer.
- It is no coincidence that defects in autophagy have been linked to neurodegenerative disorders & diseases like Parkinson's disease.

REVIEW:

Studies have shown that autophagy not only helps cells to survive periods of starvation, but also maintains the cellular equilibrium both of which are essential for the survival & normal functioning of cells.

Today, autophagy is an important in field of research. The fact that the 2016 Noble prize in physiology was awarded to Japanese cell biologist Dr. Yoshinori Ohsumi is a testimony to this.

The interest in autophagy started with the discovery of lysosome, a cell organelle that contains enzymes that can break down all biomolecules by Christian de Duve in 1995. Autophagy keeps the cells and organisms healthy by removing damaged organelles & aggregated proteins. Hence, it becomes all the more important in cells with longer span of life, like neurons. This process also plays an important role in immune response and controls inflammation and activation of adaptive immunity.

Apoorva . H. V
III B.Sc 'B' sec

"Butterflies can act as bio-indicators of climate change".

Butterflies make the world a little more colourful. Their vivid wing coloration and fluttering flight path lend a special touch of beauty to nature. However, butterflies do more than just paint a pretty picture. They help flowers pollinate eat plenty of weedy plants and provide a food source for other animals.

In addition, their presence or absence can tell us a lot about the local environment.

Butterflies play an important role in the environment, which most of us would not be aware of, like-

- They pollinate the plants, while they sip on a flower's nectar.
- They keep the organisms in check by feeding on the weeds specific to particular species of butterflies. A particular butterfly species feed on aphids and keep their population in check. Some adult butterfly species eat rotting fruit, animal excrement etc, thus ridding the environment of waste.
- During any stage of their life-cycle, butterflies provide a food source for other animals. Birds, spiders, lizards, small mammals and even other insects are all butterfly predators.
- Butterflies are extremely susceptible to pesticides and insecticides. By not requiring the use of harmful chemical applications, native habitats not only provide a safe haven for butterflies, but also for other creatures as well, thus encouraging habitats and wildlife.
- The aesthetic appeal of butterflies draws human interest, thus promoting environmental awareness. There are some of the roles played by the butterflies for the betterment of the environment. But one of the roles we are interested in is discussed below.

Acting as a vital bio-indicator, butterflies can tell us almost everything we need to know about the health of an ecosystem. According to a report by the Dorset-based charity butterfly conservation, 72% of butterfly and moth species have declined in the last ten years.

Butterflies react extremely quickly to even minor changes in the environment, making them both a good indicator of biodiversity and providing an early warning system for other reductions in wildlife. As a result, they are now the best monitored group of insects in the world.

A decline in butterflies would also have a knock-on effect on other species, in particular birds rich as blue-tits, jays and sparrows. Stephen Dickies explains: "Birds plan their whole breeding season around when caterpillars will be the most abundant. If the butterfly and caterpillar numbers are depleted then there's not going to be a lot of foot for developing chicks".

Plants will also be affected. Butterflies are a major group of pollinators of both wild and cultivated plants. Without them and other important pollinating insects flying around, there will be a significant decline in viable seeds produced.

Healthy presence of butterflies ensures the healthy status of forest ecosystem. Butterflies have got reciprocal relations with the related plants. Because of that, they are distributed at all heights in the forest areas. Life cycle changes in the butterflies are deeply related with phenology of the host plants and other related plants. Butterfly wings and its entire body is covered with billions of dust particles which are capable of absorbing quantum of light and the photons received by the dust particles produce beautiful

colorations. At the same time, these dust particles are very much sensitive to the climatic changes, i.e. changes in photoperiodism and thermoperiodism of the habitat where they are living.

Scientists use the presence or absence of butterflies as a predictor of whether an ecosystem is healthy. Adult and larval forms are sensitive to pesticides. Changes in climate will impact butterflies because temperature changes and rainfall amounts may alter migration patterns and timing.

Ecologists study butterfly behaviour, population members and migration pattern to help determine the impact of their environmental issues. Some species of butterfly help to reduce air pollution. These species decrease the carbon-di-oxide in the air. The host plants of monarch butterflies and caterpillars absorb CO_2 and reduce the amount of air pollution. The caterpillars eat host plant and grow back bigger and better so that it can absorb more carbon-di-oxide.

As butterflies have high reproductive rates and are at low trophic level due to this, they respond quickly to environmental stress. Butterflies tend to be easy to find and measure. In a particular habitat if butterfly is endangered then the plants, insects and vertebrates living in that habitat are also at risk. Therefore endangered butterflies serve as barometer of natural conditions in that habitat, which indirectly affects the climate.

By knowing all this, we can finally come to a conclusion that butterflies directly or indirectly affect the climate, thus acting as bio-indicators of climate change. Therefore, they are species richness monitoring system in ecosystem and for forecasting the climatic change. Due to this, butterflies are applicable in taking mitigation approaches to combat calamities caused because of unusual climatic changes.

STEPS TO BE TAKEN:

- Use butterflies as biotic indicators for monitoring and forecasting climatic change impacts on the biodiversity.
- Establishment of butterfly colonisation centres in the experimental forest areas.
- Establishment of butterfly parks or gardens for enhancement of ecotourism and wildlife sanctuaries.

Fariya kousar
III B.Sc ‘B’ sec

The power of the bumblebee brain

James Gorman, March 7, 2017, the New York Times

Never underestimate the power of the bee brain. In the latest triumph for one of humanity's favourite insects, bumblebees learned how to push a ball to the centre of a platform for a sugary treat. That may not make them a threat on the chess board, but soccer or even Skee-ball might be within their intellectual grasp — if it were scaled down in size, of course. The new research finding is one more reason that scientists who study insects, of all sorts, would like to point out that just because a brain is small, doesn't mean it is simple.

Clint Perry, one of the bumblebee trainers at Queen Mary University of London, and a confirmed small brain partisan, said, "I've actually been asked if bees have brains." In fact, a number of recent experiments have shown that "insects can solve problems, they can learn," he said. And scientists have yet to define the limits of insects' mental abilities. Once, insects were thought to be little automatons, hard-wired to take certain limited actions. Now evidence is growing that the abilities, even of fruit flies, approach something that isn't the same as human thinking, but isn't pure hard-wired instinct either. They remember, they choose between alternative actions. They have a kind of internal map of where they are, an abstract representation in the brain of the external world.

Vivek Jayaraman, who studies navigation in fruit flies at the Janelia Research Campus of the Howard Hughes Medical Institute, USA, said recently of his opinion of what goes on in these insects' brains, which are the size of poppy seeds: "I won't capitalise the C yet, but it's cognition in some form." David Anderson at Caltech, USA, who studies emotion like states in fruit flies, declines to call their brains simple, preferring a description along the lines of "more compact nervous systems." "They are capable of doing remarkable things," he said. And bees are something else altogether with nearly a million brain cells, compared with about 2, 50,000 in the fruit fly. Honeybees have long been known to use a tail-shaking behaviour called the waggle dance to tell each other where to fly for flowers with nectar, and to signal how good the nectar is. That's like twerking not only the address of the supermarket, but a review of its produce section.

Some researchers have even suggested that bees are capable of a minimal kind of awareness, an assertion that others consider speculation that cannot be proved or disproved. The bumblebee researchers in London, in the laboratory of Lars Chittka, have tested their subjects in other ways. Recently they showed that bees could learn to pull a string for a treat of sugar water. But in that experiment, the bees might have been learning where to go and then just scrabbled around until something worked. In this experiment, which the researchers reported last month in the journal Science, Olli J Loukola and Perry trained bees to do something even more removed from their natural behaviour. The task of pushing a little ball to the centre of a platform was completely arbitrary.

