



IRIS | DEPARTMENT OF LIFE SCIENCES | JAI HIND COLLEGE



THE CATALYST

ISSUE 3



Our Mentor



*Dr. Ashok Wadia
Principal, Jai Hind College*

Thank you sir, for encouraging the students to enhance their skills and build an indispensable knowledge to stand out.

The *Catalyst*

Department of Life Sciences

2022 - 2023

*We are presenting to you, a glimpse of our department through the
3rd issue of our student-led magazine.*

We invite you to join us in this journey of exploration!

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ACHIEVEMENTS

Avishkar



Mudita Adaniya
(Won Zonal Round
& Progressed to Final
Round)

Topic: Eggs and fruits aren't just breakfast, they're BIOFUEL!!!

Guide: Ms.Niloufer Kotwal



Hibah Mulla
(Won Zonal Round &
Progressed to Final
Round)

Topic: Developing Bioplastics as an alternative for plastic using Sodium Alginate and Coconut Husk and testing its efficiency.

Guide: Dr.Srilatha Srinivas K



Sanika Naik

Topic: Studying of evolution of cognition and its decline relating to APOE-Epsilon4 allele and mutation in APP gene in *Homo sapiens* using Bioinformatics.

Guide: Ms.Zeenia Avari



Roshani Gupta
(Won Zonal Round)

Topic: Studying the evolution of *Delphinapterus leucas* through analyzing the COX1 gene of *Delphinapterus leucas* and *Hippopotamus amphibius*.

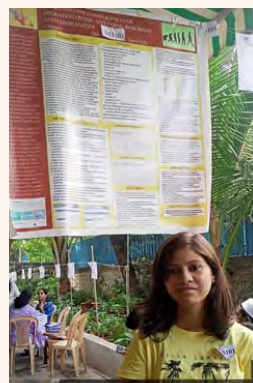
Guide: Ms.Zeenia Avari



Neha Thorat

Topic: A Comparative Study of FOXP2 and CNTNAP2 genes from Humans, Chimpanzees and Mouse.

Guide: Ms.Niloufer Kotwal



Tanaya Salvi

Topic: To study effects of migration on AMY1 Gene between Chimpanzee and human.

Guide: Ms.Zeenia Avari



ACHIEVEMENTS

Xplore (2022-23)

Hibah Nasir Mulla

Topic: Developing Bioplastics as an alternative for plastic using Sodium Alginate and Coconut Husk and testing its efficiency.

Guide: Dr.Srilatha Srinivas K

Roshani Brijwasi Gupta

Topic: The analysis of water purified using banana peels (*Musa acuminata*).

Guide: Ms.Sakina Garothwala

Sumitomo Scholars (2022-23)

Vipra Ajay Parekh
(TYBSc)

Mudita Atul Adaniya
(TYBSc)

Extra-curricular Achievements

Kaustubh Mane and Maargi Naliapara

First Prize - Skit Play
Mumbai University Level

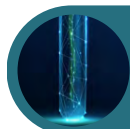
Maargi Naliapara

Cisce nationals gold
Khelmahakumbh gold
55th State Shooting Championship
Gold Medal.

Mudita Adaniya

Ms SHOUTT Runner Up 2023

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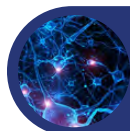


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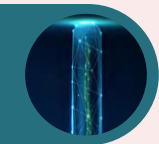
AND ITS A WRAP

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ENVIRONMENTAL BIOTECHNOLOGY





Use of Moringa, Neem, and Tulsi as Natural Herbs for Treating Wastewater

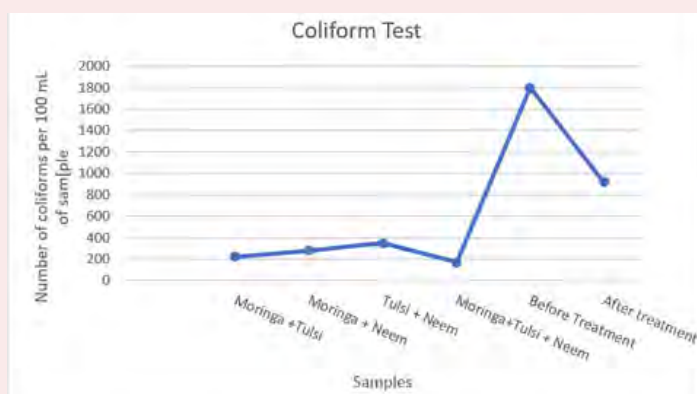


The main cause of water pollution is sewage, which is handled improperly and pollutes freshwater sources. The usual treatment methods include the activated sludge process, oxidation ponds, aerated lagoons, and trickling filters. These methods not only need a lot of space and a great amount of energy but also ample time, which drives up the cost of the treatment. The expense of the treatment process can be decreased by using natural coagulants.

Thus, this study investigates the properties of *Moringa oleifera* (Moringa), *Ocimum sanctum* (Tulsi) and *Azadirachta indica* (Neem) in the treatment of wastewater. *Moringa oleifera* (MO) seed - a natural coagulant is a crucial component in water purification and has been used to treat wastewater because it is safe for humans and has no apparent disadvantages. Another natural herb that helps in purifying water is *Ocimum sanctum* (Tulsi). The herbal plant *Ocimum sanctum* has antibacterial properties against a variety of microbes in addition to possessing anti-cancer, anti-diabetic, and anti-ulcer properties. It has been demonstrated that Tulsi is effective against the harmful effects of industrial pollutants like copper sulphate. Neem is an important natural resource that can help in wastewater treatment to a great extent owing to its exceptional properties. Heavy metal ion removal from wastewater using neem leaf powder has shown excellent efficacy. Parts of the neem plant exhibit an antibacterial function by inhibiting microbial growth and/or the capacity for cell wall breakdown. After the treatment of wastewater with herbs the potency of these herbs on coliforms, chemical oxygen demand (COD) and pH of the water was checked and compared with the water treated at sewage treatment plant.



With the increase in population, industrialization, and economic growth, freshwater consumption has increased. The water pollution is sewage, which is poorly taken care of and goes ahead to pollute the freshwater sources is a root cause and a fundamental reason. However, the expense of the treatment process can be decreased by using these natural coagulants.



This study investigated the properties of *Moringa oleifera* (Moringa), *Ocimum sanctum* (Tulsi) and *Azadirachta indica* (Neem) in the treatment of wastewater. The results obtained from these herbs treated water is compared with water treated at the treatment plants. It has been concluded that the herbs are a good natural resource that can be used for the treatment of sewage water, that is cost effective and easily available. Moreover, it is a sustainable method of treating water.

-Fatima Zehra Khan

Isolation of Adipocytes to be tested upon Fat Loss Supplements



Adipose tissue, also known as body fat, is a connective tissue spread throughout the body. The tissue present under the skin is called subcutaneous fat. Through the rise and fall of all sorts of trends, the one trend that has existed ever since the evolution of humans, is the trend of quick fat loss. So much so, that it is no longer a trend but has become a billion-dollar industry. Several companies compete to sell the 'best' fat loss supplements.

One such supplement is apple cider vinegar (ACV). It is a type of vinegar that is extracted from apples and claims to reduce inches off your waist in no time. However, the aim of the current research is to test the truth behind these claims and to validate whether apple cider vinegar actually has any effect on adipocytes at all or is it all just a HOAX!

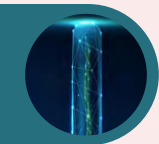


The research has currently completed its standardization phase, where the protocol for removal of maximum viable adipocytes from adipose tissue was standardized. These cells will now be treated with apple cider vinegar at variable concentrations to check for any chemical or morphological changes indicating fat loss or cell lysis. Based on extensive literature review, the cells are expected to lyse under concentrated conditions of the supplement however any vinegar would have that effect on the cell, hence the main aim of this study is to see how apple cider differs from other vinegars and does it at all contribute nutritionally towards the health of a person.

Re-evaluating the consumption of ACV is highly important as the long term effect of this is still unknown. Even though there are papers claiming that ACV has helped a lot of people in losing weight, there is no proof of its direct effect on losing adipose tissue (subcutaneous fat). There is also insufficient data focusing primarily on the long-term side effects of ACV consumption, hence, this research aims to isolate adipocytes (fat cells) from adipose tissue and test whether ACV has any direct effect on them or not.



