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THE IIS UNIVERSITY


JAIPUR

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Water Conservation through Dietary changes: An Innovative Approach

 Dr. Gargi Saxena

Department of Home Science

Earth's human population is now mostly urban, with almost 55% of people living in cities, a proportion expected to grow to 66% by 2050. Cities are producing about 80% of global gross domestic products, and are responsible for more than 75% of natural resource consumption, 60–80% of energy consumption, and 75% of global carbon emissions. It can, therefore, be argued that the battle for planetary health will be won or lost in the world's cities.

Water is considered as one of the most important natural resource, because it is an essential component for survival of living beings. Although, Earth being the Blue Planet, as 71% of its surface is covered with water, but unfortunately only 10% of it is drinkable and rest is salty.

India is projected to be the world's most populous country by 2022, surpassing China, its population reaching 1.7 billion by 2050. The research evidences show that by 2050, irrigation will account for 70% of total water use in India, which is up from the current 50%, unless farming methods change and diets shift towards food that needs lesser water to grow. Regular use of fresh water by such a large population using same farming methods and dietary habits will deplete the source. Thus, there is a dying need to save water.

According to Milner, freshwater use could be reduced by up to 30% by lowering consumption of wheat, dairy and poultry in favour of fruits and vegetables. In fact, several summer favourites like melons, squash, cucumber, beans, ladyfinger, eggplant,



pumpkin and peppers do pretty well with restricted water. The other option is to include legumes, and swap fruits requiring more irrigation, like grapes, guava and mango, with more water-efficient crops such as melon, orange and papaya, the study said. The change in dietary habits would also lower the risk of non communicable diseases like cardiovascular diseases and cancer in humans.

Care must be taken to prevent overuse of potable water sources and to protect the Earth's water from contamination. Fresh water is and will be in demand and become a very valuable resource, so, the simple and healthy changes in dietary habits can save the most valuable natural resource.

Source : The Hindu, 5 April, 2017. , The Lancet Planetary Health Journal.

Fighting infection with bioelectricity

Richa Pundir

Research Scholar, Department of Biotechnology

According to a new research from Tufts University biologists in the U.S, changing the natural electrical signaling that exists in cells outside the nervous system can improve resistance to life-threatening bacterial infections. The researchers found that administering drugs, including those already used in humans for other purposes, to make the cell interior more negatively charged strengthens tadpoles' innate immune response to infection and injury caused by *E. coli*. This reveals a novel aspect of the immune system – regulation by non neural bioelectricity – and suggests a new approach for clinical applications in human medicine. According to them, all cells, not just nerve cells, naturally generate and receive electrical signals. Being able to regulate such non-neural bioelectricity with the many ion channel and neurotransmitter drugs that are already human-approved gives us an amazing new toolkit to augment the immune system's ability to resist infections.

To examine the connection among bioelectrics, immunity and regeneration, the study investigated the effect of tail bud amputation on survival following infection. Surprisingly, removing embryos' tail buds increased their ability to survive *E. coli* infection. Instead of the added stress of tail regeneration overwhelming the embryo, the injury and the infection induced common defense



Source: almag.com/news/2017/05

mechanisms, including recruiting macrophages (a type of white blood cell that is part of the innate immune system), which appeared to increase efficiency in eliminating the bacteria.

Source: <https://now.tufts.edu>

Natural Occurrence of Androgenesis in *Squalius alburnoides*

Vidhi Kumawat

Research Scholar, Department of Zoology

Androgenesis among vertebrates is considered a rare phenomenon. But the first empirical evidence of the natural occurrence of spontaneous androgenesis in a vertebrate, the *Squalius alburnoides* was reported in early 2017. It is a species of fish in the family Cyprinidae. It is found in Portugal and Spain. Its natural habitats are rivers and intermittent rivers. This species is a highly peculiar fish concerning its evolution and reproduction. *Squalius alburnoides* is not a species in the usual sense but rather something called a hybrid complex, a group of organisms with multiple parental combinations that can mate with one another. The group is thought to have arisen from hybridisation between females of one species, *Squalius pyrenaicus*, and males of another species, which belonged to a group of fish called *Anaocypris*.

Most hybrids, like mules, are sterile because the chromosomes from their parents of different species have trouble combining, swapping DNA and dividing steps required for egg or sperm production. *Squalius alburnoides* males circumvent this problem by producing sperm cells that do not divide and therefore contain more than one chromosome set. In *Squalius*



Image Source: <http://contenidos.educarex.es/mci200319/especies/calandino.htm>

alburnoides, sperm with multiple chromosome sets can provide all the nuclear genetic material needed for a viable offspring. This is the first documented instance in vertebrates of a father producing a near clone of itself through sexual reproduction – androgenesis.