Bees don't do anything like this in nature, where they seek out flowers for nectar and pollen. So it was a brand-new behaviour demanding some kind of general ability to learn. The way the bees learned was important, too. They were pre trained to expect a treat in the centre of a platform. But having to push a ball to the centre to get the treat was something they hadn't seen.

Then the researchers tried several ways of teaching the bees what to do. The bees learned best by watching a fellow bee perform the feat. After that kind of observation, 10 of 10 bees solved the problem on the first try. On later tries, they continued to improve, taking less time. That kind of imitation is social learning, say the researchers, the sort of thing more often seen in animals with much bigger brains, like monkeys.

Ralph Adolphs, who studies social cognition in humans at Caltech, USA, cautioned that the feat did not mean the insects achieved the kind of insight that humans do when they watch a task performed and understand the principle involved. "If I show you some new complex thing to do, you can watch, understand it, and do it at 100% thereafter," he said. "These bees are slowly, over multiple trials, getting somewhat better," he said, which suggests a different mechanism.

The bees also learned, although not as well, when the ball moved seemingly on its own, pulled by a hidden magnet. But, Ralph said, "I would completely agree that the limits of bee cognition are entirely unknown." Skee -ball anyone.

Write-up:

Insects form the most diverse group of animals. Many insects are also well known for the social behaviour and organization that they exhibit. The size of their brains has always made scientists wonder how they are capable of functions that are close to cognitive functions of higher animals. Drosophila or fruit fly, which is often used as a model insect to study the nervous system has about 2,50,000 neurons . Honeybees have about one million. Surprisingly, one of Linnaeus's criteria for class Insecta was that its members had no brain! In fact , some scientists believe that insect brains aren't simple but are only very compact and also that they can perform several functions such as learning, recognizing and interacting , even with such compact brains.

Studies have shown that insects are capable of exhibiting attention, social learning, individual recognition, concept learning, generalizing, decision making and also forming abstract concepts.

For example, honey bees can not only interact using the 'waggle' action but can also decide which flower yields more nectar. They can also differentiate and learn which species yields more nectar and also the particular time which is best for collection.

In the article, the experiment with bumble bees involves training the bee to move a ball to a target. In a similar experiment the bees were allowed to decide between multiple balls. Each time they moved the ball closest to the target. When the colour of the ball was changed, they still moved the closest ball.
In many experiments, insects that were decapitated (head chopped off) were still able to perform certain functions that are governed by the central nervous system. This is due to the special arrangement of various parts of the central nervous system. Some insects also exhibit long term memory after decapitation

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Keerthi Prakash
III BSc 'B' sec
II Prize

TEN OF THE UGLIEST ANIMALS THREATENED BY CLIMATE CHANGE

Everyone cares that pandas and polar bears are endangered because, let's face it, they're adorable. They're known as "charismatic mega fauna"- they're large animals with popular appeal. Also included on this list are elephants, lions, tigers, sharks, and whales. In short, looks matter.

Conservation organizations love these animals because they easily capture our attention.

The hope is that as we work to conserve these charismatic species, we'll also save the plants and animals share their habitat-a concept known as the umbrella effect. By protecting lions, for example, we also protect the less flamboyant fauna that live in the same eco-system.

And by focusing on the big guys, we're reinforcing the idea that the only animals worth saving are the ones humans find attractive. But just because a species is small, or ugly, doesn't mean that it deserves to be extirpated.

Acipenser sinensis (Chinese sturgeon)

It's not as internationally famous as the Panda. But in its home country, the Chinese sturgeon is regarded as a "national treasure"—but not for its looks. Sturgeons date back to the Cretaceous period.

Ambystoma mexicanum

Native to Central Mexico, this amphibian once crawled the ancient system of water channels and lakes in Mexico City. But it's disappeared from most of its range.

Atelopus onorei

This frog, with a vibrant coloration that you either love or hate, is native to Ecuador-and it might already be extinct.

Conolophus marthae (Pink Iguana)

Sure, there are green iguanas, and gray iguanas, and even blue iguanas. But pink? Yes, the pink iguana is indigenous to Isabela Island in the Galápagos. Its unique coloring costs it some points in the looks category.

Cottus rondeleti

This odd-looking fish is found only in the coastal waters of Southern France.

Crocodylus siamensis (Siamese crocodile)

The Siamese crocodile, a freshwater crocodile native to Indonesia, is one of the least studied and most critically endangered of its kind.

Daubentonia madagascariensis (Aye Aye)

From its rodent-like teeth to its thin, slender fingers, the assemblage of features that comprise the Madagascan aye-aye (a type of lemur) make it a hard animal to adore.

Euastacus guruhgi

This blue crayfish endemic to the waters of Australia serves as a visual reminder that shellfish are often little more than sea cockroaches.

Fregata andrewsi (Christmas Island Frigatebird)

This sea bird native to Christmas Island is known to engage in Kleptoparasitism-it harasses other birds into regurgitating their food so it can feast on the vomit.

Geronticus eremita

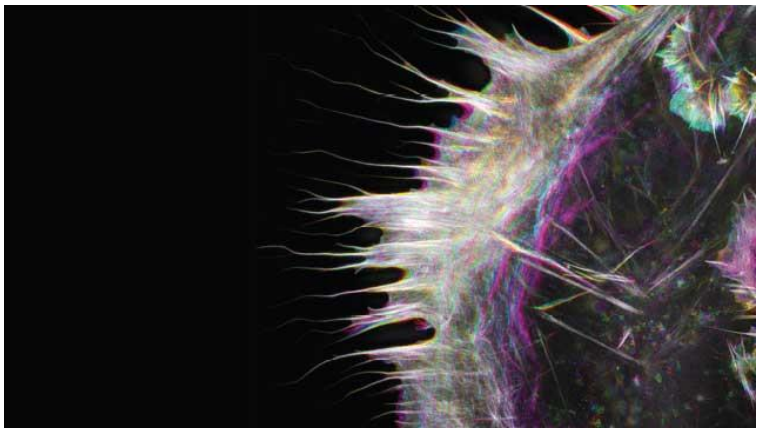
The northern bald ibis has a history that dates back 1.8 million years, but disappeared from Europe more than 300 years ago. Now there are a few hundred members of the species left in the wild, mostly concentrated in the Mid-East.

Reference:
Popular Science (Magazine)
By - Kendra Pierre-Louis
March 7th 2017

Naresh .K .S
III B.Sc ‘B’ sec

MAY THE FORCE BE WITH YOU

The discussion of how cells sense and propagate physical forces is leading to exciting new tools and discoveries in mechano-biology and mechano-medicines.



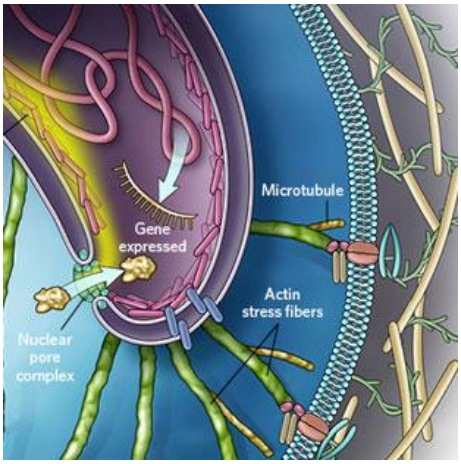
CELL SCAFFOLDING: This composite super-resolution microscopy image shows actin (on a scale from blue to magenta/red, for earlier to later time points of imaging) in a living pig kidney cell.