-Labdhi Jain

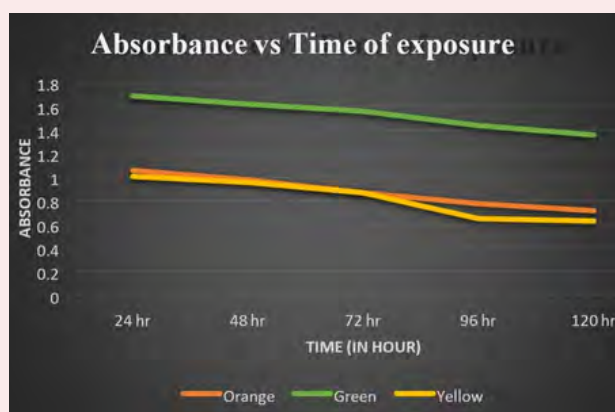
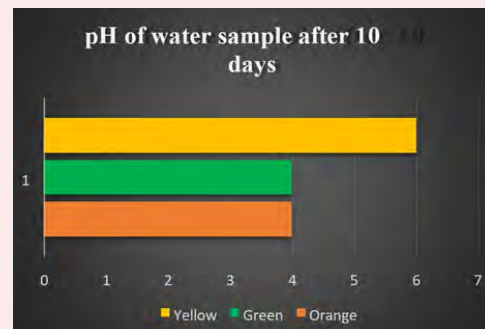


Effect of Synthetic Food Colourants on *Danio rerio*



A food additive (FA) is a supplement that may be a nutrient or a chemical preservative that becomes a component of a food product either explicitly or implicitly at certain stages of processing, storage, and handling. FAs are consciously added to food to improve flavour, appearance, or preservation.

Unfortunately, the human body suffers when these compounds are used in excess. Thus, consumers' concern over the toxicity of these food additives has increased. These food additives are illegal in a few countries due to their potentially dangerous effects. Furthermore, there is conflicting evidence about the possible dangers of food colouring. Food colouring is frequently used to provide colour to meals, medications, and cosmetics; nevertheless, it has been shown to have certain carcinogenic and mutagenic effects on living things.



A well-known model organism, *Danio rerio*, is utilised as a specimen because of its great genetic similarity to humans, small size, transparency of the body, and low cost of production. The azo dyes were used in this experiment that we consume in our day-to-day life. Azo dyes are any of a large class of synthetic organic dyes that contain nitrogen as the azo group $N=N$ as part of their molecular structures; this class contains more than half of all commercial dyes. All of these azo-dyes are solid, and they are all water soluble.

This study aims to investigate the toxic effects of food colourants on the adult zebrafish, by studying their behavioral pattern, morphological changes in them and by conducting few tests such dissolved oxygen (DO) test, checking absorbance, pH test, acidity test, etc. As a result, the study of this research justified that the environment and environmental factors play a key role in the maintenance of the fishes. Climate change, habitat loss and pollution can cause zebrafish to struggle in the environment and also lead to death. As the genome of the zebrafish has 70% similarity with humans, these food colourants can also be toxic to human health as there is no such need of consuming the synthetic food colourants as it just makes the food more attractive and colourful. Hence, the synthetic food colourants were proved to be toxic to the zebrafish and have also proved that the surrounding environment plays a vital role for marine life.



-Neha Thorat

Bio Hydrogels using Chitin Extracted from Plants and Animals



Do you remember the tiny gel structure that made our childhood colorful? Does the word 'Orbeez balls' ring a bell? An Orbeez ball is nothing but a hydrogel. These structures grow as they absorb the surrounding water. Due to its flexibility, compact structure, and hydrophilic nature, research on hydrogel has skyrocketed.

As a result of their applications in agriculture, pharmaceuticals, cosmetics, and medicine, hydrogels have gained popularity, particularly synthetic hydrogels. Despite the promising results of synthetic hydrogels, natural decomposition processes will depolymerize all hydrogels after a few years (usually 2–5 years). In the presence of fertilizers, the degradation rate increases. The area of concern isn't the degradation process, but the kind of byproduct that will be released into the environment. The most commonly used hydrogel is polyacrylamide hydrogel. On degradation, they release potassium acrylate and acrylamide. The latter is a harmful neurotoxin that is lethal. It is also responsible for causing cancer in laboratory animals and can be easily taken up by the skin as well as inhaled dust. These are non-biodegradable. The production of synthetic hydrogels is still plagued by plasticizers, thus contributing to the long-term risk of environmental pollution. Thus, this study aims to devise a methodology for making fully biodegradable hydrogels that leave no harmful residues behind.

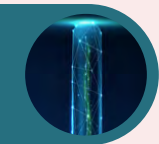
A natural polymer-based hybrid hydrogel was created using two biopolymer solutions, i.e., chitin and sodium alginate. Chitin was extracted from a fungal source, i.e., mushrooms (*Agaricus bisporus*), and an animal source, i.e., Prawn shells (*Penaeus indicus*).



The process of extraction involved three steps: deproteinization, demineralization, and deacetylation. The chitin extracted from the demineralization step has no free ends for cross-linking. To generate free ends, it undergoes deacetylation with the help of sodium hydroxide. Chitosan, being a cationic biopolymer, was homogenized with an anionic biopolymer, sodium alginate. By absorbing divalent metal ions, such as Ca^{2+} , the hydrogel is formed. It is kept in the refrigerator overnight, and its stability was checked by keeping it at room temperature for four days.

The hydrogel swelling ability was obtained to be 5.86%, and the gel fraction comprised 66%. Thus, a biodegradable prototype of hydrogel that is environment-friendly and capable of absorbing water was made.

-Manali Chakraborty



Developing Bioplastics using Sodium Alginate, and Coconut Husk and testing its Efficiency



Plastic packaging, widely being used, is a growing concern as it poses a threat to the environment and nature. Much of the plastic is dumped in landfills, where it takes at least thousand years to get completely degraded. Further, the chemicals in plastics are endocrine disruptors, which can cause various health disorders and even cancer. To overcome this problem, we can replace traditional non environment-friendly plastics with biopolymers, in particular polysaccharides or macromolecules having film forming properties. These biodegradable materials, which find applications mostly in food packaging, can largely contribute to the reduction of environmental pollution. The present research work introduces an environmentally safe approach to producing two types of bioplastics using naturally obtained biodegradable substances. The aim of this study was to produce Biodegradable materials, which find applications mostly in food packaging, and can largely contribute to the reduction of environmental pollution. Affordability, simplicity of manufacture, adaptability, renewable and degradable materials with a higher durability were focused.

Two types of bioplastics are developed and compared for their pectin content, cellulose content, total sugar content and degradation time along with cost analysis. Alginate Bioplastic is produced using a mixture of sodium alginate, glycerol, sunflower oil, and water.



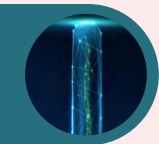
Sodium alginate is derived from salt of alginic acid and gum extracted from the cell wall of brown algae. It is extensively used in food industry as thickening agent. Here, alginate bioplastic makes use of sodium alginate as the polymer. Glycerol is a natural plasticizer with high plasticising capacity and thermal stability at processing temperatures. It forms hydrogen bonds with alginate, while destroying the current hydrogen bonds between hydroxyl groups in alginate molecules.

When sodium alginate along with glycerol comes in contact with calcium chloride, it undergoes polymerization with sodium alginate. Since calcium is divalent and sodium is monovalent, there is cross linking.

The husk bioplastic was produced using a mixture of coconut husk, arrowroot powder, glycerol, acetic acid, and water. Coconut husk is used as a natural source of cellulose. Resistant to fungi and rot, provide excellent insulation against heat and sound, not easily combustible, flame retardant, unaffected by moisture and dampness, tough and durable, resilient, springs back to shape even after constant use, totally static free, and easy to clean, makes coconut husk an apt choice for bioplastic. Arrowroot powder is used as a thickening agent while glycerol is a natural plasticizer that will bond with husk. Acetic acid produces cellulose acetate along with glycerol which increases the compressive strength of bioplastic.



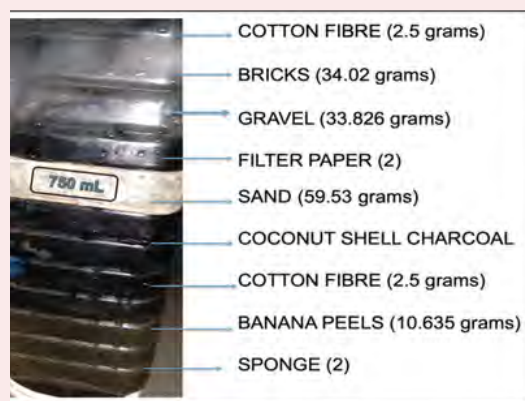
-Hibah Mulla



Analysis of Water Purified using Banana Peels



A secure water supply is essential to sustain human life, local ecosystems, and communities. Drinking water treatment is a complex subject and the treatment chain involves multiple processes that vary depending on regulations, disposal goals, and associated costs. In this study, we have focused on filtering the water using banana peels. Banana (*Musa acuminata*) peels are generally thought of as waste that is thrown away, but they have significant benefits for purifying water. This study anchored on determining if banana peels are capable of purifying water. Banana peels contain potassium, which acts as a coagulant and helps to remove impurities and pollutants from water. They also contain phosphorus, iron, calcium, magnesium, and sodium. The porous structure of banana peels also helps to trap dirt and other particles, making it an effective filter. Additionally, the antimicrobial properties of banana peels can help to kill bacteria and other microorganisms in water, making it safer to drink.