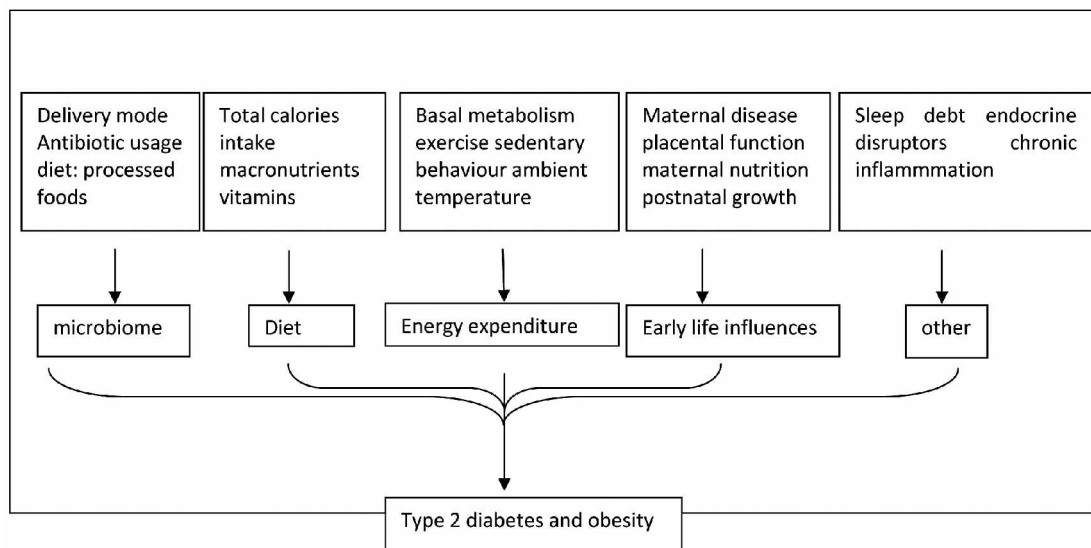
Source: Yin S. (May 28, 2017), *The Hindu*

Environmental Exposures; Type-2 diabetes and obesity

■ Dr. Sreemoyee Chatterjee
Department of Biotechnology

The rising prevalence of type-2 diabetes (T2D) and obesity constitute major threats to human health globally. Powerful social and economic factors influence the distribution of these diseases among and within populations. These factors act on a substrate of individual predeposition derived from the composite effects of inherited DNA variation and a range of environmental exposures experienced throughout the life course.

Although “western” lifestyle represents a convenient catch-all culprit for such exposures, effective treatment and prevention may be informed by characterization of the most critical, casual environmental factors. Understanding of the genetic basis of T2d and obesity can highlight non-genetic exposures that derive development of these conditions.



Examples of environmental exposures and mechanisms implicated in the development of T2D and obesity

Source: Science (Sciencemag.org) 7 Oct. 2016. Vol 354 issue:6308, page 69-73

GENES RESPONSIBLE FOR THE REGENERATION OF VITAL PARTS OF ACORN WORM

Is it possible for humans to re-grow an amputated arm or leg or completely restore nervous system function after a spinal cord injury? It might be possible one day as new study of one of our closest invertebrate relatives, the acorn worm reveals that they can re-grow every major body part, raising hopes for generation in humans.

Acorn worms burrow in the sand around coral reefs; they have a genetic



Image Source: real monstrosities.com

■ Science Spectrum Team

make-up and body plan surprisingly similar to ours.

A study led by the University of Washington has shown that acorn worms can re-grow every major body part including the head, nervous system and internal organs from nothing after being sliced in half.

Human share thousand of genes with these animals and have many of the same genes they are using to regenerate their body parts.

The researchers analyzed the gene expression patterns of these worms as they re-grew body part. They suspect that a “master control” gene or set of genes is responsible for activating a pattern of genetic activity that promotes re-growth.

When these gene patterns are known, eventually tissue from a person with an amputation could be collected and the genes in those cells activated to go down a regeneration pathway. Then, a tissue graft could be placed on the end of severed limb and the arm or leg could re-grow to the right size.

It is believed that humans have the potential to regenerate, but something isn't allowing that to happen. Humans have these same genes, and if we can figure out how to turn on these genes we can regenerate.

Source: Developmental Dynamics, 245:1159-1175, 2016

Human Saliva : Anti Bacterial Healing Substance!!

A report by scientists from The Netherlands identifies a compound in human saliva that greatly speeds wound healing. This research may offer hope to people suffering from chronic wounds related to diabetes and other disorders, as well as traumatic injuries and burns. In addition, because the compounds can be mass produced, they have the potential to become as common as antibiotic creams and rubbing alcohol.

Specifically, scientists found that histatin, a small protein in saliva previously only believed to kill bacteria was responsible for the healing. To come to this conclusion, the researchers used epithelial cells that line the inner cheek, and cultured in dishes until the surfaces were completely covered with cells. Then they made an artificial wound in the cell layer in each dish, by scratching a small piece of the cells away. In one dish, cells were bathed in an isotonic fluid without any additions. In the other dish, cells were bathed in human saliva.

After 16 hours the scientists noticed that the saliva treated "wound" was almost completely closed. In the dish with the untreated "wound," a substantial part of the "wound" was still open. This proved that human saliva contains a factor which accelerates wound closure of oral cells. Because saliva is a complex liquid with many components, the next step was to identify which component was responsible for wound healing. Using various techniques the researchers split the



Image Source: janachuberth.com

■ Purnima Gabhrani
B.Sc Sem VI

saliva into its individual components, tested each in their wound model, and finally determined that histatin was responsible.

"This study not only answers the biological question of why animals lick their wounds," said Gerald Weissmann, MD, Editor-in-Chief of The FASEB Journal, "it also explains why wounds in the mouth, like those of a tooth extraction, heal much faster than comparable wounds of the skin and bone. It also directs us to begin looking at saliva as a source for new drugs."

Source: sciencedaily.com

SALT :- HEALTH DEMON, OR NOT ?

■ Prakriti Dewan
M.Sc., Department of Biotechnology

Humans evolved for millennia on diets that were naturally very low in salt, hunter gatherers probably ate less than 1 gram of salt a day, then about 6000 years ago, the Chinese began using salt to preserve food and ever since it's been a major ingredient in our diet the world over.