It is well known that some human diseases are related to changes in mechanical properties of tissues. In patients suffering from arteriosclerosis, the arteries lose some of their elasticity and become thicker and stiffer. In liver or lung fibrosis, excessive fibrous connective tissue has a similar hardening effect on those organs. And patients with aneurysms have balloon-like bulges in their blood vessels that, if left untreated, can expand under pressure until they burst.

Of course, mechanical properties and forces aren't just important in disease, but in health as well. Almost all living cells and tissues exert and experience physical forces that influence biological function. The magnitudes of those forces vary among different cell and tissue types, as do cells' sensitivities to changes in magnitudes, frequencies, and durations of the forces. Touch, hearing, proprioception, and certain other senses are well-known examples of specialized force sensors. But force detection and sensing are not limited to these special cases; rather, they are shared by all living cells in all tissues and organs. The underlying mechanisms of force generation and detection are not well understood, however, leaving many open questions about force dynamics; the distance over which a force exerts its impact; and how cells convert mechanical signals into biochemical signals and changes in gene expression.

Applied forces concentrate at actin stress fibers and propagate over longer distances in the cytoplasm.
In recent years, biologists have begun to uncover the molecular players that mediate force sensation and propagation at the cellular level, and they're collecting clues as to how mechanical stimuli influence biological function. Such work could pave the way for a deeper understanding of how physical forces influence biological functions in embryonic development, normal physiology, and complex diseases. Translating this research into the clinic may help create new ways of treating certain diseases using mechanics- and engineering-based tools.

Mechano transduction at a distance



For many years, the prevailing view in the field of mechano transduction was that forces transmit only a short distance in living cells, and thus a local force can only exert significant effects at the periphery of the cell. From a materials science point of view, this limited reach would be reasonable if the material was homogeneous and isotropic—in other words, there is no difference in its stiffness or other mechanical properties when the force direction is changed. In this case, a local stress would rapidly decay as the distance increases. However, the cytoplasm of a living cell is neither homogeneous nor isotropic; it is heterogeneous and anisotropic, meaning that the material's mechanical properties do depend on the direction of force. Importantly, there are stiff, pre stressed actin bundles (also called stress fibers) in the cell. Applied forces concentrate at these actin bundles and propagate over longer distances in the cytoplasm.

Since the early 2000s, many group of researchers have demonstrated that forces do propagate across relatively vast cellular distances—on the order of tens of micrometers—in living cells, and that this long-distance signal is dependent on the inherent tension in the cytoskeleton. Just as a violin string can only ring with the correct resonance and sound the right note if it has proper tension, when the pre stressed actin bundles are disrupted, force propagation becomes short-range (acting over only a few μms). The higher the tension, the farther the force will be propagated.

Most recently was founded that specific signaling molecules—in particular, the tyrosine kinase Src and the GTPase Rac1—can be activated at distances of more than 60 μm away from the site of the local force application via integrins at the cell membrane. Importantly, this activation is fast, taking less than 300 ms from force application to the activation of Src and Rac1, making mechanotransduction much faster than the 10 to 20 seconds it takes a soluble growth factor–induced signal to travel over the same distance.

Mechanotransduction in the nucleus

In contrast to the emerging picture of force propagation in the cytoplasm, we know very little about nuclear mechano transduction. The nuclear envelope is physically tethered to the actin cytoskeleton via the LINC (linker of nucleoskeleton and cytoskeleton) complex. In the late 1990s, Ingber and colleagues

published the first evidence that force-carrying connections reach from the plasma membrane to the nucleus, perhaps playing a role in the regulation of gene expression. Using a micropipette coated with fibronectin to attach to the cell surface, the researchers pulled on the cell and found that the nuclear envelope distorted. Later, my group revealed a force-induced protein-protein dissociation inside the nucleus.This change was dependent on both a properly stressed cytoskeleton and an intact nuclear lamina, a layer of intermediate filament proteins called lamins that line the inside of the bilamellar nuclear envelope. Subsequent research has demonstrated that lamins are mechanosensors critical for extracellular matrix stiffness–directed differentiation and for regulation of transcription factors

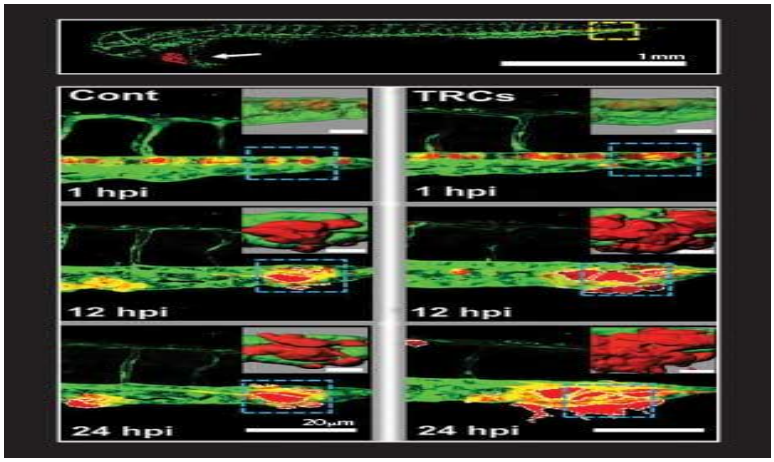
.

Mechanomedicine is poised to emerge as an exciting branch of medicine that uses mechanics- and engineering-based principles and technologies for precision diagnostics and effective therapeutics.

To more directly investigate whether a physiologically relevant force can directly deform chromatin structure in a living cell to regulate specific gene expression. They used bacterial artificial chromosomes to insert multiple green fluorescent proteins and the gene for dihydrofolate reductase (DHFR), an essential enzyme for the synthesis of thymine, into the same chromatin domain in Chinese hamster ovary (CHO) cells. When applied a local force to those modified cells via integrins. Sure enough, they measured an uptick in DHFR transcription in response to the applied force. Conversely, disrupting cytoskeletal tension, or the force transmission pathways from the cell surface to lamins and to the nuclear structural proteins that connect to the chromatin, abolished force-induced DHFR expression.

This work provides the first evidence that externally applied forces can stretch chromatin and promote gene expression. As expected with physical force–mediated processes, the response was rapid; we were able to quantify DHFR transcription upregulation within 15 seconds after force application. Interestingly, force-triggered transcription is sensitive to the angle and direction of force relative to the actin bundles: the higher the stress angle, the greater the transcription. Because endogenous forces are constantly generated inside a living cell, these findings suggest that gene expression might be incessantly regulated by physical forces via this direct structural pathway and the indirect pathways of matrix rigidity–dependent nuclear translocation of certain factors, such as yes-associated protein (YAP) and TWIST1. More research is needed to understand the relative contributions of each of these mechanisms in determining overall gene expression levels in any given cell.

From mechanobiology to mechanomedicine



TUMOR POTENTIAL: When melanoma cells were injected into embryonic zebra fish pericardium (red cells indicated by white arrow), the membrane that surrounds the heart, the cells travel to the tail in just one hour post injection (hpi). Differentiated melanoma cells cultured on stiff substrates (Count) were less efficient than undifferentiated tumor-repopulating cells (TRCs) cultured on a soft matrix at establishing new tumor.

