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FROM THE EDITOR'S DESK

It never ceases to amaze me how everything around us is governed by science. Will our love for science ever stop us from being curious?

Welcome back readers to the second edition of Life : E- Newsletter. In this edition, we open with a powerful article on our theme this year –Biodesign. An article on Biofloc will helps us understand the revolution in aquaculture. One of the articles included will shed some light on how the field of medical has progressed using nanotechnology. Lastly, we have an article celebrating the Nobel Laureate for Medicine and its implications for the future.

We would close this edition with the "Photo Galleria" which is sure to grab your attention.

So, sit back and enjoy this journey of reading with us!

SAKSHI POOJARY
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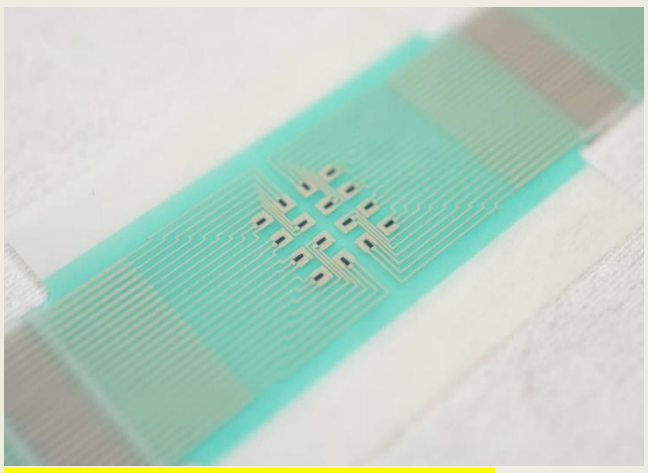
LIFE: E-NEWSLETTER

BIOMIMICRY AND BIODESIGN IN ARCHITECTURE



THE LATEST IN MEDICINE

Graphene and the surveillance against diabetes’

Ayaaz Khan,
SYBSc, A

Graphene is a crystalline allotrope of carbon with 2-dimensional structure. Its carbon atoms are densely packed in a regular atomic-scale chicken wire (hexagonal) pattern. Each atom has four bonds, one σ bond with each of its three neighbours and one π-bond that is oriented out of plane. Graphene has a special set of properties which set it apart from other allotropes of carbon. In proportion to its thickness, it is about 100 times stronger than the strongest steel. Yet its density is dramatically lower than any steel, with a surface mass of 0.763 mg per square meter. It conducts heat and electricity very efficiently and is nearly transparent. Graphene also shows a large and nonlinear diamagnetism, even greater than graphite. Diabetes to this day has been a major health problem worldwide. As per the World Health Organization 422 million people suffer from diabetes worldwide and remains one of the leading causes of death with a major factor being apathy towards early diagnosis in low- and middle-income countries. But now due to advances in nanotechnology scientist have found a way to diagnose diabetes without extracting a single drop of blood. Researchers in the University of Bath in UK have invented a needle-free approach for diagnosis of both type 1 and type 2 diabetes. This technology measures the glucose levels within the interstitial fluid of the cell. A patch consisting of glucose oxidase is placed on the skin which reacts with the glucose present in the interstitial fluid to release hydrogen peroxide which is detected by the graphene sensors. These graphene sensors are nanometres in length and yield results within 15 minutes. The researchers at the University of Bath state that their next step would be to advance to technology to monitor glucose levels for 24-hour period and optimize its glucose sensors.

"Hung’s design, brings life to unsafe waterways, restoring them as a space for community benefit."

Jellyfish Lodge – The near future of lodges

Hemant Bagwe
MSc- Part II, Microbiology

Our rivers, reservoirs, lakes, and seas are drowning in chemicals, waste, plastic, and other pollutants. This widespread problem of water pollution is jeopardizing our health. On the other hand, our drinkable water sources are finite. Less than 1 percent of the earth’s freshwater is actually accessible to us. “Jellyfish Lodge”, designed by Janine Hung, a graduate architect based in the Philippines helps combat this issue with an innovative, yet familiar, form.

These structures look like giant robot jellyfish, but they could one day function as eco-friendly hotel lodges. The lodge is powered by the solar cells that cover its dome-shaped roof, and its glass walls protect the structure from storms and keep mosquitoes out. Each lodge also contains a living area, kitchen, private quarters, and compost toilet inside the bell of the jellyfish. In addition, an aquaponic garden in present their underbelly where four kinds of fish could be raised, along with plants like lettuce, basil, and oregano. Local residents who help maintain the structure would be able to benefit from the garden. Beyond all these facilities, Jellyfish Lodge’s biggest achievement is owed to its tentacles.

As the lodge floats along, polluted water flows through the tentacles into small round chambers that filter out harmful substances. The filtered water is returned to the water system or stored in one of four spherical cistern tanks for domestic use. Hung’s design, brings life to unsafe waterways, restoring them as a space for community benefit. While we can't expect to see these lodges leap off the paper and into real rivers any time soon, it's certainly a novel idea.