Our body naturally maintains a constant balance of salt and water, with our kidneys keeping the equilibrium by filtering and reabsorbing salt. Without the shadow of doubt, this is clear that large quantities of salt pushes up our blood pressure, In turn this is responsible for a massively increased risk of stroke, heart attack, kidney disease and heart failure. So why are we eating so much salt?

The salt we add to our food only constitutes 15-20% of all the salt we eat everyday most of it comes from the processed food we buy. The little pinch of salt we add can become a way more harmful for our health. Therefore, one must choose low salt products, cut back on salt slowly so we don't notice the difference, flavour food with herbs, spices, garlic and chilli instead of salt, avoid foods that have hidden salt like soya sauce, stock cubes, bacon and flavoured noodles and yes, last but not the least if you crave a packet of salty chips then have it but just don't forget to cut back on salt elsewhere that day.

Lowering our salt consumption will surely have significant effects for

reducing cardiovascular morbidity and mortality. There's only one way to go-find a better hiding place for that Salt shaker!



Image Source: michaelmorningstar.com

Source: Australian Division of world action on salt and health(AWASH)/Readers digest 2013.

GECKO'S UNDER THE COVER!

■ Science Spectrum Team

Geckolepis megalepis is most remarkable species because of its huge scales. The scientists have discovered these very new gecko species that can easily shed all of its skin under attack and leave its predator with a mouth full of large scales. These are by far the largest of all known species. Though several other Geckos are able to shed their skin off if they grasped firmly, *Geckolepis* apparently do it actively. The geckos can regenerate their scales within a couple of weeks or so.

The researchers hypothesise that the larger scales tear more easily than smaller scales, because of their greater surface area relative to the attachment area larger friction surface as well. The scientists also quoted that the regeneration mechanism



Image Source: kids.nationalgeographic.com

Source: Ht, page one Plus, february 10, 2017.

WHY AND HOW DO ZEBRAS AND SQUIRRELS GET STRIPES?

■ Prakrati Deewan

M.Sc., Department of Biotechnology



photograph by : Richa Pundir (research scholar)

A recent paper by R.M Allarino and co-workers which has very recently appeared in the journal nature (doi:10.1038/nature 20109) explained the scientific reason behind this fact. The gene MTF which is known to be a master regulator of the cells known as Melanocytes or pigment cells which generate colour in hair cells and thus the skin. Another called AL \times 3 through its protein, appears to repress the regulator MITF.

Talking about the molecular biology of development, basically the gene AL \times 3 is involved in normal facial development, although if there is any deficiency in its function leads to malformed noses in humans as well. likewise, Mutations in the other gene, MITF leads to small eyes, deafness and some related disorders. Thus nature has recruited these two genes in order to draw lines on their body and thus protect some of these tropical mammals is one of those surprises that evolutionary biology often throws at us!

Source: The Hindu, December 5, 2016. EduPlus.

IDENTIFIED THRUST AREAS & RESEARCH FACILITIES

Thrust Areas

DEPARTMENT OF LIFE SCIENCES

- Animal cell culture and Microbiology
- Cancer biology and Pharmacology
- Microbial toxicology and Cell biology
- Microbial Enzyme Production and Phytochemistry
- Micromorphology and Plant Tissue Culture
- Toxicology and Bioremediation

DEPARTMENT OF CHEMICAL SCIENCES

- Synthetic Organic Chemistry
- Analytical Chemistry
- Computational Chemistry
- Solid State Chemistry
- Environmental Chemistry
- Co-ordination Chemistry

DEPARTMENT OF HOME SCIENCE

- Public Health and Nutrition, New product development
- Clinical and therapeutic nutrition
- Food analysis and Gerontology
- Eco friendly textile processing
- Intervention and Special Education
- Early Childhood Education, Behaviour Modification

DEPARTMENT OF COMPUTER SCIENCE AND IT

- Software Engineering, Databases
- Data mining, HCL, AI, Cloud computing
- Aspect programming, Networking
- Agile methodology, Cryptography
- E-commerce and Web Engineering

DEPARTMENT OF PHYSICAL SCIENCES

- Electronic structure of metal, alloys, metallic glasses and superconductivity
- Synthesis of various Electronic semiconductor devices
- Optical coating (such as anti-reflective coating)
- Hard coating on cutting tools
- Thin film deposition for energy generation(e.g.thin film solar cells) and storage (e.g. thin film batteries)
- Nanoparticle synthesis

Research Facilities

- ✦ The University has been recognized by scientific and Industrial Research Organization (SIRO), Department of Scientific and Industrial Research (DSIR), Govt. of India, Ministry of Science and Technology.
- ✦ Animal House approved by The Committee for Purpose of Control and Supervision of Experiments on Animals (CPCSEA).
- ✦ 4 labs equipped with high-end computers, High speed internet facilities and softwares associated with respective studies .
- ✦ Animal Cell Culture.