Mechano biology is becoming increasingly relevant to stem cell biology. For many years, researchers have cultured cells on top of rigid plastic or glass coverslips. However, it is well known that various types of living cells in soft tissues attach to matrices of varying stiffness. Tuning the substrate stiffness in a controlled manner, Yu-Li Wang and colleagues demonstrated that the size and dynamics of focal adhesion complexes as well as the migration of living cells are dramatically altered by substrates of different rigidity. Later, Adam Engler_of the University of California, San Diego, and Dennis Discher of the University of Pennsylvania reported that mesenchymal stem cell differentiation can be directed by extracellular matrix stiffness. And they also demonstrated that by applying local force can spur the differentiation of a single embryonic stem cell. Physical forces also appear critical in the patterning and organization of germ layers during early mammalian embryonic development.

Researchers are also considering mechanical forces in cancer research. For example, despite decades of study, it is still unclear why only a few cancer cells out of thousands are able to metastasize. The answer may lie in the tumor's physical environment. Scientists have shown that, in primary tumors, high mechanical tension and matrix stiffening are important in cancer progression, and high fluid/solid pressure in the primary tumor often accompanies tumor growth. However, secondary metastatic sites of tumors appear to be softer—suggesting that they have lower forces—than the surrounding normal tissues.

Conclusion:

Using a 3-D soft matrix made of fibrin gels, one can isolate and grow cells that are highly tumorigenic and malignant, called tumor-repopulating cells (TRCs), from several murine or human cancer cell lines. Interestingly, melanoma TRCs cultured in soft 3-D matrices are less differentiated—and thus more tumorigenic—than melanoma cells grown in stiff matrices or on rigid plastic, suggesting that low matrix stiffness drives TRC growth. These soft-cultured melanoma TRCs also move out of the blood vessels in zebrafish to secondary sites more efficiently than more-differentiated melanoma cells cultured on stiff substrates. These findings suggest a common thread in metastatic colonization of malignant tumors: a few tumorigenic cells are able to survive, metastasize, and grow at the secondary sites of soft matrices because these cells are undifferentiated.

And the role of physical forces in biology is by no means limited to stem cells and cancer biology. Across the life sciences, researchers are continuing to draw on insights into mechanobiology to better understand and treat a wide variety of conditions. Human organs-on-a-chip for novel drug screening, shear force–activated cleaning of thrombosis, mechanically tuned hydrogels for bone formation, and tumor cell membrane–derived therapeutic micro particles for reversing cancer drug resistance are just a few recent examples of clinical applications of mechanobiology-based technologies. Mechanobiology- based medicine (mechanomedicine) is poised to emerge as an exciting branch of medicine that uses mechanics-

and engineering-based principles and technologies for precision diagnostics and effective therapeutics of diseases that are beyond the reach of existing toolboxes.

Sai Kumar. S
III B.Sc 'B' sec

WATER LOSS MANAGEMENT IN RESERVOIRS

Reservoirs are built across the rivers to provide water supplies for human consumption, agriculture hydropower etc. At present, there are about five lakh reservoirs around the world and about five thousand of them are situated in India. Reservoirs are of great importance, as they are one of the important sources of drinking water. Increasing population and water pollution has led to a condition where there is scarcity of drinking water supply around the world. According to a study conducted in the year 2013, about 1.2 billion people lack clean drinking water supply around the world. One of the reasons for scarcity of water is loss of stored water in reservoirs.

The loss may due to many reasons like evaporation, reservoir damage, overloading etc. The greatest loss is by evaporation. Water evaporates due to rise in temperature. If the temperature of the water is decreased, the rate of evaporation can also be decreased. Because of exposure of large surface area of water to the sun, about 170 km^3 of water evaporates from world's reservoirs every year. It is more than 7% of total amount of water consumed by all human activities. Hence prevention of water loss by evaporation is of great importance.

Many methods have been implicated to prevent water loss by evaporation. Some of them are:

- Construction of underground storage dams.
- Covering the surface area of water by formation of thin oil films.

Recently, in the year 2015, Los Angeles made an attempt to cover the reservoirs with black plastic balls to prevent evaporation, and were successful to reduce the water loss to a considerable extend. But the project turned out to be pretty expensive costing about $35 million.

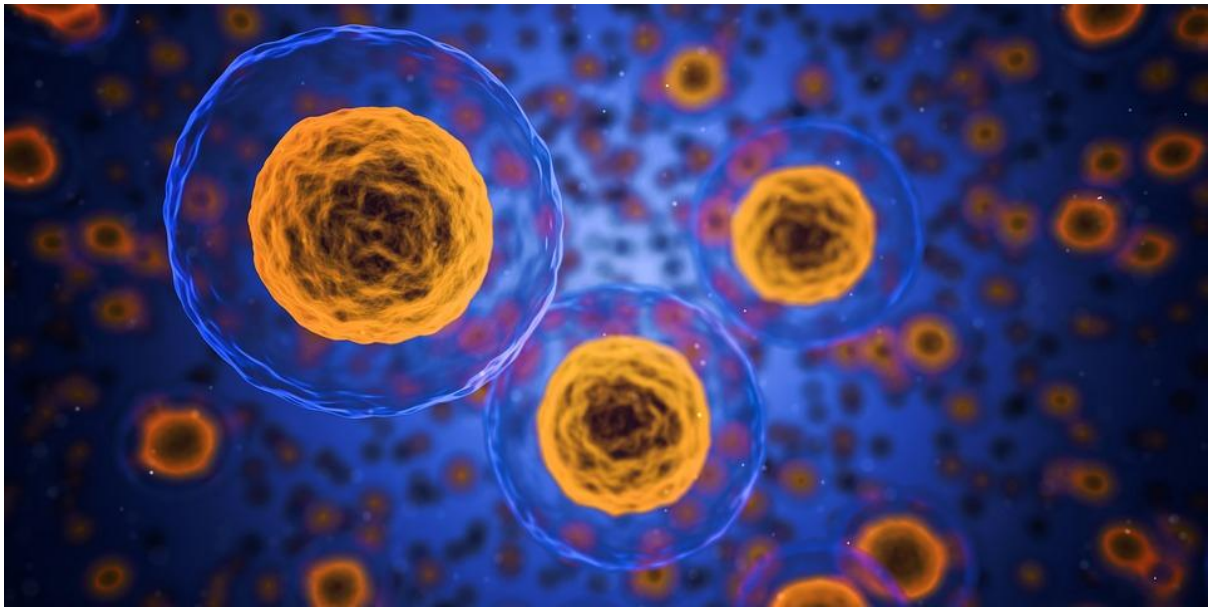
One possible solution to prevent water loss is by the application of chemicals. Dodecanoic acid (Lauric acid) and hexadecanol (cetyl alcohol) are the two potential chemicals that can be used to prevent evaporation. These compounds are insoluble in water and hence they don't affect the purity of water. Lauric acid is naturally occurring fatty acid and is one of the important fatty acid present is breast milk. Experiments have been shown that lauric acid acts as an anti-viral and anti-bacterial agent. Hence, even if small concentration of lauric acid is dissolved in the water (0.6mg per litre) it does not affect human health. The property of these materials that can be used to prevent evaporation is that they act as Phase Change Materials (PCM).

Phase Change Materials are those materials that can absorb large amount of heat from the surrounding and store them. During the course of heat absorption they undergo a change in their physical state. Hence these PCMs can be used to decrease the temperature of the water stored in the reservoirs. They are in the form of powder at room temperature and gradually change to a liquid state at higher temperatures. Copper/ Aluminium cases containing these compounds can be introduced in the reservoirs. Since Copper and Aluminium are good conductors of heat, they can transfer the heat from water to these compounds. By this process, the temperature of water can be decreased, hence decreasing the rate of evaporation. Experiments have to be conducted to evaluate the efficiency of this method.