The preliminary preparation was to collect materials - cotton fibers, bricks, gravel, filter paper, sand, coconut shell charcoal, banana peels, and sponges. The materials were placed in a 750 mL water gallon. The banana peels were collected and cut into small pieces and dried in the oven at 1000°C for 30 minutes. The water samples in the study were of four types. i.e. tap water, borewell water, beach water, and Mithi river water, these being commonly used by the people of Mumbai City, Maharashtra.

The water samples were passed through the filtering system. The filtered water was analyzed further on various physical and chemical parameters like color, pH, copper, nickel, sulfate content, and the number of coliforms before and after filtration. The observations were analyzed using line graphs and T-test and the results were noted. The conclusion derived from this study is that banana peels could be used for purification of the water from various sources.

TEST	Number of times the water was passed through the system	Sample	Before Treatment	After Treatment
Colour	1-6	Tap water	Colourless	Colourless
		Borewell water	Yellowish	Colourless
		Sea water	Yellowish	Colourless
		Mithi river water	Blackish	Colourless
pH	1-6	Tap water	6.5	7
		Borewell water	7	7
		Sea water	8	8
		Mithi river water	8	8
Copper (mg/L)	3-6	Tap water	0.3030	0.01
		Borewell water	1.1111	0.1111
		Sea water	1	0.1414
		Mithi river water	1.2121	0.2020
Nickel (mg/L)	3-6	Tap water	2.3181	0
		Borewell water	32.1818	1.7727
		Sea water	32.4545	5.4545
		Mithi river water	32.5909	5.0454
Sulphate (mg/L)	3-6	Tap water	82	14
		Borewell water	85	62
		Sea water	285	175
		Mithi river water	475	400
MPN	3-6	Tap water	50	0
		Borewell water	>/1800	170
		Sea water	>/1800	225



It was found that there is a difference in physical and chemical properties of water filtered in the banana filtration set-up before and after the process in terms of color, heavy metal content, non-metal content, and pH, and several coliforms present in water samples. The low-cost and easy-to-use

water filtering system could help in remote areas where there isn't access to water filtration technology or where there are health concerns about contaminated water.

- Roshani Gupta

Production of Bio-Briquettes using Coconut Shell & Sawdust: Alternative Cooking Fuel

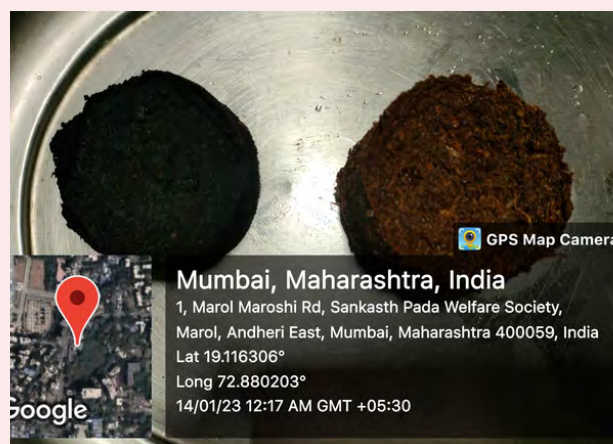
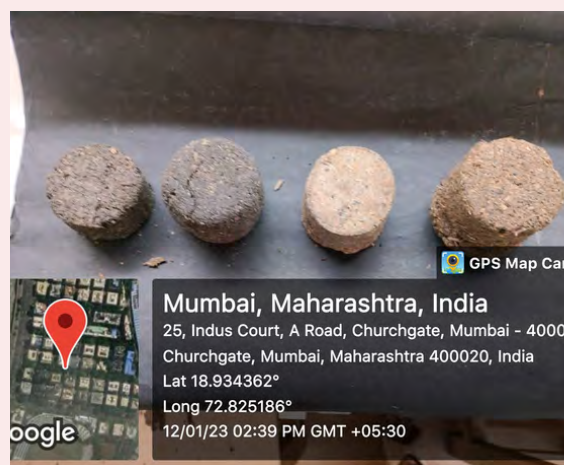


This research aims to check the utilization of coconut shells and sawdust as raw materials to produce bio-briquettes and perform different tests to check the efficiency of bio-briquettes as cooking fuel and their usage in heat-generating units. Sawdust and coconut shells are biomass sources that are available in abundant amounts and yet not utilized optimally. Both can be utilized as alternative energy sources through briquette production technology. Binders are required to hold the particles together. One such example is starch. When the starch is boiled it leads to the formation of intermolecular hydrogen bonds between amylose and amylopectin. In this study, the binder used is tapioca starch. Biomass briquette production comprises the following steps: collecting raw materials, drying, carbonizing, grinding, mixing, compacting, and drying.



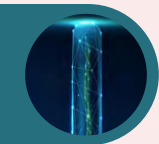
About 6 samples were prepared with different ratios of sawdust and coconut shell. The production cost is less and the process is not dangerous as coal mining. The characteristics of briquettes include density, moisture content, ash content, volatile matter, fixed carbon, heating value, and burn time. The samples were characterized based on their performance and working as biomass energy. The densities of bio-briquettes are close to the literature values, demonstrating that the bio-briquettes produced have good compaction, and the particles are tightly bound together. This durability helps during transportation.

The highest moisture loss was noticed in sample 2 and showed a high heat value. The importance of ash content has not been fully established yet, ash is considered as the measure of non-combustible organic compounds, it was the least in sample 2. Due to the high volatile matter content, biomass becomes a highly reactive fuel with a faster combustion rate. Thus, sample 6 shows the highest volatile rate. The heating property of biomass depends on the moisture content and ash content, the highest were found in samples 2: 60% sawdust and 40% coconut shell, and 6: 100% coconut shell bio-briquettes.



The heating value is a characteristic of bio-briquettes that gives the amount of heat produced. They have a higher practical thermal value and much lower ash content (2-10% compared to 20-40% in coal). In fact, they are 40% more efficient, as well as hotter and longer lasting than firewood. This greater efficiency can be attributed to their low moisture and density. Thus, bio-briquettes prove to be an eco-friendly alternative to conventional fuels that are utilised for cooking and heating purposes.

-Renuka Yadav

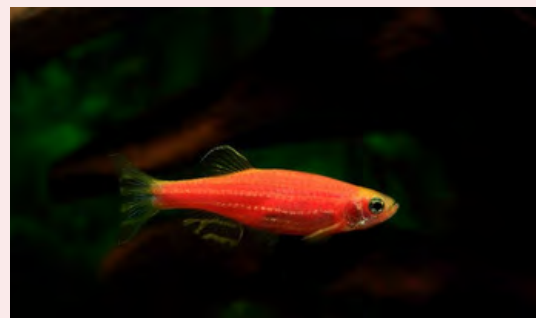


A comparative study to understand the effect of Petroleum-derived and Bioplastic-derived Microplastic on *Danio rerio*



Although the toxicity of conventional microplastic types (i.e., petroleum derivatives) in different organisms are already known, knowledge about the effects of alternative biopolymers on aquatic vertebrates remains incipient. Thus, the objectives of this study were to identify the physical effects and behavioural changes in zebrafish (*Danio rerio*) induced by various concentrations of Polyethylene (PE) and Polylactic acid (PLA) microplastics (MPs) in various size ranges, to chronic exposure for 21 days.

Adult zebrafish are used as model organisms for behavioral and gene expression studies as their genomes are fully characterized and their physiology parallels that of humans. In the current study, polyethylene microplastics (PE MPs) were used as representative of conventional plastics and polylactic acid (PLA) as bioplastic. Both MPs were tested at 2.5 mg/L, 5 mg/L and 7.5mg/L.



Plastic materials were ground to generate smaller particles to create a mixture of fragments of different sizes and shapes similar to the MPs dispersed in the natural environment after the degradation of larger particles. Aquarium water was fully replaced every 4 days and rinsed with water.

Based on the results obtained, no significant differences were observed in the biomass of animals in different experimental groups or their body measurements. There were sudden fluctuations in pH levels that were noticed during the exposure period. PLA tended to decrease the average swimming velocity of adult zebrafish, indicating a sedative effect on both genders. Indicating that the behavioural parameters related to locomotory activity were significantly affected by PLA as compared to polyethylene. Compared with the control group and polyethylene exposed group, a significant difference was detected in the above behavioural parameters of zebrafish exposed to PLA. The protocol for testing acetylcholine esterase activity (AChE), from the animals' brain processing was determined in this experiment, but due to the high mortality rate, the tests could not be performed. Studies like these can contribute to a better understanding of how these materials can affect the ichthyofauna in freshwater ecosystems and, consequently, to the assessment of toxicity associated with their use.



Acetylcholinesterase (AChE) activity was supposed to be determined based on the spectrophotometric method by Ellman (1961) as that will help us improve the knowledge about the possible mechanisms of action of microplastics in models' central nervous system.

-Kaizeen Balsara

Eggs and Fruits aren't just Breakfast, They're BIOFUEL!



Denatured ethanol is widely used as fuel for ethanol stoves, especially by travellers. It is prepared using 10% methanol. This fuel tends to run out fast and sources such as wood are preferred as a source of heat. Increasing the efficiency by increasing the burn time of such fuels using 'green' sources, has been covered in this project.