Other available in house facilities are as follows

Abbe's Refractometer, BOD Incubator, Body composition analyzer, Camera fitted microscopes, Centrifuge, Cleavanger's and Soxhlet Apparatus, CO₂ Incubator, Cryostat, Deep Freezers, Diffractometer, Digital DO Meter, Digital Thermo-Hygrometer, Digital Turbidity Meter, Dipole meter, E-H Tuner (C-, X-, Ku-, J-band), Electronic Balances, G.M. Counter, Gel Doc, Gel Electrophoresis Unit, Hall effect, Harpendens Calipers, Heightometer, Homogenizer, Infantometer, KEL plus and Fibra plus, Laboratory jigger, Melting Point Apparatus, Michelson and ultrasonic interferometer, Microwaves, Microwave benches for ku-, C-, J- and X-band, Moisture analyzer, Oil Bath, Laminar Air Flow , PCR, pH meters, Seed germinator, Sewing machines, Singer fashion maker, SOCS plus, Soil and Water analysis kits, Spectrophotometers, Spot reflection Galvanometer-600 Ohms, Stereoscopic Microscopes, Temperature controlled Water bath, Thermal Evaporation System (Smart Coat 3.0 A), UV Visible Spectrophotometer, Vacuum Pump, Winch machine

Check your Awareness:

■ Science Spectrum Team

1. Which animal is responsible for the most number of human fatalities in the history of earth accounting for almost a billion deaths since records were maintained?
2. Australia has two types of mammals which have fascination ways of giving birth, one of them (Kangaroo) gives birth to a live but underdeveloped fetus which travels into its mother's pouch and then develops there. The other one (platypus) lays eggs! In zoology, these unconventional mammals are known as Metalheria and Prototheria. What are they commonly known as?
3. A pioneering cytogenetist and botanist (who created a high yielding strain of sugarcane). She was selected to the Indian Institute of Science by C.V. Raman. She co-authored The Chromosome Atlas of Cultivated Parts, and has a species of flower named after her. Who is this extraordinary woman?
4. Born in 1958 in west Bengal, This Indian was a physicist, biologist and archaeologist. He was the first person to demonstrate wireless communications. He also invented the crescograph which could measure botanic response to stimuli. Who is this polymath who has a crater on the moon named after him?
5. This brilliant engineer from Mysore was also a scholar, statesman and Diwan of Mysore. He designed a flood protection system for Hyderabad and at one time supervised the construction of the British Indian Empire. Who is this genius whose birthday is celebrated in India as Engineers day?
6. He was the first National professor of independent India. He went on to become the first non - Caucasian individual to win a Nobel Prize in science. A keen lover of music, he also investigated the harmonic nature of the sound of table and mridangam. He started a company which manufactured potassium chlorate for the match industry. Who was this man who has such fascination for light?
7. James Prescott _____ was an English physicist and brewer. After he took over the family brewery, his scientific inquisitiveness led him to discover many laws which are still in use in physics, In honour of his work, the SI unit of heat was named after him as what?
8. Hephaestus is the Greek God of fire, including the fire of volcanoes, metalworking and the forge in ancient religion and myth. The chemical process of converting natural rubber into a more durable material is named after his Roman counterpart. Who is the Roman God of fire and what is the process?
9. In the bible, this essential element of life is called brimstone and apparently hell smells of this. Indian alchemists were using it to make rasashastra in the 8th century. What is this elements that when burnt melts to a blood red liquid while emitting a bright blue flame?
10. Sabeer Bhatia launched this service on July 4, 1996, symbolizing "freedom" from ISP-based email and the ability to access a user's inbox from anywhere in the world. The name was chosen as it included the letters HTML, the marking language used to create web pages. What was this revolutionary service and what is it known as now?

NOTE: Answers are given somewhere in this issue.

Workshop at HBCSE, Mumbai

■ CUBE Team

It is correctly said that "Sophistication is required in mind not in Lab".

We (Mahima and Devyani, B.Sc sem V) learned the significance of this wonderful line when we visited HBCSE, TIFR, Mumbai.



Overcoming chaos of mind and feeding it with intellectual and scientific thinking seems difficult to us before being in CUBE Lab. We were very curious about the people we have to interact with. The biggest doubt that my conscience had was: Will I be able to absorb their perspective and level of thinking?

The moment we entered Lab, My heart somehow regained it's original position and that was a mark of relief as there were only two people working. Then we tried to interact with one of them. The interaction began with general discussion regarding model organisms, interestingly ended at the note we were about to strike i.e. about Fruit flies (*Drosophila*). At the end of the day we combated our fear and concluded it on lighter note with some quality discussions.

"Are we channeling our mind in the right direction?"

"To what extent we can rely on rote learning and spoon feeding?"

The moment such queries keep on continuously striking the lobes of your brain and that is the moment you have acquired scientific attitude. This attitude is not only about keeping the thoughts to yourself but about sharing in a huge collaboration, That's what CUBE stands for (Collaboration Undergraduate Biological Education).

We came across a new and a key component of research field i.e. CAUSARIE. This term basically stands for an interactive session where researchers present their work till date and deals with critical aspects of their work going on with a notable query for further research. There is a term called failure in the dictionary results are not obtained it opens a path towards a fresh work to be indulged in.

"Learning turns more soulful, when the knowledge is explored widely"

This evoked an idea of inspiring other students by establishing a lab in our university.

"Joining two points, form a line and when lines are joint a collaborative network is formed"

This networking is main aim of Cubists.

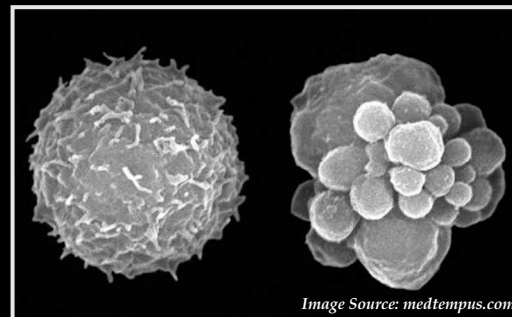
In this context, we are establishing a part of this wide network at IIS University, Jaipur.