The process is economical too, since these compounds are easily available and are of low cost. Lauric acid naturally occurs in coconut oil and palm oil in high ratio. Since it has a lower density than water, it does not sink in water, instead it floats on water. Since these materials are immiscible in water, they can be easily separated from water even if they are leaked out. They also prevent the growth of microbes, since they have anti-microbial properties.

Sharath. M
III B.Sc 'B' sec

ENZYME FOUND THAT CAN PREVENT SENESCENCE



Cellular senescence is the phenomenon by which normal diploid cells cease to divide. In culture, fibroblasts can reach a maximum of 50 cell divisions before becoming senescent. This phenomenon is known as "replicative senescence", or the Hayflick limit. Replicative senescence is the result of telomere shortening that ultimately triggers a DNA damage response. Cells can also be induced to senesce via DNA damage in response to elevated reactive oxygen species (ROS), activation of oncogenes and cell-cell fusion, independent of telomere length. As such, cellular senescence represents a change in "cell state" rather than a cell becoming "aged" as the name confusingly suggests. Nonetheless, the number of senescent cells in tissues rises substantially during normal aging.

Although senescent cells can no longer replicate, they remain metabolically active and commonly adopt an immunogenic phenotype consisting of a pro-inflammatory secretome

An enzyme that blocks cellular senescence and its mechanisms has been discovered by a research team from Kumamoto University, Japan. They found that a reduction of the enzyme SETD8, which regulates cell proliferation and gene function, results in the promotion of cell aging features.

Many types of cells in the body eventually stop proliferation as their ability to divide decreases. This is called cellular senescence and is considered to be an important factor related to the aging process and life span. Although there are various etiologies of cellular senescence, the mechanism is still not well understood. In particular, stress-induced cellular senescence occurs when genomic DNA is damaged by physical factors, such as radiation, or by DNA-targeting chemicals. Additionally, when cells start becoming cancerous, cellular senescence occurs to prevent the onset of cancer. Unfortunately, increased age makes it easier to become sick, so it is important to properly control this particular cell function.

Senescent cells have a hypertrophied and flattened morphology, and lose their proliferative capacity. In recent years, it has been discovered that senescent cells secrete a variety of proteins which sometimes promote chronic inflammation as well as cancer development by acting on the surrounding cells. Since senescent cells are more active than expected, cellular senescence is considered to be the cause of the aging phenomena for the whole body. For example, it has been reported that when senescent cells of old mice are eliminated; whole body aging can be suppressed. In other words, if we can adjust cellular senescence, whole body aging may be controlled.

The team from Kumamoto University has been researching the mechanisms of cellular senescence from the viewpoint of epigenetics, a research field that studies the changes in gene expression by molecular modifications. They screened for factors related to the senescence of cultured human fibroblasts (cells in connective tissue which aid in cell proliferation, differentiation, and repair) by using various cell- and gene-mediated analyses. They discovered that the enzyme SETD8 methyl transferase, which adds methylation on histone H4 lysine 20 (H4K20), regulates senescent features.

Normal cells stop proliferation after dividing many times (replicative senescence), and when oncogenes are activated for cancer initiation, senescence occurs to prevent it (oncogene induced senescence). In the past, SETD8 was reported to regulate cell proliferation and gene function via H4K20 mono-methylation, but its relation to cellular senescence was unknown. The researchers, however, found that SETD8 decreased markedly in senescent cells. When they performed a gene knockdown experiment (using RNA interference) to suppress the function of SETD8 in fibroblasts, cellular senescence was induced with typical features. Furthermore, using a drug that inhibits the enzyme activity of SETD8, similar senescent cells appeared. In other words, SETD8 plays a role in preventing cellular senescence.

The researchers then comprehensively analysed all gene expression in senescent cells with decreased SETD8. The results showed that the expression of genes involved in cellular senescence had increased, particularly the genes for ribosomal proteins and ribosomal RNAs responsible for cellular protein synthesis, and the genes of proteins that inhibit cell proliferation. This shows that a loss of SETD8 augments protein synthesis and growth arrest in senescent cells via gene regulation.

Senescent cells need large amounts of energy to maintain cellular functions such as protein synthesis and secretion. The researchers previously reported that energy production in mitochondria is markedly increased in senescent cells (Takebayashi et al. Aging Cell, 2015). Now, researchers have found that the activation of mitochondria is regulated by SETD8, and microscopic observations confirmed that the nucleolus and mitochondria were remarkably developed in SETD8 depleted cells. Therefore, cell senescence and its corresponding metabolic activities are promoted by a decrease in SETD8.

This research reveals that SETD8 protects against cellular senescence. It is expected that this result will be useful for understanding the mechanisms of senescence and developing a way to control cell aging.

Ullas. M
III BSc ‘B’ sec

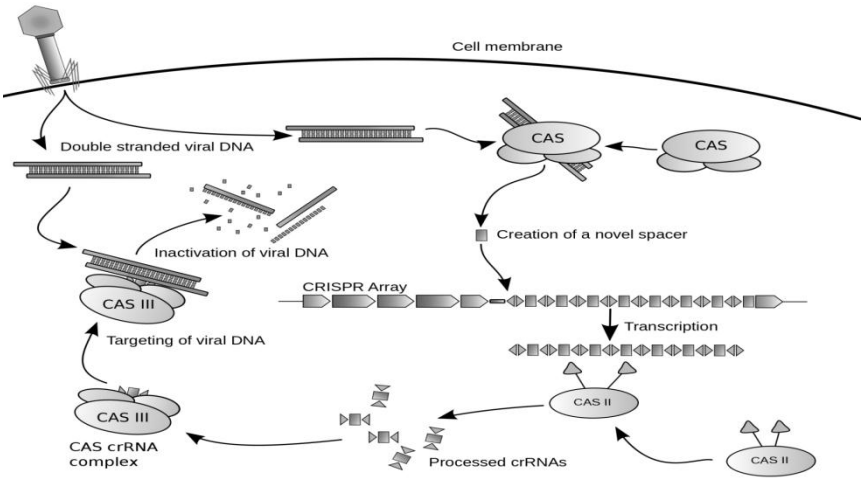
The CRISPR- Cas System

Basic research leads to a revolution

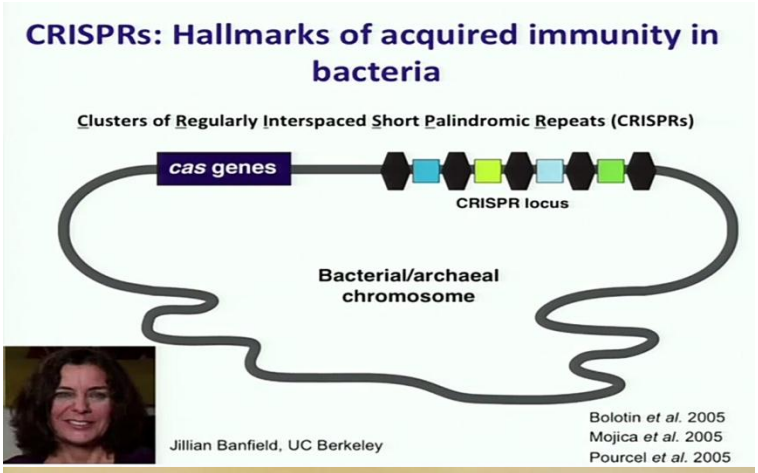
A common approach in modern biological research is to modify the DNA sequence of an organism and observe the impact of this change on the phenotype of the organism. Gene editing is being done since the 70s and after three decades gene editing technology has been improved drastically.
The development of efficient and reliable ways to make precise, targeted changes to the genome of living cells is a long-standing goal for biomedical researchers. Recently, a new tool based on a bacterial CRISPR-associated protein-9 nuclease (Cas9) from bacteria *Streptococcus pyogenes* has generated considerable excitement.