Basic laws of fermentation and chemistry have been applied to create a much more efficient biofuel. Using rotten fruits and discarded eggshells, the burn time of ethanol has been improved. Acetic acid was obtained from various fruits by fermenting them for over a month. This acetic acid was then used to extract calcium carbonate from eggshells to obtain calcium acetate. When ethanol (polar) is combined with calcium acetate (non-polar), the ethanol gets dispersed throughout the calcium acetate molecules. On lighting this biofuel on fire, it burns with the oxygen in the air at a slower consumption speed. Therefore, this increases the burn time of ethanol and is more environmentally friendly. The leftover egg shells and solid fruit wastes can later be used for composting as well.

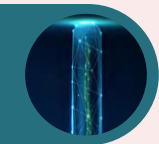


Various fruits were used for this study to check which would provide the best results. Thereafter, the following tests were conducted to test efficiency, and results were tabulated using a point system:

1. Jelly Formation (most formation to least)
2. Total burn time (from most efficient to least efficient)
3. Time taken to boil 10mL water (Least time taken to most time taken)
4. Approximate cost of fruit-derived acetic acid (from least to most)
5. Amount of residual remained (from least residue remaining to most)
6. Overall efficiency (highest to least points)

	particle size	Burn time	Time to boil water	Residual remaining	Base cost	Total
Control	3	9	8	9	4	33
B.II	1	5	7	7	5	25
P.II	1	8	9	4	2	24
O.I	1	2	6	6	3	18
O.II	1	7	2	5	3	18
MF.I	1	3	3	8	1	16
P.I	2	4	5	2	2	15
MF.II	1	6	4	1	1	13
B.I	2	1	1	3	5	12

-Mudita Adaniya



Bioplastic synthesis using Banana and Orange Peels and its Characterization



Plastics are a valuable resource for civilization because they frequently offer functionality that is neither easily nor cheaply substituted by other materials. The aim of this research was to explore the potential of orange and banana peels as a main raw material in production of bioplastic and to characterize the bioplastic using water absorption, soil degradability test and to determine the tensile strength of plastic for its future use. The idea behind this research is to reduce the problem of plastic pollution and carbon emission on earth. The key objective of this study is to create an ecosystem free from conventional plastic for a better survival of life.



In this study, bioplastics from banana peels and orange peels were formed by varying the operating parameters in order to produce a high-quality bioplastic with the best possible physical, mechanical, and biodegradability characteristics. It is safe to claim that, based on the results obtained, that the research objectives were nearly realized. The overall results demonstrated that bioplastic made using banana peels are better when compared to the bioplastic made using orange peels. Banana bioplastics degrade faster, do not burn easily, have almost negligible solubility in alcohol, can be molded into various structures and shapes and absorb less water. While orange bioplastic is thermostable but due to the less degradability in soil, high solubility in alcohol and high water absorption capacity it cannot be used for a commercial purposes. The higher pectin content in orange bioplastic can be used for various studies. However, in the future, with the use of better technology and more research, banana bioplastics could potentially be used instead of conventional plastics which not only cause pollution but are also hazardous to all life forms on earth. Additionally, production of bioplastics using banana peels could be an effective solution in reducing the dependence on synthetic materials required for making of traditional plastics. Extensive research is required in the area to develop a potential bioplastic that can completely replace conventional and outlawed plastics while posing minimal to no environmental harm, having a low likelihood of being expensive to produce, and being readily available to meet changing societal demands. From this study, it was concluded that banana peels and orange peels, which are typically discarded as waste, can be used to make fair-quality bioplastic using the various tests.

-Megha Thakur

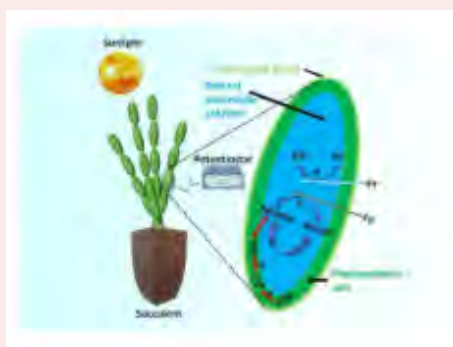


Bio-Solar Cells (Bio-Photoelectrochemical Cell in Succulent Plant)

The world faces a rapidly increasing demand for sustainable energy. Man-caused changes that threaten the climate forces us to rely on alternative biomass sources. First and second generation bio-fuels cannot fulfil this need in a sustainable and societal manner. Sustainability leads us to the thought of the largest option available: The Sun. It is our challenge to make the most of this incredible resource and our researchers have done the job. While solar power currently revolves primarily around the application of photovoltaic cells, new emerging ideas are available with photobiological cells or bio-solar cells with the help of succulent plants. Bio-solar cells are natural processes that use photosynthesis to convert sunlight into usable energy.



Collecting available electricity from photosynthetic biological systems is usually done by placing the system in an electrolyte solution. Aqueous solutions in fleshy tissues can be used directly as natural bio-photoelectrochemical cells. Scientists have created a solar-powered plant using cells from the succulent *Corpuscularia lehmannii*, also known as the 'ice plant'. The thick water holding the outer cuticle of the succulent plant *Corpuscularia lehmannii* acts as an electrochemical vessel, and the water content in it acts as an electrolyte. When a metal anode and a platinum cathode is placed in the leaves of the plant, the is voltage is found to be 0.28 V.



It produces a photocurrent density of up to $20 \mu\text{A}/\text{cm}^2$ when connected to a circuit and can sustain current for more than a day when exposed to sufficient light. Connecting multiple leaves in series can increase the amount of power produced. A special team of scientists have developed a solar cell in the leaves of the ice-plant, so that the protons in the inner leaves can combine at the cathode to produce hydrogen gas that can be collected and used for other purposes. Bio-solar cells have several benefits such as helping us with low production costs. The biological material used is not unusual. It also has the advantage of trapping greenhouse gases and providing us with the most important gas for humans (oxygen). This method could lead to the development of sustainable, efficient green energy technology in the future.



-Anjali Mishra



WORD SEARCH TIME!!!!

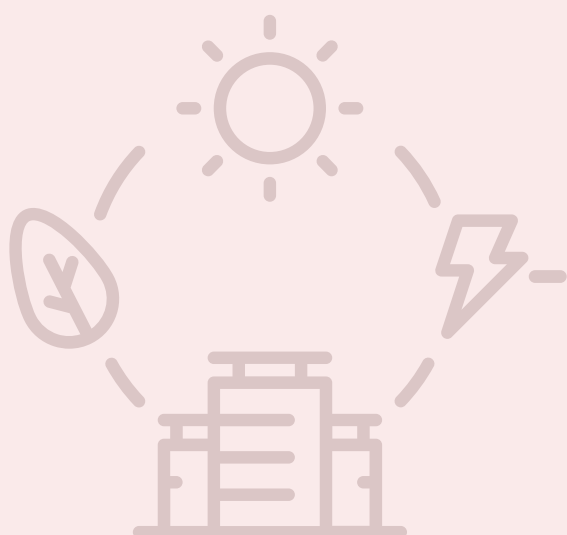
ENVIRONMENTAL BIOTECHNOLOGY



BIODEGRADABLE
BIOFUELS
CONSERVATION

HAZARD
METHYL ISOCYANIDE
POLLUTION

SOLAR ENERGY
TURBINE
SUSTAINABILITY





PHYTOLOGY

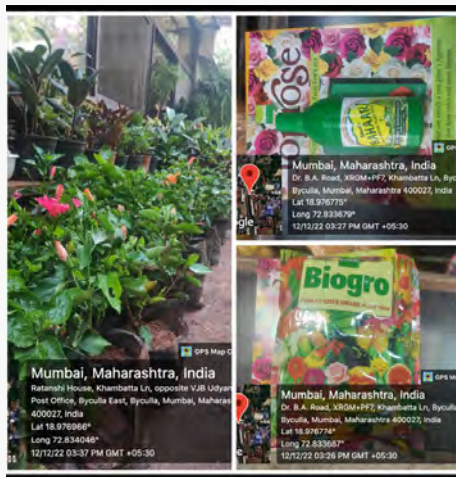


Effect of Different Fertilisers on the Growth of Hibiscus Plant



The green revolution boosted the yield of crops produced per unit of land, but it also increased the need for chemical fertilisers in farming. Numerous health issues and irreversible environmental degradation are brought on by agriculture's extensive use of inorganic fertilisers. The aim of this research is to explore the effects of organic and chemical fertilisers on the overall growth of plants and to check the carbon content of soil for the evaluation of fertiliser potential in agriculture.