The mechanics of programmed cell death unravelled

■ Shivangi Goyal
Research Scholar

Apoptosis also known as programmed cell death is a tightly regulated process in which cells die as a result of various biochemical events. As known earlier, cells that are destined to die trigger certain chemicals in order for it to undergo the process of apoptosis. However recent study shows a novel triggering mechanisms that lead cells for programmed cell death. This novel approach can be understood as physical mechanism. According to the study some specific type of defect in the alignment of cells indicates these cells to undergo apoptosis.

The correlation has been studied by a group experimentally using five different kinds of epithelial tissues. Cells that line inside and outside of an organ are called as epithelial cells. These cells possessing protective role, call for their removal if they undergo any damage. Thus cells that are destined to die are pushed out of the layer in the epithelial tissue and undergo apoptosis. Cells of the epithelial layer are arranged in very neat and regular fashion, resembling bricks on a wall, such that the axes of the bricks are parallel to each other. These axes can undergo various defects in their alignment, one of them being tilt in the axis. Researchers correlated the tilt defect to that of a comet, radiating out from a point. Cells that are needed to undergo death follow a certain path. They lie close to the head of the comet shaped defect followed by pushing themselves out of the layer of the cells and eventually undergoing apoptosis. Researchers of this study emphasize on physics, more precisely mechanics behind the cell extrusion process, and not just only biochemistry. Thus it implies that applying forces on cells make them to behave in a certain trait.



The entire mechanics behind the process was a collaborative effort bringing scientist from different parts of the world. Force that was applied on the cells was measured and computed using traction force microscopy. Statistical methods (Bayesian inference) were also being developed to compute the level of pressure inside the cells.

Pilot scale study suggested the link between the mechanics and cell extrusion. Thus it becomes imperative to use it on a large scale such as use of external pressure to control the development of tumors and thus help in preventing fatal diseases like cancer.

Source: The Hindu, May 20, 2017

USE OF MANGO LEAVES TO MAKE FLUORESCENT GRAPHENE QUANTUM DOTS

■ Dr. Manisha Patni
Department of Chemistry

Recently, researchers from the IIT Bombay have been able to produce cheap probes using Mango leaves to synthesize fluorescent graphene quantum dots for bioimaging and for intercellular temperature sensing. Unlike the currently used dyes, quantum dots synthesized from Mango leaves are biocompatible, have excellent photostability and show no cellular toxicity.

Green route

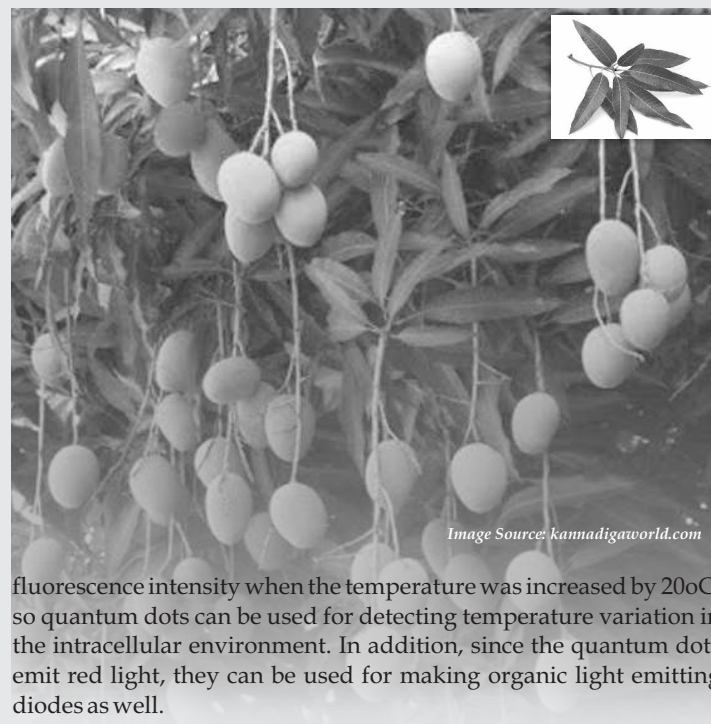
To synthesize quantum dots, the researchers cut Mango leaves into tiny pieces and froze them using liquid nitrogen. The frozen leaves were cut into powder and dipped in alcohol. The extract was centrifuged and the supernatant evaporated in an evaporator and then heated in a microwave for five minutes to get a fine powder.

Using mice fibroblast cells, the potential of quantum dots for bioimaging and temperature sensing applications has been evaluated. In mice cells, in vitro studies, the graphene quantum dots were able to get into the cells easily without destroying the integrity, viability and multiplication of the cells. The quantum dots get into the cytoplasm of the cells.

The quantum dots, 2-8 nm in size, were found to emit red luminescence when excited by UV light.

Nanothermometer

The quantum dots found inside the cells showed intense fluorescence at 25°C. As the temperature rises to 45°C, the intensity of fluorescence tends to decrease. As a result, the researchers found upto 95% reduction in



fluorescence intensity when the temperature was increased by 20°C, so quantum dots can be used for detecting temperature variation in the intracellular environment. In addition, since the quantum dots emit red light, they can be used for making organic light emitting diodes as well.