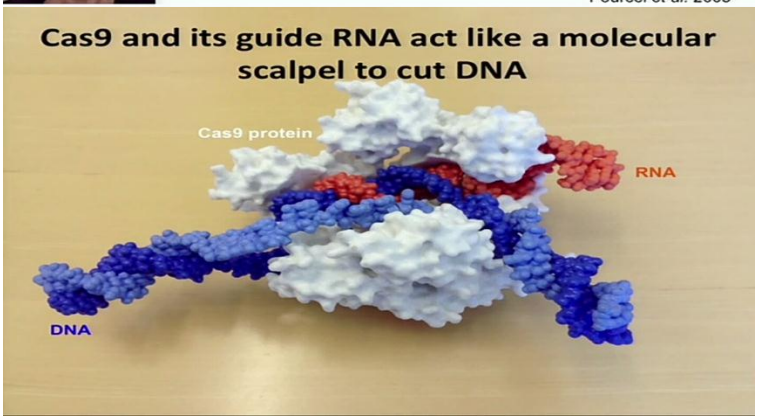
News about the CRISPR Cas9 and its efficient role in genome editing has been making quite a buzz since its discovery in 2012. In April 2015 the first gene editing in human embryos were reported. On March 8th 2017 CRISPR-Cas9 was used to modify an archaeal species for the first time. On March 10th 2017 a Chinese group reported to have edited the genetic makeup of viable human embryos. With all this excitement in the field I decided to write about this revolutionary technique and share my views.

The CRISPR pathway
Clustered regularly interspaced short palindromic repeats (CRISPR) are segments of prokaryotic DNA containing short, repetitive base sequences (about 40bp). CRISPR/CRISPR-associated Cas systems provide bacteria and archaea with adaptive immunity against viruses and plasmids by using CRISPR RNAs (crRNAs/ guide RNA) to guide the silencing of invading nucleic acid. The CRISPR sequences are transcribed to CRISPR-RNA which associates with the Cas protein to form a CRISPR-Cas complex (a ribozyme with tracrRNA and crRNA). This complex binds to the viral DNA and creates double stranded nicks rendering it inactive.



Bacterial immunity pathway





The chopped up viral DNA is incorporated and kept as a guide in recognizing future viral infections. This can be passed on to the further generations of bacteria. In an event of an infection the DNA in the CRISPR loci is transcribed and the resulting mRNA associates with the Cas protein and recognizes the viral DNA and opens it up. The mRNA binds to the DNA forming a RNA-DNA hybrid. The cleaving domain of the protein complex cleaves the DNA.

CRISPR and genome editing

This defense pathway was worked out by Jennifer A. Doudna of UC Berkley and Emmanuelle Charpentier of Umeå University, Sweden in their paper: '*A Programmable Dual-RNA–Guided DNA Endonuclease in Adaptive Bacterial Immunity'.* In this paper they also highlighted the potential to exploit the system for genome editing. Jennifer Doudna and Emmanuelle Charpentier re-engineered the Cas9 endonuclease into a more manageable two-component system by fusing the two RNA molecules into a "single-guide RNA" that, when mixed with Cas9, could find and cut the DNA target specified by the guide RNA. By manipulating the nucleotide sequence of the guide RNA, the artificial Cas9 system could be programmed to target any DNA sequence for cleavage. Another group of collaborators with Gašiūnas, Barrangou and Horvath showed that Cas9 from the *S. thermophilus* CRISPR system can also be reprogrammed to target a site of their choosing by changing the sequence of its crRNA. These advances fueled efforts to edit genomes with the modified CRISPR-Cas9 system. Feng Zhang's and George Church's groups (MIT) simultaneously described genome editing in human cell cultures using CRISPR-Cas9 for the first time. It has since been used in a wide range of organisms, including baker's yeast

(*Saccharomyces cerevisiae*), zebrafish, *Drosophila*, nematodes (*C. elegans*), plants, mice, monkeys and human embryos.

Applications

CRISPR/Cas can be used to target virulence factors, genes encoding antibiotic resistance and other medically relevant sequences of interest. This technology thus represents a novel form of antimicrobial therapy and a strategy by which to manipulate bacterial populations. Some of the affected genes are tied to human diseases, including those involved in muscle differentiation, cancer, inflammation and fetal hemoglobin. It is now possible to completely cure a person of the identified genetic disease. Research is being done on curing cancer and AIDS using CRISPR technology.

Ethics

With the CRISPR system we now are capable of editing even a single nucleotide in the genome. Within a span of one year after Doudna's paper, many labs across the world started using this technology and a need arose to consider the ethical issues at hand. The technology has various applications in various fields such as human health, agriculture etc. Many people have concerns about the possible use of genome editing in humans, for example, about the risks of unintended effects due to off target DNA alterations, and the implications of making irreversible changes that will be passed on to future generations. Another key concern is the possible orientation of research towards human enhancement, going beyond disease prevention into the engineering of 'desirable' genetic characteristics.

A lesson to learn

The discovery of the CRISPR technology was not through a focused effort to discover such a technology but through a curiosity driven project to identify how bacteria fight a viral infection. The project was started by J Doudna after a conversation with a friend and a colleague Jillian Banfield of UC Berkley who works with bacteria. She had noticed in her data that all bacteria have these 40bp repetitive sequences called CRISPR. Doudna worked on small RNA molecules and their role in gene expression and so Banfield approached Doudna and asked what role would RNA from these CRISPR loci would do. It had already been pointed out that the sequences between these repeats corresponded to a viral DNA. So she

wondered whether bacteria keep record of the infections in these sequences and somehow with the Cas genes it played a role in warding off viral infections. Doudna tested this idea with collaborations with Charpentier and as it turns out she was right and in the process they had discovered a new method to edit DNA using these CRISPR-Cas complexes.

This story puts Doudna in the company of great scientists like C Darwin who came up with the Theory of evolution on his voyage on the Beagle and I Newton who came up with the theory of gravity after being inspired by a fall of an apple.

This story reminds us that doing science is being passionately curious, asking the right questions and trying to understand the universe around us. It is not working for money, position or manipulating data to meet deadlines. Our current science has a lot of pressure from the profiteering group that's funding research. Peter Higgs admits that he could not have worked out the mathematics for the Higgs-Boson particles in today's conditions. Science does not grow under corporate pressure. Science does not grow under deadlines. Science grows with the people who are inspired and enlightened. It should be our fundamental duty to try to understand the truth about the universe. To quote Richard Feynman "study hard what interests you in the most undisciplined, irreverent and original way possible".

This story also tells us how discussion and sharing of ideas is crucial for development of one's knowledge. And with that knowledge one can revolutionize the world. Curiosity does not kill the cat, it changes the world.

Vinayaka. P. J
III BSc 'B' sec

MODIFIED YOGA FOR CARDIO WORKOUT

This write-up is based on the article that was published in Times of India on 10th Feb 2017. Yoga has seen a steady rise in popularity over the past few years. According to a 2008 report released by Yoga Journal, 15.8 million American adults were practicing yoga. In 2010, that number grew to 21.9 million.