COMMUNITY ARTICLES:

Articles of intrigue sourced from the community of students within SIES

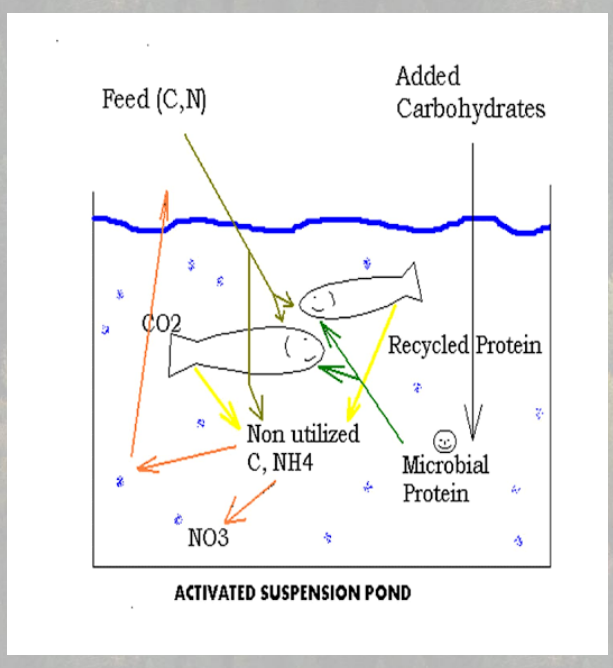
RESOURCE CONSERVATION:

Biofloc: The need to save resources

Devendra Tamhane,
SYBSc A

Biofloc is a technology which converts toxic compounds like Ammonia, Nitrate and Nitrite into useful compound, Protein. This is used in aquaculture systems with limited to zero water exchange under high stocking, high aeration and the biota formed by biofloc. This system improves the environmental control over the aquatic animal production. In aquaculture, the strong influential factors are the feed cost, accounting to 60% of the total production cost, and most limiting factor is the water/land availability. High stocking density and rearing of aquatic animals requires wastewater treatment. This system is a wastewater treatment which has gained vital importance as an approach in aquaculture. The principle of this technique is the generation of nitrogen cycle by maintaining higher Carbon to Nitrogen ratio through stimulating heterotrophic microbial growth, which assimilates the nitrogenous waste that can be exploited by the cultured spices as a feed. The technology is not only effective in treating the waste but also provides nutrition to the aquatic animals.

The higher Carbon to Nitrogen ratio is maintained through the addition of carbohydrate source, molasses, and the water quality is improved through the production of high-quality single cell microbial protein. In such condition, dense microorganisms develop and function both as bioreactor controlling water quality and protein food source. Immobilization of toxic nitrogen species occurs more rapidly in bioflocs because the growth rate and microbial production per unit substrate of heterotrophs are ten-times greater than that of the autotrophic nitrifying bacteria. This technology is based on the principle of flocculation within the system. The biofloc technology has been implemented in shrimp farming due to its bottom dwelling habit and resistance to environmental changes. Studies have been conducted to assess the larval growth and reproductive performance of shrimps and Nile tilapia. An improved breeding performance was observed in shrimp reared in the biofloc system when compared to that of normal culture practices and improved larval growth performance was also observed.



ACTIVATED SUSPENSION POND

NOBEL LAUREATE 2019-2020

Cells and Oxygen; Understanding of the basic unit of life

Anusuya Nair
SYBSc A

Oxygen is the eighth element of the periodic table and is a colourless, odourless gas at room temperature. It is a surprisingly unassuming molecule, which contributes to it's intrigue as one of the most important biomolecules that supports life on earth. Oxygen has been an integral part of life on earth since the Paleoproterozoic era and the Great Oxidation Event, approximately 2.4mil years ago. Animals require oxygen to breakdown food which in turn provides energy to the organism.

However, while the fundamental value of oxygen has been lauded for years, the core mechanism of how cells adapt to changes in levels of oxygen ahs been unknown. Oxygen levels vary with certain conditions, for instance the oxygen level is assumed at it's most dense at sea level and it begins thinning out with elevation in altitude. This year, the recipients of the Nobel Prize for Medicine are William G Kaelin Jr., Sir Peter J Ratcliffe and Gregg L. Semenza who discovered the molecular machinery that helps cells sense and adapt to changes in oxygen levels.

Oxygen also affects us on a more day to day basis and the levels fluctuate on a microsomal level too, and the availability of oxygen to each cell is very subjective and entirely dependant on the location of the cell. It is essential for the functioning of the entire body as an amalgamation of various organ systems to be constantly aware of the general amount of oxygen in the body at all times. The carotid arteries, the major arteries present in the neck, have various structures called the carotid bodies which help in detecting the general amount of oxygen present in the blood. If the carotid bodies sense that the amount of oxygen is less, they send signals to the nerves to increase your breathing rate, which helps increase the amount of oxygen present in the blood. Another factor called erythropoietin, a hormone nicknamed EPO also helps in this by stimulating the body into producing more RBC's in a process called erythropoiesis. The research undertaken by Kaelin Ratcliffe and Semenza was able to answer the question on how cells reacted and communicated between each other with respect to hypoxia-inducing factor (HIF) and VHL, a gene Kaelin came cross while studying a genetic syndrome called von Hippel-Lindau's disease, a mutation if carried in the family, increases the risk of certain cancers.