Source : ACS Journal Sustainable Chemistry and Engineering, 2017

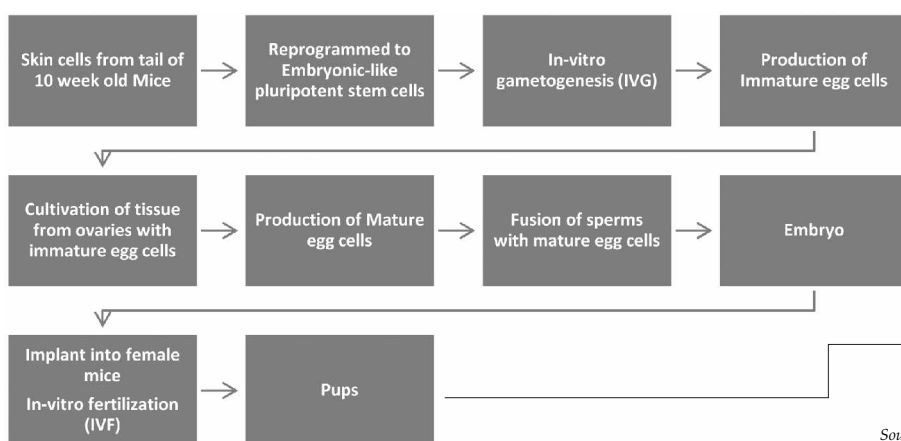
In-vitro Gametogenesis: Creating Babies from Skin Cells- Avenue for New Fertility Treatments for Humans

■ Dr. Payal Mehtani

Department of Biotechnology

After IVF (In-vitro fertilization), a new breakthrough in reproductive biology is IVG (In-vitro gametogenesis). IVG is development of eggs and sperm from normal cells in laboratory. Scientists in Japan have transformed mouse skin cells into eggs in a dish, and used those eggs to birth fertile pups. Katsuhiko Hayashi, a reproductive biologist at Kyushu University in Fukuoka, led the group that announced the breakthrough on 17 October in Nature.

After extracting skin cells from the tails of 10-week-old mice, scientists reprogrammed the cells into embryonic-like pluripotent stem cells. These cells were immersed in a complex chemical bath that coaxed the cells into becoming immature egg cells. After adding tissue taken from the ovaries of mouse fetuses, the immature eggs developed into mature eggs, or functional oocytes. A total of 4048 mature eggs were generated in the study. The eggs were fertilized using sperm from brown mice to check the probability of production of babies from these eggs. 1348 embryos were generated which were implanted in the uteruses of female albino mice and of these eight pups were born.



Eleven-month-old mice born from eggs made entirely in a dish.

Source: Hikabe O., Hamazaki N., Nagamatsu G., Obata Y., Hirao Y., Hamada N., Shimamoto S., Imamura T., Nakashima K., Saitou M., Hayashi K. (2016) Reconstitution in vitro of the entire cycle of the mouse female germ line. *Nature*;539:299–303. doi:10.1038/nature20104

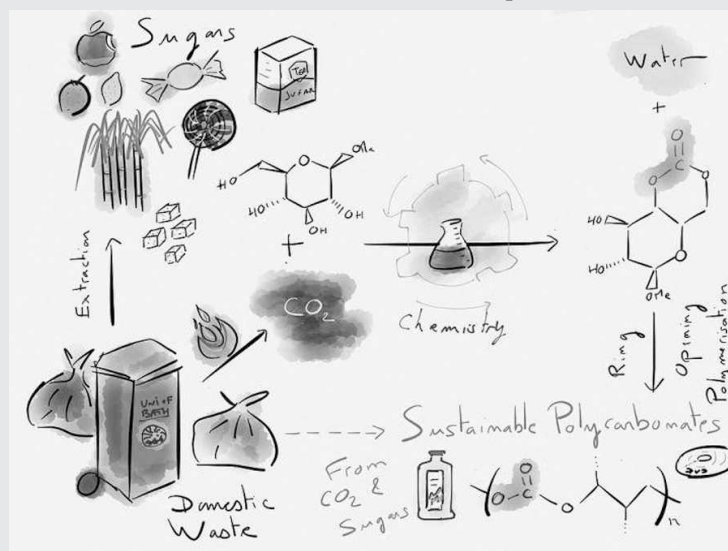
PLASTIC MADE FROM SUGAR AND CARBON DIOXIDE

■ Dr. Pratibha Mittal

Department of Chemistry

Scientists from the Centre for Sustainable Chemical Technologies (CSCT) at the University of Bath have prepared biodegradable plastics from sugar and carbon dioxide, replacing unsustainable plastics made from crude oil. Bath scientists have made alternative polycarbonates from sugars and carbon dioxide in a new process that also uses low pressures and room temperature, making it cheaper and safer to produce. This new type of polycarbonate can be biodegraded back into carbon dioxide and sugar using enzymes from soil bacteria. This new plastic is bio-compatible so could in the future be used for medical implants or as scaffolds for growing replacement organs for transplant.

Polycarbonates from sugars offer a more sustainable alternative to traditional polycarbonate from BPA, however the process uses a highly toxic chemical called phosgene. Now scientists at Bath have developed a much safer, even more sustainable alternative which adds carbon dioxide to the sugar at low pressures and at room temperature. The resulting plastic has similar physical properties to those derived from petrochemicals, being strong, transparent and scratch-resistant. The crucial difference is that they can be degraded back into carbon dioxide and sugar using the enzymes found in soil bacteria. The new BPA-free plastic could potentially replace current polycarbonates in items such as baby bottles and food containers, and since the plastic is bio-compatible, it could also be used for medical implants or as scaffolds for growing tissues or organs for transplant. "The properties of this new



plastic can be fine-tuned by tweaking the chemical structure -- for example we can make the plastic positively charged so that cells can stick to it, making it useful as a scaffold for tissue engineering."