The majority reported that they practice yoga for a number of health benefits, stress reduction and relaxation. Yoga is a great complement to a well-rounded exercise routine, no matter what your fitness level. It offers a variety of modifications (as needed), styles and intensities, giving it a wide appeal among exercisers of all fitness levels and goals.

The Benefits of Cardio

Aerobic exercise strengthens your heart and lungs (which make up the cardiovascular system). During exercise, your muscles demand more oxygen-rich blood and give off more carbon dioxide and other waste products. As a result, your heart has to beat faster to keep up. When you follow a consistent aerobic exercise plan, your heart grows stronger so it can meet the muscles' demands without as much effort. Everyone, regardless of their weight, age, or gender, can benefit from aerobic exercise.

In addition, cardio burns more calories than any other type of exercise, making it the go-to type of exercise for weight loss. As we know, the more calories you burn, the more weight you'll be able to lose. So if weight-loss is a goal of yours, calorie burning is key.

Does Yoga Meet the Criteria of a Cardio Workout?

When deciding whether or not yoga is a cardio workout, you have to ask yourself if it meets the criteria for aerobic exercise. A true cardio workout will meet ALL of the criteria.

It can be hard to make a blanket generalization about yoga when there are so many styles and disciplines under the yoga umbrella. Some are definitely not much of a workout. Others can be fast-paced and more intense. But most types of yoga share the same poses—just done at different paces. Some of those poses use the "large muscle groups" of the body (think legs). Others don't. Holding any one pose (even though this is strength-building isometric exercise) for more than a couple of seconds diminishes the rhythmic nature and therefore the cardio workout potential.

Other types of yoga, such as faster-paced Ashtanga or "power" styles involve fewer holds/pauses and move practitioners quickly from one pose to the next. While these involve more "rhythmic" and "continuous" movements, it may or may not be enough to elevate your heart rate to an aerobic level—depending on the class itself and your own fitness level.

Here's a related example. Walking can be a great form of exercise. Leisurely walking (what most of us do in everyday life) meets most of the cardio criteria (large muscles, rhythmic nature, continuous movement); but at an easy pace, it typically will not meet the heart rate guideline—and therefore would not count as a

true cardio workout. Only walking that is brisk enough to bring up your heart rate for an extended period of time truly offers the health and calorie-burning benefits of "cardio" exercise.

Source: http://www.sparkpeople.com/blog/blog.asp?post = does_yoga_count_as_cardio

Jyothishree.V
III BSc 'H' sec

SHRILK BIOPLASTIC

Our reliance on plastic is one of our biggest environmental issues. Plastic bags, bottles, packaging etc… and more can take centuries to break down, and accumulate by the ton in oceans and landfills worldwide. Plastic is usually made from petroleum, the extraction of which also causes significant harm to our Earth.

Harvard University Wyss Institute researchers have recently developed an innovative material which may significantly help us prevent further plastic pollution. They have successfully manufactured a completely biodegradable plastic using the shells of shrimp and other crustaceans. Chitosan, a component of crustacean shells and insect bodies, is a variety of chitin.
The shells from the millions of pounds of shrimp consumed worldwide are usually either thrown away or used in fertilizers. Instead, they could be used to make a wide array of plastic items, from garbage bags to diapers to cell phone casings. The material has been named "shrilk," and is composed of chitosan, coated with beeswax to make it waterproof. The truly remarkable thing about shrilk, besides the fact that it can biodegrade completely in just a few weeks, is that it returns nutrients into the soil.

As researcher Javier Fernandez explained -copepods alone… produce a billion tons of chitin per year. In other words, in the last twelve months they have produced the same amount of chitin than all the plastic we have produced since 2009. According to the team, chitosan-based plastic is cheap and easy to make on larger scales and wouldn't take up land like plant-based bio plastics. The material can be dyed by changing the acidity of the chitosan solution; the dyes can be collected and reused when the material is recycled.

The efficiency with which the shells would be converted into bio plastic depends upon the method of collection on a large scale, processing and acceptance into the global and the ground markets are yet to be tried. If we were able to use the shells from crustaceans already consumed, shrilk could be an exciting alternative indeed. Without petroleum plastics polluting our environment, our world's future would look a bit brighter.

Nishanth
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RECENT DISCOVERY OF NEW SPECIES

India's thriving biodiversity has never failed to amaze scientists and enthusiasts. With the recent discovery and addition of 445 new species in the year 2015, it won't be wrong to assume that there is a lot more left to explore and discover in the field of biology. The most discoveries were made in the Eastern Himalaya region, which accounts for 19% of the total discoveries.

Four species of reptiles, six species of amphibians, 26 species of fishes, three species of wild ginger and th ree of figs are among the 445 species new to science identified in India in 2015. The figure includes 262 animal species and 183 plant species.

Some of the notable additions to the list of animals include a rock gecko (Hemidactylus yajurvedi) found in Kanker Chhattishgarh, a new frog species (Fejervarya gomantaki) from the Western Ghats, and a shiny new species of fish (Barilius ardens), also from the Western Ghats.
Among the plants, a new species of ginger Zingiber bipinianum has been found in the South Garo hills of Meghalaya, and a species of mushroom (Bondarzewia zonata) has been collected from north Sikkim at an altitude of 2,829 m.

Scientists of the Botanical Survey of India (BSI) are delighted that all regions in the country have recorded new species while those from the Zoological Society of India (ZSI) are excited that more than 15 per cent of the new species are higher vertebrates.

The most discoveries were made in the Eastern Himalaya region, which accounts for 19 per cent of the to tal discoveries followed by the Western Ghats (18 per cent) and Andaman and Nicobar Islands at about 15 per cent, BSI director Paramjit Singh said. ZSI Director Kailash Chandra said the new discoveries reflect the faunal-diversity potential of ecosystems in India. The country is home to 97,514 species of animals.

And much more recently in the current year about 7 new species of miniature frogs were discovered in the Western Ghats. After six years of trudging through the rainforests of the Western Ghats in southern In dia, scientists have discovered seven new endemic species of Nyctibatrachus, or night frogs. Four of these species are hardly 14 mm in length. The study outlining this discovery was published on Tuesday.

The insect-like calls of the newly-discovered night frog's species deceived scientists on several occasions. In the Western Ghats "For a long time, we heard these calls while we were walking through certain forest patches and thought they were insects till we spotted them under leaf litter," said Sonali Garg, who undertook the study as part of her doctoral research at the University of Delhi. These miniature species we re locally abundant, she said, but they had probably been overlooked by previous researchers because of their extremely small size and secretive habitats, apart from their deceptive insect-like calls.

According to the study, night frogs represent an ancient group of frogs that spread across the Indian landm ass approximately 70 million to 80 million years ago. The first species belonging to this group was docum ented in 1882, and since then the group has been relatively well-studied.

These seven species add to existing knowledge about 28 species that have been identified so far as belongi ng to the ancient lineage of night frogs. This frog genus is endemic to the Western Ghats and is found near the marshy forests and mountain streams of five states – extending from the southern tip of Tamil Nadu ac ross the tropical landscape of Kerala, Karnataka and Goa till northern Maharashtra.
"These frogs are very important links to understand how evolution took place over time," said Garg. "In terms of evolutionary studies, these are the remaining relics of ancient frogs that lived on this landscape."