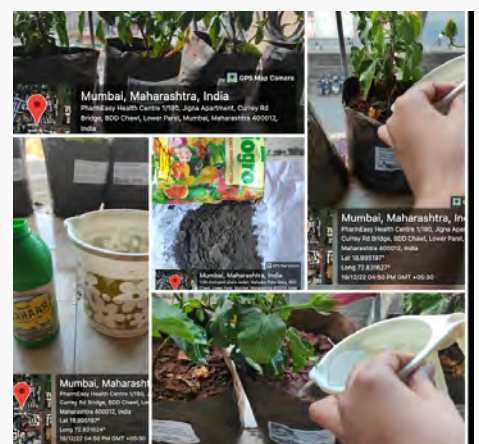
Organic fertiliser (Bioagro) consists of 20% leaf mould, 10% poultry litter, 5-7% horse and cattle refuse, 50% vermicompost and blended with plant materials and humus (10-12%) was used in this study. For the chemical fertiliser (Bahar) NPK fertiliser consisting of a mixture of the major components of nitrogen (8%), phosphorus (8%), and potassium (8%) was used. Plants were allowed to acclimatize for 2-3 days to get adapted to new environmental conditions.



The organic manure (weighed as per the requirement) and chemical fertilisers were applied to all 9 plants and 1 litre of water is supplied to plant number 10 (control). By hand, the fertiliser was dispersed equally among the plants and thoroughly incorporated into the soil. Plants were allowed to settle for 15 days. After 15 days of application of fertilisers growth measurements were performed where in few plants started showing signs of improvement while few plants started showing symptoms of toxicity and stress. At the end of the study statistical analysis was carried out.

Treatment with organic fertilisers and chemical fertilisers significantly showed the various signs and symptoms in the hibiscus plant. Treatment with organic fertiliser + chemical fertiliser significantly increased the growth of the hibiscus plant i.e. a synergistic effect of both fertilisers was observed.

However similar growth is observed in the case of organic fertilizer. But an application of chemical fertilizer leads to toxicity in plants which results in the yellowing and wilting of leaves. Findings with no substantial changes after fertilizer (chemical and organic both) application were observed in rest plants.



-Vinay Chandekar

Effects Of Microplastics & Other Polluting Agents On Mangroves Propagation



An integral part of Marine ecosystems are Mangroves. They help in maintaining the stability of tidal waves around coastal areas including many other functions. Plastic pollution has been identified as a major mangrove concern. Plastic waste becomes trapped in the extensive root system of mangroves i.e. among the pneumatophores, directly suffocating. Mangrove roots and sediment are effective at capturing plastics which affects how much plastic accumulates and spreads within the mangroves. The area that this project is focusing on is Dahisar mangrove zone. One of the main causes of involvement of human interference at Dahisar Mangrove zone is Ganpat Patil Nagar. This is a settlement which began forming in 2000. They cut down a major chunk of mangroves from the Dahisar mangrove to encroach that land. Consistently, the amount of Marine debris and plastic waste reached its peak. I wanted to point out that human interference is making a difference in the plastic quantity.



Therefore, I performed a quantitative analysis of plastic on water and soil samples, deciding two specific areas from Dahisar mangrove system, one as test (with presence of human interference) and one as control (absence of human interference). Microplastic analysis was performed with the help of Fenton's reagent which is a mixture of hydrogen peroxide and ferrous ions. I also performed a qualitative analysis where I calculated the Dissolved oxygen of both test and control water samples.

The results of the microplastic analysis were such that the microplastic debris collected in the test samples of soil and water were more in weight than the control samples. So our early hypothesis was deemed correct, about human interference affecting the Dahisar mangrove ecosystem. As far as DO is concerned, the control water sample stated DO to be 5.2 mg/L and test sample to be 2.4 mg/L. In the Literature review it was found that mangroves needed a minimum of 5 mg/L of DO for marine biota like zooplanktons and fishes to survive.



The Dahisar mangroves are a forest area that has been protecting the coastline for decades, but no concrete action has been taken yet. If quick actions are not taken, only a few years would be left for the mangrove to exist. Small steps if taken in unison could lead to a big change.

-Prerana Kamat



Comparative Biochemical Analysis of Chemical and Organic Herbicide Infused Soil Samples

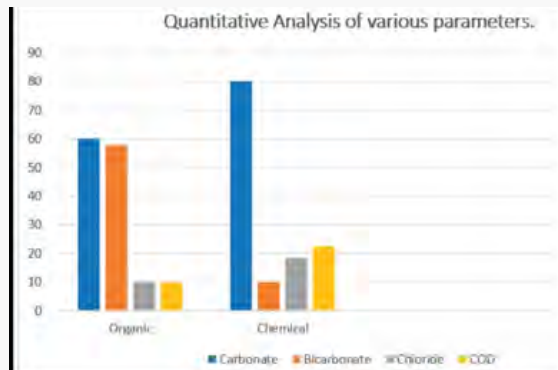


Herbicides are frequently used in the chemical control of weeds in various crops, so they are more frequently detected outside the application areas (areas which are under herbicide treatment), contributing to the risk of environmental contamination. The main protagonists, the chemical and organic herbicides used for the study were Glyphosate 41%SL (Commercial name: Sinochem Popular herbicide) and a combination of neem, vermicompost, rock phosphate, waste mica, pyrite, lime etc. (Commercial name: Hariyali Organic). The organic fertilizer “Hariyali” containing Neem, vermicompost, rock phosphate, waste mica, pyrite, lime, etc. are used in its production.



The soil sample selected to be tested was from a field in Vasai, Maharashtra. The parameters considered for doing so were that the sample had to be from a field actively under farm related activities and not barren land. Another point to be considered was the presence of weeds in the area selected. NPK stands for Nitrogen- Phosphorus- Potassium. NPK tests were done as preliminary tests as the results.

We saw excessively heightened levels of carbonate in chemical herbicide infused soil and slight increase in the same bicarbonate levels as well. We can infer using the above information how that would be hazardous to the overall soil health. From the quantitative tests performed for determination of chloride levels in soil it was established that the chloride levels showed a linear and steep increase in the chemical herbicide infused soil as compared to a very slight increase in the organic herbicide soil samples. The general consensus has been that Cl^- inhibits NO_3^- uptake and accumulation in higher plants, which lowers agricultural output. By testing the various parameters i.e NPK testing, wet tests for soil pollutant levels and COD testing and by analysis of the acquired results we can successfully conclude that chemical herbicides have a range of hazardous effects on the well-being of soil ranging from making other essential ions less available, decreasing nutrition uptake, reduce the fertility of the soil and poison crops, reducing the amount of land that can be used for agriculture, inhibiting NO_3^- uptake and accumulation, lowering agricultural output etc. making it ill-suited for usage bearing soil health in mind.



-Pranali Dongre



Sustainable Colour for a Sustainable Future



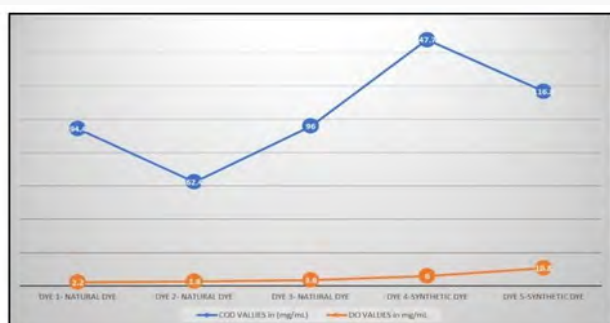
Dye is a colour-giving substance that is used to give textiles, paper, leather, and other materials their colour. Natural dyes are widely found in plants, animals, and microorganisms. They have a number of positive health effects, including antioxidant, anti-inflammatory, anti-cancer, antimicrobial, and anti-viral properties. But nowadays chemical and synthetic dyes are ruling the world.

In this work *Allium cepa*, *Spinacia oleracea L*, *Curcuma longa* was used to extract dye. Onion pigments predominantly consist of flavanols while spinach consist of chlorophyll and turmeric have curcuminoids. Extraction was done by exhaustive extraction technique by using soxhlet apparatus.



The extracted dye samples were used to test different parameters such as efficiency, durability, mordant technique and to check dissolved oxygen (DO) and chemical oxygen demand (COD). For the efficiency test three different types of fabric were taken: Muslin cloth, Poly cotton and Synthetic fibre. The fabric was allowed to be kept in dye solution in different time intervals to check which time intervals provided with best results. For mordant Aluminium potassium sulphate also commonly known as Alum was used. To check the durability detergent, dish wash soap and bathing soap was used.

Water is a vital resource for both the survival of life on the planet and the growth of civilization. The textile industry is one of the anthropogenic activities that pollutes and uses the most water. Textile dyes significantly increase BOD and COD levels, photosynthetic impairment, plant growth inhibition, access into the food chain, mutagenicity, and carcinogenicity. As a result, in this study, the DO and COD levels were also tested and compared with chemical dye.



The purpose of this project is to see if the harmful chemical dye which is playing a major role nowadays can be replaced using a natural source which can promise the same effects as that of chemical dye. Through my work it was seen that natural dye has quite promising durability and efficacy and also causes less damage to aquatic ecosystems due to less DO and COD levels.