While fascinating on a scientific point of view, the implications of this data goes far beyond general scientific intrigue. This data helps in understanding human diseases like cancer and anaemia. Their work has also led to researchers develop drugs that target oxygen sensing processes, particularly in case of cancer. These drugs are called prolyl hydroxylase inhibitors and help prevent VHL bind to HIF and can potentially help prevent anaemia and renal failure.

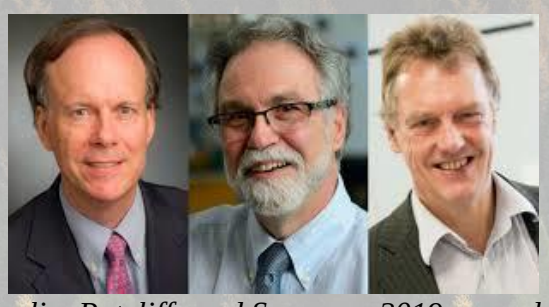
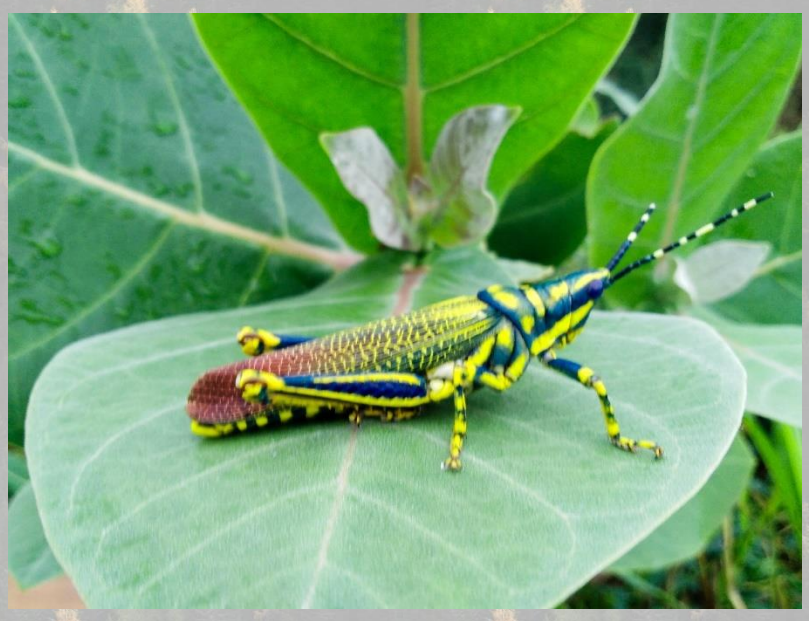

Kaelin, Ratcliffe and Semenza, 2019, awarded the Nobel Laureate for Medicine/Physiology

PHOTO GALLERY

Submissions from our own community of students with a gift for capturing nature at its finest



Painted Grasshopper: *Poekilocerus pictus*

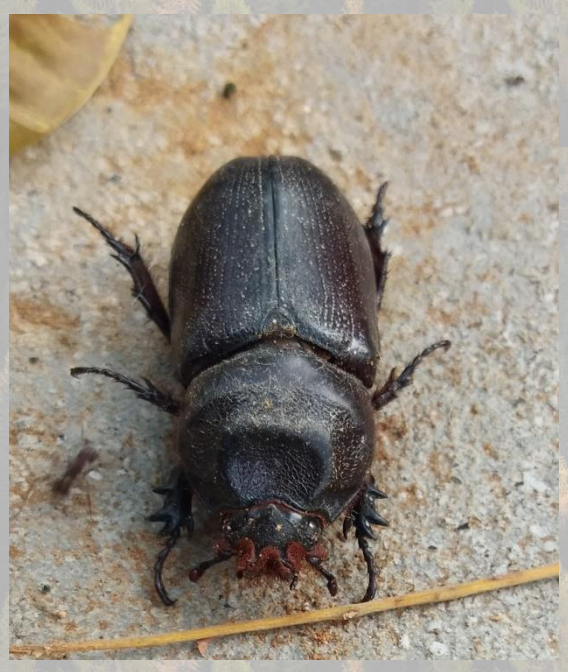
Pawanraj Gadipalli, SYBSc A

Indian Rock Python: *Python Molurus*

Vaishnavi Dalvi, SYBSc A

North American Brown Pelican

Anish Varkuru, SYBSc A



Beetle

Rithika Ravishankar, Ex-student TyBSc Zoology 2018-19

Giant African Snail

Abhay Kumar Dubey, SYBSc B

Praying Mantis

Ashish Paul, FYJC Sci F

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