Enormous diversity

Of the 28 species of night frogs, 13 species were identified and documented over the last five years. With every discovery, scientists have realised just how diverse the group was. In 2007, Garg's mentor SD Biju, who has discovered over 80 species of frogs so far, found India's smallest frog species Nyctibatrachus minimus, that is just 10 mm in length. Popularly known as the frogman, Biju and his team went on to find 12 other species belong to the night frogs group in 2011. The largest species of night frog found, Nyctibatr achusgrandis, is 77 mm in length and lets out a deep croaky call.

Not only do night frogs show immense diversity in terms of size and calls, but also in reproductive behaviour. Across the 7,500 species of frogs found across the world, researchers have observed six mating positions. But in 2016, a study also found a species of night frog, known as the Bombay night frog, which practices a seventh mating position – the dorsal straddle – a technique which is not found in any other frog species till date.

"This is a very interesting group of organisms to study since it is so diverse in every way," said Garg. "It's DNA gives us information of a much longer time frame. It is evolutionarily significant information if we want to understand why certain frogs are found in small regions, or distributed widely, or to explain their diversity."

Significance of miniatures

Of the 35 night frogs found in the Western Ghats so far, seven are miniature, less than 18 mm in length.

"In group after group of amphibians, miniatures have evolved," said David B Wake, an evolutionary biologist at the University of California, Berkeley, who has studied miniaturisation in amphibians over many years. "We have been slow to understand this because the miniatures often look like juveniles of common larger forms and have been overlooked."

Wake explained that miniaturised species often occur in environments that are not usually the favoured ha bitat of larger frogs. For instance, in the case of the new species found by Garg, the miniature frogs are more terrestrial and occur in leaf litter unlike the larger ones that are found largely near streams.

"Also, in salamanders and in groups of frogs in many parts of the world, the miniatures have abandoned th e tadpole stage,"said Wake. "Eggs develop directly into miniatures of the adults and the eggs are laid on land. This frees them from reliance on water and expands ecological and evolutionary opportunities."

The miniature frogs found by the team, however, are known to go through the tadpole stage. But the team has observed certain other adaptive changes across the new species. While the larger frogs by the streams had webbed feet used for swimming and sticking onto slippery surfaces, this was not found in miniature frogs. “There was little webbing of the feet in the miniature frogs, probably because they did not need life in water,” said Garg. “This indicates that they are adapting to a terrestrial habitat.”

Conservation

Although night frogs are quite common across the Western Ghats, they face considerable threats from human activity.

“While new species are being identified, the known ones are moving towards extinction,” said by Biju. He said that frogs are already threatened with extinction in one-third of the Western Ghats. He said of the seven new species found, five required immediate priority for conservation since they were all found outside the protected forest zone.

Rohit. M
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LONDON SCIENTISTS TEACH BEES HOW TO PLAY SOCCER

Isn't that quite interesting to hear a bee playing "soccer!"?? Yeah, definitely it is. Indeed there arises a question how do they ever play that? After all they are tiny little bees. Well, this article was published by Times of India on 28th of February 2017.

The 18-month study at Queen Mary University of London saw scientists train 50 bees to move a small yellow ball to a circled location in order to score a goal and receive a sugary food reward.

The first group of bees then showed others in the colony how to play, with the second group impressing scientists by expanding the game. "The bees solved the task in a different way than what was demonstrated, suggesting that observer bews didn't simply copy what they saw, but improved on it, "said Olli.J. Loukola, who co-led the study. This shows an impressive amount of cognitive flexibility, especially for an insect.

*How they train?

Olli Loukola first endeavoured to teach bews, he nearly gave up after two weeks of trying but today he can train a bee in a day or two using sugar water, patience and fake bees. Bumblebee colonies in the lab are connected to training arenas where researchers present bees with a task where bee had to push the ball into the centre of a platform to get a reward. Eventually, the task required them to put in the hole. For stumped bees, he deployed an artificial been-on-a stick to nudge the ball and demonstrate proper technique and they caught on.

And training a bumblebee is an investment that pays dividends, because they'll train others in the colony. How small kids imitate elders bees observe others in colony, and they like to follow others in situations when they don't know what to do.

Bee that watched a trained bee spins ball for sugar learnt the task faster and also they finished their job by pushing the ball to hole regardless of the ball's colour when they were swiped. These were so brilliant when given a choice between the balls, bees choose the one nearest to the hole, even if their trainer bee choose the one farthest away. In other words, bees didn't just copy their members, they generalized what they learnt.

It's an impressive fear, because there isn't a flower that requires a bumblebee to turn its back and pull a ball into a whole access is pollen. It isn't an instinctual behavior. Just because an animal doesn't do something, doesn’t mean it can't. The ecological pressures just might not be there. Training these bees helps in pollinating certain flowers of our choice and to maintain diversity in our ecosystem. There is lot to learn to from this honeybee though it's having a pinhead size brain it can learn what we teach, interpret and develop them so well, it's truly inspiring for an individual to learn new things and work on them. In future we can train these bees to pollinate our choice of flowers and for lot more things to bring balance in our ecosystem. These are really brilliant bumblebees-brilliant buzzzzzzzzz.

Sushmitha. S
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III Prize

INTERVENTION BASED ON MAMMALIAN GENETIC SIMILARITIES

In an article titled – "Dolphin genes can help treat kidney failure" in the 'Times of India' newspaper, dated 28th February 2017 cited that a group of researchers in New York have successfully mapped the various proteins present in marine mammals. Researchers have finished creating a detailed, searchable index of all the proteins found in the bottlenose dolphin genome. The project aimed to provide a new level of bio analytical measurements to help in better understanding of the gene expression in marine mammals.

Earlier research has proved that human genome and dolphin genome are basically the same; just that there are a few chromosomal rearrangements that have changed the way genetic material is put together. Even their brain size is the second largest after humans! The researchers are specially interested in specific proteins that the dolphins may have which help in the protection of their heart and kidneys from damage due to erratic flow of blood and oxygen at the time of their underwater forays. The most recent research has discovered a protein called Vanin-1 (VNN-1) which is common to both humans and dolphins. Elevated levels of Vanin-1 are implicated to play an important role in offering protection to kidney. This VNN-1 is found in a comparatively smaller quantity in human beings. In a series of other researches, VNN-1 is also implicated to be an oxidative stress sensor in epithelial cells and was most commonly associated with progression to chronic ITP i.e. Immune Thrombocytopenia. The Vanin-1 activity may also be a new target for therapeutic intervention in inflammatory bowel syndrome, high blood pressure and even in diabetes. In various other series of studies with lab mice, it was found that absence of Vanin-1 activity improves insulin sensitivity and may play a role in regulating hepatic gluconeogenesis.

Every common person is familiar with the basic facts related to dolphins such as their brilliant mode of communication and their high intelligence but one can rarely think that we share so many similarities with them.

A greater and in depth understanding of the expressions of same genes in humans and dolphins can open a wide range of possibilities in management of human diseases and act as a key to decipher the future course of treatment for several disorders using advanced gene therapy techniques. Once the genes of interests will be determined, they can then be manipulated to alter their expression which in turn can provide permanent treatments at the same time being extremely lucrative for the researchers. In fact, there may be many similar genes common to mammals but whose expression and protein products cause extremely different traits in related species. Dolphins, that are at present known only mostly their extremely social behaviour and friendly interactions with humans may soon be a source of helping in elimination of various common health related distresses that we face. As a common quote says – "We see, but we do not observe". Truly, it is highly possible that we may get the solutions we desire if we observe carefully but the main issue is our lack of observation and curiosity to search for the unknown.

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