Image & Article Source: sciencedaily.com, June 13, 2017

USE OF CROWN ETHERS AS FLUORESCENT PROBES

Anjali Sharma
M.Sc., Department of Chemistry

Crown ethers, discovered by the winner of the Nobel Prize Charles Pedersen, are cyclic chemical compounds that consist of a ring or multiple rings containing several ether groups that are capable of binding alkali ions. Owing to their strong binding affinities to various metal ions and chemical species, members of the crown ether family have been widely applied in the design of smart fluorescence-based sensor systems.

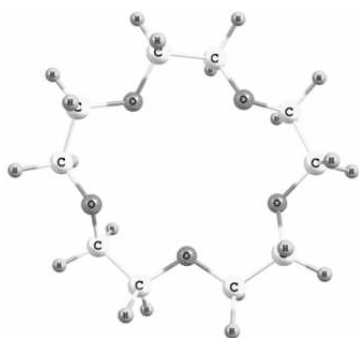


Fig.1 18-crown-6

A smart fluorescent probe containing a crown ether moiety could be developed as a sensor for metal ions, anions and other bio-molecules and be further applied to monitor the relevant biological process and they are useful for molecular recognition because of their high sensitivity and facile mode of operation. The probes usually contain three components: a fluorophore, a linker and a binding moiety (crown ether). In most cases, photoinduced electron transfer (PET) from N or O atoms in a crown ether moiety quenches fluorescence of the fluorophore and binding with metal ions or other species blocks PET and results in recovery of fluorescence.

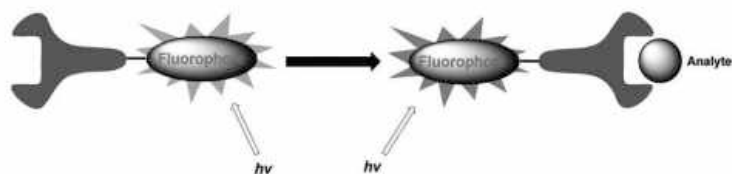


Fig.2 Commonly used strategy for the design of fluorescent probes

Bio-molecules, metal ions, anions and other bioactive molecules play important roles in cells/tissues that are related to several diseases, such as neurodegenerative disease, cancer and diabetes. As a consequence, bio-sensors are needed as potential tools for disease diagnosis. By selecting the crown ether and fluorophore properly, it is possible to develop highly selective fluorescence probes for bio-imaging.

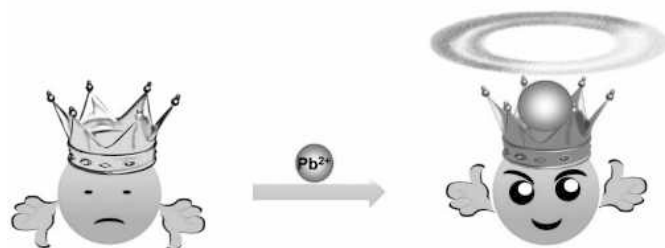


Fig.3 Working of fluorescent probe

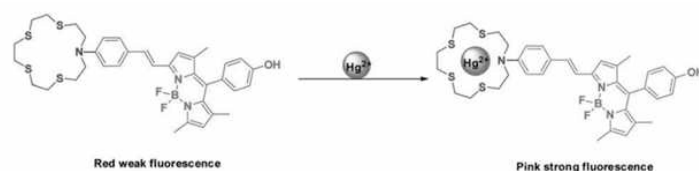


Fig.4 Fluorescence probes containing azathia crown ether groups

Source: Chem. Soc. Rev., 2017, 46, 2437-2458

WATER DROP LENS

Pratibha Sharma
Research Scholar, Department of Chemistry

Physicist Bruno Berge, has developed a liquid optical lens by a process called as electro-wetting. In this process, a water drop is deposited on a metal substrate and covered by a thin insulating layer.

The liquid drop modifies the angle when a voltage is applied to metal. The liquid lens is comprised of two liquids- Water which is conductor and oil which is insulator.

A variation in the voltage causes a change to the curvature of the liquid to liquid interface which changes the focal length of the lens.

Best features

- ❖ Low cost construction.
- ❖ No moving part.
- ❖ Electrical consumption is low.
- ❖ Quick response.
- ❖ High optical quality.



Image Source: mymodernmet.com

Source: mydreamtechnology.com

Answers to the Questions at page number 7
1. Mosquitoes 2. Marsupials and Monotremes 3. Janaki Ammal 4. Sir Jagdish Chandra Bose 5. M. Visvesvaraya 6. C.V. Raman 7. Joule 8. Vulcan and Vulcanisation 9. Sulphur 10. HotMail, now Microsoft Outlook

Murderous Plants

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Chase et al. (2009) introduce the concept of murderous plants that comprised of carnivorous plants as a subset. Use of the word "murderous" in this context is a slight exaggeration because it does not correspond to the usual definition of the word that simply implies causing death. The difference between the two is simple: Carnivorous plants are simply feeding themselves with prey. Murderous plants are noticeably killing victims and utilizing the corpses for food.



Drosophyllum lusitanicum leaf.

Conspicuous killing is a key concept here. All plants are potential killers because all plants contain toxic substances to limit predation. Charles Darwin laid the foundation for modern research on carnivorous plants. In Insectivorous plants, Darwin (1875) put forward a relatively new concept of homology to demonstrate evolutionary and functional convergence across apparently unrelated taxa. Darwin determined for the first time that these plants directly dissolved animal protein using enzymes whose action was similar to pepsin and other proteases. He further showed that dissolved nutrients were directly absorbed by carnivorous plants and that the trapped insect contributes notably to plant growth. Carnivorous plants are predatory flowering plants that kill animals in order to derive nutrition from their bodies. They share three attributes that operate together and separate them from other plants.