Without a doubt, there is a lot of discussion regarding natural dyes and their applications, even though none of them are entirely sustainable. Some fundamental characteristics for a viable natural plant dye are colour performance and quality, affordability, environmental responsibility, and health considerations. Nevertheless, colourants from natural sources might be utilised more frequently in the textile industries as a potential replacement for some synthetic dyes.

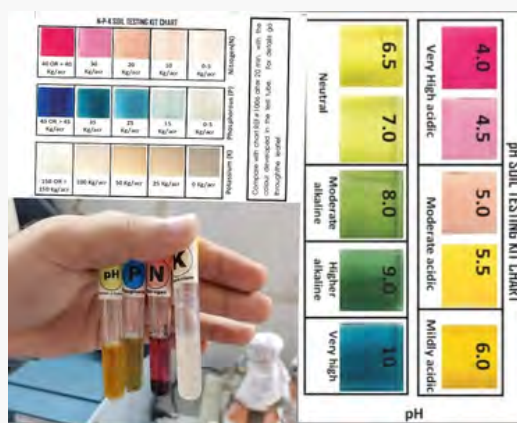
-Drishya Nair



To Study and Check Whether Green Detergents are Less Toxic than Conventional Detergents

Greywater is defined as the generated wastewater from household activities, which include bathroom, showers, laundry, and kitchen but not black water from the toilet. The percentage of greywater generated from household activities represents 50–80% of the total water usage; among these wastes, the laundry greywater represents up to 33%. The soil environment consists of a variety of physical, chemical and biological factors that affect the abundance and diversity of microbes found in the soil. The main aim of the study is to compare green detergents with conventional detergents and know the effects of them on soil and earthworms.

The conventional detergent was found to be quite detrimental to earthworms in higher concentrations. Different doses of detergent i.e 5ml and 10 ml were administered to the soil in trays. A control set up was run parallel to the experimental setup. There were significant changes in weight and length of tested earthworms after exposure to high doses of green and conventional detergent. The weight of earthworms exposed to high concentration of conventional detergent decreased steadily than in green detergent. The sharp decrease in the weight of earthworms revealed that high concentration of conventional detergent was detrimental to the worms. However, at low concentration of detergent there was no significant change in morphological parameters like weight and length of the earthworms in green detergent but in conventional detergent the growth was slow. The properties of soil were checked using the NPK kit which helps in giving the approximate levels of nitrogen, phosphate and potassium in the soil. The pH of soil was also checked using the kit.



But even if a low concentration of detergent is discharged to the soil repeatedly, thus there is a probability for the bioaccumulation of detergent in the soil as well as inside earthworm and it may affect its normal functions.

This study is thus to examine the effects of green and conventional detergent on earthworms and soil as the grey water is often disposed of in the soil which affects the properties of soil as well the earthworms present in it. By this work, we conclude that low concentration of green detergent used in this study is not harmful for earthworms and even the

nitrogen, phosphorus, potassium content in soil is not affected. But high concentration of conventional detergent affects the pH of the soil and to an extent (NPK content).

Even though the low concentration of detergent is discharged into soil, if the earthworms get enough food and moisture, they are able to grow normally. When a high concentration of green detergent is discharged it affects the growth of earthworms but when conventional detergent is discharged into the same area of soil, it adversely affects earthworms. It will make a considerable decrease in growth and functioning of earthworms and can be fatal.

-Tanushree Patil

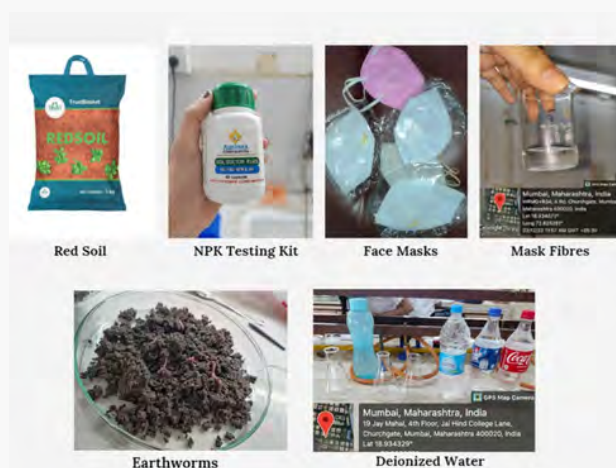


Evaluation of the Eco-Toxicological Effects of Soil-Borne Face Masks on Earthworms

The COVID-19 pandemic has led to an increase in plastic face masks, which are often composed of polypropylene, adding to the issue of microplastic pollution. Earthworms are critical for soil productivity but are susceptible to ingesting and accumulating microplastics. This article discusses the ecotoxicological effects of microplastics on earthworms and the potential impacts on their behavior and physiology.

The study used *Eisenia fetida* earthworms, and soil samples were prepared using red soil. Microplastics were prepared by cutting face masks into small pieces and immersing them in deionized water on a shaker for six days. The earthworms were divided into three groups, with the first group exposed to mask layers 1-3, the second to layers 4-6, and the third serving as a control. The earthworms were exposed to microplastics for 28 days, and their behaviour and physiology were monitored.

The behavior of the earthworms was monitored daily, including movement, feeding activity, and burrowing behavior. The earthworms' body color, length, and shape were analyzed to understand the effect of microplastics. Earthworms exhibit shivering or vibrating behaviors to increase dispersion or escape low oxygen levels, and negative phototaxis is a defensive mechanism as they are sensitive to UV radiation. Earthworms change color when exposed to soil treated with microplastics due to various factors. Exposure to microplastics results in weight loss and possible intestinal irritation or hindered nutrient absorption.



In conclusion, the increased use of plastic face masks during the COVID-19 pandemic has led to potential environmental consequences. This study provides insights into the ecotoxicological effects of soil-borne face masks on earthworms, highlighting the need for sustainable alternatives to plastic face masks and improved waste management to mitigate the negative impacts of plastic waste on the environment.

Overall, this research suggests that microplastics may have negative impacts on the health and behavior of earthworms. Furthermore, microplastics can alter the chemical and physical properties of the soil, leading to a decline in biodiversity. Additional research is needed to fully understand the effects of microplastics on soil ecosystems.



-Kainat Khan



The Millets are Back!

The Story of Millets Began More than 4000 Years Ago

Millets are currently poised for a comeback. There are initiatives to boost millets' demand. Efforts are being made to change people's attitudes in this regard. This superfood's nutritional value and sustainable production are being promoted through restaurants, culinary groups, workshops, recipe books, and exhibitions. The fact that millet is gluten-free and hence perfect for people who are sensitive to contemporary wheat or other gluten containing grains is another factor contributing to its recent rebirth.

Gluten-free cuisine has changed over the past 10 years from being derided for its flavour and texture to being a way of life for health-conscious customers in affluent nations. The availability of millets in these areas is being driven by demand created by informed urban and semi-urban customers.

Unfortunately, backward integration is still difficult, and it is very worrying because the revenue from value addition has not trickled down to the farmers to create demand. Multiple organisations are emerging to promote this cause. The Smart Food campaign, with the slogan "good for you, good for the planet and good for the smallholder farmer," being one instance.

They are environment-friendly due to their diversity and ability to adapt to various climatic conditions and farming techniques, millets make a compelling case for both enhancing biodiversity and diversifying the world's supply of food grains. Millets are the most reliable food crops for humans under a scenario of climate change, especially for the resource-poor dryland farmers of the world because they are climate change resistant and ensure sustainable grain production with minimal inputs. The versatile ones like foxtail millet, barnyard millet, proso millet, and little millet, have the ability to adapt to any climate shift and protect farmers from a complete crop failure.

The future increased millets production and consumption directly aid in reducing malnutrition and reducing the rate of progression of diseases like anaemia and escalating health issues including diabetes, hypertension, metabolic syndrome, and gluten intolerance.

Millets can now be projected as superior nutritious cereals that are good for human health thanks to data on scientific evidence supporting their nutritional claims.

Moreover, ready-to-eat and ready-to-cook varieties of millet dishes are now offered. Because of the increased prices brought on by this new demand for millets, their production may become lucrative, guaranteeing millets' rightful position in global food basket.