The Venus flytrap, Dionaea muscipula.

The simplest trapping mechanism in the 'murderous plants' is the adhesive trap. The flypaper-like leaves of *Pinguicula* have specialized short stalked glands that secrete a sticky mucilage that traps small creatures. The glands are stalked so the leaf itself doesn't smother in slime while it waits for a prey.

Pitfall traps are leaves modified into pit-like

structures. The Bromeliad **Murdreous plants:**

carnivores are the simplest pitfall traps where the base of the whorl of leaves seal to form a cup to catch water. Prey slip down the leaves into the pool at the base and drown. The other

carnivores with pitfall traps have highly modified leaves where each leaf is a separate trap. The traps may have nectaries, bright colors, or a flower-like scent to attract prey. The leaves may also adjust the pH of the water and release digestive enzymes.

The most dramatic trap is the snap trap of *Dionaea* and *Aldrovanda*. Pitfall, lobster

pot, and pigeon traps are static. But snap traps leave little to the imagination. As the prey moves into the trap it brushes against the trigger hairs and the trap shuts very quickly enclosing the prey. The trap closes by almost

explosively expanding the cells on the outer surface of the leaf. After being triggered the halves are cupped. The trap then slowly seals and digests the prey, reopening when it is done.

It has been proved, beyond doubt that the most complex plant leaf on this planet is the *Utricularia* suction

trap. The traps ready themselves by pumping water out of the sealed trap creating what would be considered a vacuum if air were involved. When triggered, they work so quickly that the highest speed video cameras show the prey outside the trap in one frame and already sucked inside on the next frame. Once inside the prey is digested and the trap rearms itself.

1. Capture and kill prey

2. Have a mechanism to facilitate digestion of the prey

3. Derive a significant benefit from nutrients assimilated from the prey.

Not much attention was paid to why botanical

carnivory might evolve until Givnish et al. (1984) proposed a cost-benefit model to explain why such plants are most common in habitats that have optimum resources in terms of light and moisture but are very low in nutrients. The model proposed a trade-off between the nutrients gained by capturing animals and the energy expended by constructing



The pitcher plant-Nepenthes x spectabilis

photosynthetically unproductive traps instead of leaves. Benzing (2000), additionally considered decaying litter as a nutrient source and this added more substance to the earlier hypothesis by Givnish.

Scientists have been able to identify three ways in which nutrients acquired through carnivory could result in energetic profits to the plants. First,



Drosera rotundifolia, the sundew plant

photosynthesis could increase with increasing nutrient uptake (following prey capture and digestion). Secondly, the excess nutrients derived from carnivory could be allocated to reproduction. Thirdly, if carnivorous plants could extract carbon from prey, they could bypass photosynthesis

as a means of producing sugars. This last benefit could be most important for aquatic carnivorous plants, as CO₂ used for photosynthesis is often limiting in water because it must be obtained by diffusion. After more than a century of being regarded as botanical oddities, carnivorous plants have emerged as model systems that should be studied, urgently, for addressing a broad array of ecological and evolutionary questions as their habitats are vanishing rapidly.

Source: *Journal of Experimental Botany*

MEDITATION... THE BEST MEDICATION

 **Dr. Shelja K Juneja**
Department of Environmental Science

Meditation is an effortless technique to attain happiness, mental hygiene, good health, clarity of thought and peace of mind. The best part of this practice is that you just have to sit and relax, and do nothing. If practiced daily, it gives you an unshakeable inner strength and an amazing sense of wellbeing. Recent researches have shown that it has infinite benefits, some of them have been listed below:

- * Increases Serotonin-“**The Happy Neurotransmitter**”, that improves mood and behaviour
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- * Decreases production of **Cortisol and Adrenaline**-“**The Stress Hormones**”
- * Boosts **GABA (gamma aminobutyric acid)**-“**The Calm Chemical**”, best known for making you keep calm
- * Increases production of the anti-aging hormone **DHEA (dehydroepiandrosterone)**-“**The Longevity Molecule**”
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Collaborative Undergraduate Biology Education (CUBE)

CUBE is an initiative of Homi Bhabha Centre for Science Education, Mumbai towards building up scientific acumen in the mind of high school and undergraduate students. On invitation, one of our faculty; Dr. Sreemoyee Chatterjee visited the lab in the month of March, 2017 for three days and started regular scientific exchange with the youth engaged in research nationwide. This was followed by the students from our university visiting TIFR lab and this time they got an exposure to work there for two weeks. The training at CUBE lab was an eye-opener for them. The change in them was apparent to notice and the zeal to learn led them to set up a formal workstation in their very own campus as I Lab (Inspiration lab) to work upon the model organisms.

The IIS University, Jaipur is now recognized as one of the CUBE centre and happily engaged in basic understanding of intricate biological phenomenon. The main aim of this centre is to bridge the gap between theoretical knowledge and practical knowhow along with establishing a network of collaboration. The lab is open to all the students who want to experience excitement in learning. We welcome all students from biology background to visit lab at D-block 2nd floor. Interested students may contact any one of the following faculty; Dr. Sreemoyee Chatterjee, Dr. Payal Mehtani and Dr. Lopamudra Guha.

CUBE Team, The IIS University

Articles for next issue of Science spectrum may be submitted for publication at sciencespectrum@iisuniv.ac.in. The guidelines for writing the paper may be downloaded from the IISU website.



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