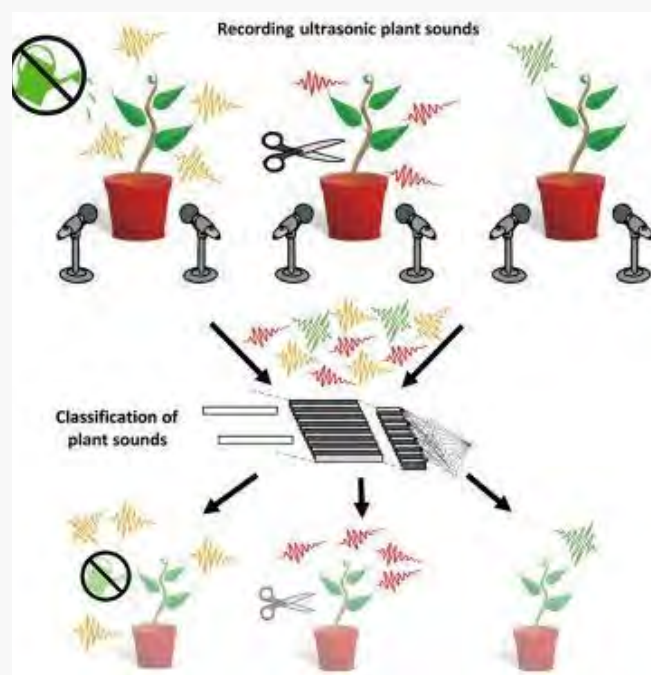
-Shravani Kelkhar



Sounds Emitted by Plants under Stress: Airborne and Informative

Plants show off significant changes in their phenotypes in reaction to pressure. They differ visually, with reference to both colour and shape, from unstressed plants. Mostly, plants have been demonstrated to produce visual, chemical, and tactile cues, which other organisms can respond to. Nevertheless, the capability of plants to discharge airborne sounds that could potentially be heard by other organisms has not been sufficiently explored. “There are brutes that can hear these sounds, consequently there is the potentiality that a lot of auidial commerce is being. “Although ultrasonic climate has been recorded from plants ahead, this is the first validation that they are airborne, a fact that makes them more workable for other organisms in the fiefdom.”

In their disquisition, Professor Hadany and compatriots exercised microphones to record healthy and stressed tomato and tobacco plants, first in a devitalized auidial chamber and in a noisier greenhouse fiefdom. They stressed the plants via two styles, by not distressing them for several days and by cutting their stems. After reporting the plants, the researchers trained an engine-knowledge algorithm to disassociate between unstressed plants, thirsty plants, and slash plants. They set up that stressed plants discharge farther sounds than unstressed plants. The plant sounds recalled pops or clicks, and a single stressed-out plant emitted around 30- 50 of these clicks per hour at callers of 40- 80 kHz and apparent arbitrary intervals, but unstressed plants emitted far lower sounds.



The exact medium behind these bow-wows is unclear, but the authors suggest that it might be due to the conformation and eruption of air bubbles in the plant’s vascular system, a process called cavitation. Whether the plants are producing these sounds in order to live with other organisms is also unclear, but the fact that these sounds reside has monumental ecological and evolutionary implications.

“It’s practicable that other organisms could have evolved to hear and respond to these sounds.”

-Harsh Jain



WORD SEARCH TIME!!!!

PHYTOLOGY



ACTINOMORPHIC
BRACT
ENTIMOPHILY

OCREA
LANCEOLATE
RACHIS

MEGASPORE
PERIANTH
XEROPHYTE





ENVIRONMENTAL MICROBIOLOGY



Comparative Study of the Antimicrobial Property of *Spirulina platensis* and *Chlorella vulgaris* on *Escherichia coli* and *Staphylococcus aureus*

Antibiotics are extensively used antibacterial agents. The antibiotic's flaws are resistance effects and components that can also have harmful effects. As a result, the usage of antibiotics began to be replaced by the use of natural antibacterial agents. The rising usage of industrial medications, particularly antibiotics, has had numerous detrimental implications. Furthermore, due to the emergence of mutations against these antibiotics, abuse of these antibiotics resulted in the development of disease-causing bacteria that were resistant to them. As a result, there has been a push towards using alternative materials to reduce negative health effects. Because of the numerous advantages of employing plants and their extracts, many pharmaceutical companies have begun to develop a variety of extracts from medical algae that require minimal therapeutic doses and have no toxicity.

This study focuses on determining the antimicrobial properties of *Spirulina platensis* and *Chlorella vulgaris*, because of their high usage in the nutritional field as dietary supplements. As microalgae, they tend to contain substances that help to inhibit microbial growth. *Escherichia coli* and *Staphylococcus aureus* are the two bacterial species used because they majorly contribute to causing diseases in the human gut. This study aims to determine the efficacy of algae *Chlorella vulgaris* and *Spirulina platensis* in inhibiting and reducing pathogenic bacteria *Escherichia coli* and *Staphylococcus aureus* growth. Hence, an antimicrobial sensitivity test was performed for both the species of microbes against both species of bacteria.



Figure 6- Growth inhibition of *Escherichia Coli* and *Staphylococcus aureus* by *S.platensis*.

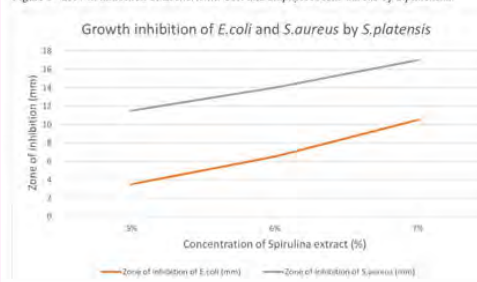
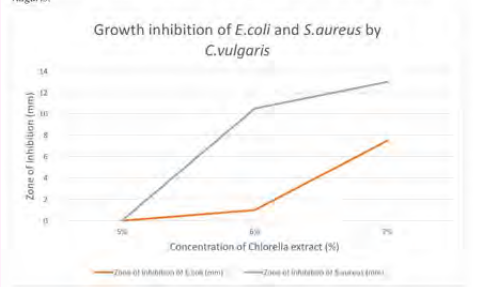


Figure 7- Growth inhibition of *Escherichia Coli* and *Staphylococcus aureus* by *Chlorella vulgaris*.



Spirulina platensis is a cyanobacteria. Microcystin, a cyclic heptapeptide, is found in all cyanobacteria. The current study found that biological treatment with the algae *Spirulina platensis* and *Chlorella vulgaris* on *Escherichia coli* and *Staphylococcus aureus* bacteria at different concentrations, considerably inhibited their growth as the concentrations increased. The rate of growth slowed, and the inhibition increased. In comparison to the researched algae, the *Spirulina platensis* algae were more successful in inhibiting, implying that the studied bacteria were more sensitive than the *Chlorella vulgaris* algae. All tested *Spirulina* and *Chlorella* extracts displayed antibacterial properties that grew stronger in a concentration-dependent way. We conclude that *Spirulina* and *Chlorella* may function as promising natural antibacterial agents. They can therefore be used as substitutes for antibiotics and other conventional chemical medications.

-Riya Mehta



Effect of Phenol and its Derivatives on *Daphnia magna* and Testing its Toxicity Level



Phenol is regarded as poison, categorised under the second class of hazards due to its toxicity. This indicates that it poses a serious environmental risk. Phenol and its derivatives can have toxic effects on *Daphnia magna*, a species of freshwater crustacean, commonly used as a model organism in ecotoxicity testing. The toxicity of phenol and its derivatives is primarily due to their ability to interfere with cellular respiration and other vital processes. In high concentrations, phenol and its derivatives can cause death, reduced growth and decreased reproductive success in *Daphnia magna*. In high concentrations, phenol can cause mortality, inhibit feeding behaviour and disrupt the normal life cycle of the organism. In lower concentrations, phenol can cause sub-lethal effects such as changes in swimming behaviour, reduced fecundity and alterations in biochemical processes.

To test the effect of phenol and its derivatives on *Daphnia magna*, the following four parameters were studied:

1. Heart rate
2. Colour change chemical toxicity
3. Mobility- Movement
4. LC50

The derivatives considered here are: (1) Phenol (2) Adipic acid (3) Phenolic resins.

The organism was being fed with yeast granules as a nutritive source on a daily basis. With these parameters being tested on the cultures, 0.2ml in 10ml concentration showed decreased mobility and further death, colour change to reddish brown which indicated toxicity and decreased heart rate. This concentration is regarded as lethal concentration. This was observed with respect to phenol and its other two derivatives as well. This indicated complete toxicity. Apart from this the entire assay indicated that 0.1ml in 10ml concentration is safe for the organism before it moves to further toxicity. Considering these results, 0.1mg/dm is the ideal concentration of phenol and its derivatives to be let into water bodies. The organism reacted in several different ways to different concentrations of chemicals, they either showed decreased or increased heartbeat, halted or sped up mobility and colour change due to chemical toxicity or no colour change. Further work should be done on more derivatives of phenol as well as other chemicals and its derivatives and other model organisms too with extracted chemicals from products and industrial waste water. To estimate the dissolved oxygen content, BOD should also be measured.



-Sanika Naik

Custard Apple Seed Extract and its Antimicrobial Properties



This research aims to determine the effects of custard apple (*Annona squamosa*) seed extract on the growth of *Escherichia coli* and *Staphylococcus aureus* bacteria. The treatment was used to reduce the inhibition zone growth of *E.coli* and *S.aureus*. Agar cup method was used as supporting data. Custard apple is a tropical fruit belonging to the Annona and Annonaceae family. It contains alkaloids and its seeds contain acetogenins, which are toxic to insects and have insecticidal capabilities. ACGs have a wide variety of biological properties, including anti-inflammatory, cytotoxic, immunosuppressive, pesticidal, antiparasitic, and antimicrobial properties.

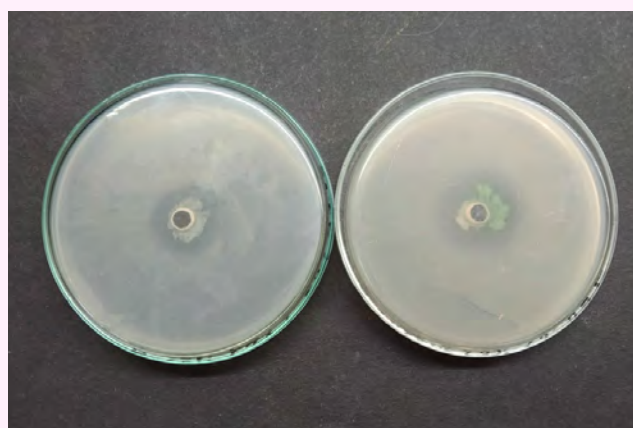


Custard apple is an insecticide, antifeedant, and repellent. Research has shown that its seed extract has a strong anti-tumor activity with acetogenin being the most potent mitochondrial complex I inhibitor. Acetogenin compounds have a wide ability as pesticides, parasiticides, antimicrobials, inhibitors of cell growth and anti-cancer properties.



The average diameter of inhibition zones of *Escherichia coli* and *Staphylococcus aureus* for the extracts were 23.5 mm (20 days old extract), 21.5 mm (10 days old extract) and no inhibition zone for freshly prepared extracts. Therefore, the extract is more efficient on microorganisms after being stored for 20 days and 10 days. The seed extract of custard apple is effective in inhibiting the growth of *Escherichia coli* and *Staphylococcus aureus*. The inhibition zone of bacteria due to the seed extract can be observed by measuring the diameter of the constraints zone formed.

The 20 days stored extract yielded the widest area of the inhibition zone, which is 23.5 mm. The inhibition zone is an area around a well or paper disc that is not overgrown with bacteria. The diameter of the inhibition zone formed showed the effectiveness of the seed extract of custard apple in inhibiting the growth of *Escherichia coli* and *Staphylococcus aureus*. The formation of an inhibition zone due to the seed extract showed that the seed extract has an antibacterial active compound that can inhibit and even kill the bacteria. An antibacterial can act by inhibiting the synthesis of important metabolites in bacteria.



-Sundari Kumari

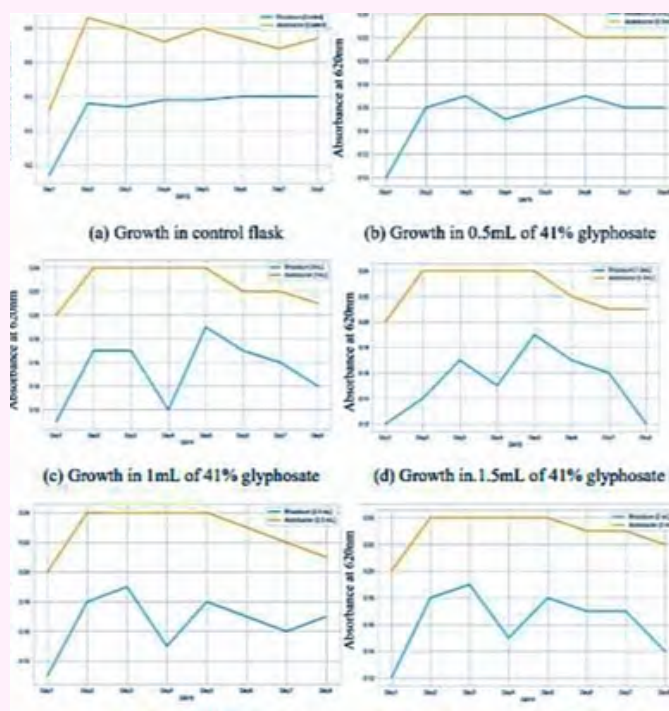


Effect of Glyphosate on Nitrogen Fixing Bacteria *Rhizobium* and *Azotobacter*

Glyphosate is a broad-spectrum herbicide derived from phosphonic acid used to kill specific types of broadleaf weeds and grasses growing in the field. It inhibits an enzyme 5-enolpyruvyl-3-shikimate phosphate synthase of shikimate pathway which takes place in plants for the synthesis of amino acids phenylalanine, tyrosine and tryptophan. According to various studies performed, certain microorganisms have the ability to resist the action of glyphosate whereas some organisms have the ability to degrade glyphosate and use it as their nutritional intake such as carbon or phosphorus sources. Considering the environmental impacts glyphosate has on humans, animals, algae and aquatic organisms, this paper aims at highlighting the impact of glyphosate on two majorly found nitrogen fixing soil microorganisms *Rhizobium* and *Azotobacter*.

Introduction of the inoculum was done to different concentrations of glyphosate and the absorbance was checked for seven days. After the results were obtained the graphs for each concentration were plotted and the following results were observed. It was observed that a dip was seen in the absorbance of *Rhizobium* on day 4, at all concentrations.

Flask	Amount of Bushnell Hass media (mL)	Bushnell Hass media (mL) Amount of 41% glyphosate (mL)	Amount of <i>Azotobacter</i> / <i>Rhizobium</i> suspension (mL)
Flask 1	100mL	0.5mL	2mL
Flask 2	100mL	1mL	2mL
Flask 3	100mL	1.5mL	2mL
Flask 4	100mL	2mL	2mL
Flask 5	100mL	2.5mL	2mL
Flask 6	100mL	3mL	2mL



Certain amount of growth was observed with respect to *Rhizobium* in all the concentrations of glyphosate but a significant decrease in the duration of stationary phase was seen as compared to the control which explains that the organism is somewhat able to degrade the glyphosate present in the medium. On the other hand, in the treatment of *Azotobacter* it was observed that as the concentration of glyphosate increased the duration of stationary increased significantly which shows its ability to survive in high concentrations of glyphosate.

From the overall results, it can be concluded that different nitrogen fixing bacterial communities show different growth/behavior from one another towards glyphosate whereas some organisms are able to degrade the glyphosate concentrations and some are able to degrade the glyphosate as their nutritional source. Further studies also show that glyphosate may be toxic to other nitrogen fixing bacterial strains. Hence, further studies on the effect of glyphosate needs to be done in order to understand growth behavior of other nitrogen fixing bacteria in the presence of glyphosate.

-Vipra Parekh



Effects of Cardioactive Drugs on *Daphnia magna*

The sophistication of the models utilized by pharmacology to determine and comprehend the mechanisms of action of drugs has advanced significantly. Additionally, in diversifying particular models to investigate a single determined pharmacological impact. The main aim of this study is to check the effects of different cardioactive drugs on *Daphnia magna* and to observe the impact of these drugs on various parameters like heart rate, mobility and chemical toxicity. *D.magna* bioassays have a number of valuable benefits, including ease of laboratory culture, brief life cycle, discrete growth, transparency, simplicity of use and low maintenance costs.

The basic physicochemical parameters of the drug solutions were measured prior to performing the bioassays. The medication solutions were exposed to light and air environmental experiments. The drugs chosen were verapamil, metoprolol and metaproterenol based on their location of action and solubility in water. The toxicity of these drugs is primarily due to their ability to interfere with vital processes of the organism.



In high concentrations, these drugs can cause the death of the organism. Verapamil caused a dose-dependent acceleration of heart rate to decrease at higher concentrations and showed a negative inotropic effect. Metoprolol induced a positive chronotropic effect only at the lowest concentration while high concentrations caused a gradually progressive slowing, so the frequency decreased significantly. Metaproterenol caused a positive chronotropic effect in increasing order on the organism; there was an increase of up to 25 percent. Metaproterenol had no activity at any dose upon systole and diastole.

The organism was being fed with the yeast granules on a daily basis. The parameters being tested on these cultures, in a lower concentration of these drugs showed normal activity of the organism whereas in higher concentrations of the drugs showed hyperactivity and also the death of the organism. At concentrations 25 mg and 50 mg metoprolol caused the organism to take up a reddish brown color that indicated complete toxicity and verapamil showed no color change. According to this research, the most toxic drug of all was metoprolol because at higher concentrations it is the most toxic for the organism. Further work needs to be done on more cardioactive drugs as well as on other organisms along with the measurement of BOD as another parameter for the organism.



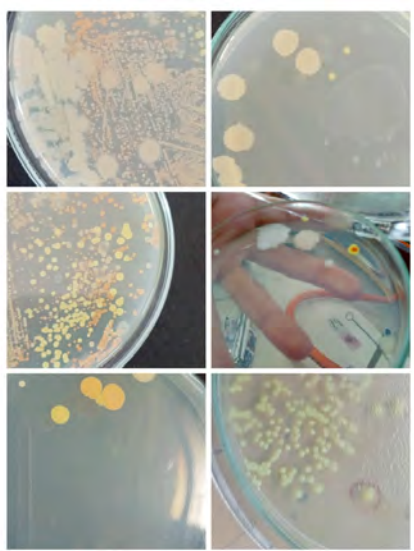
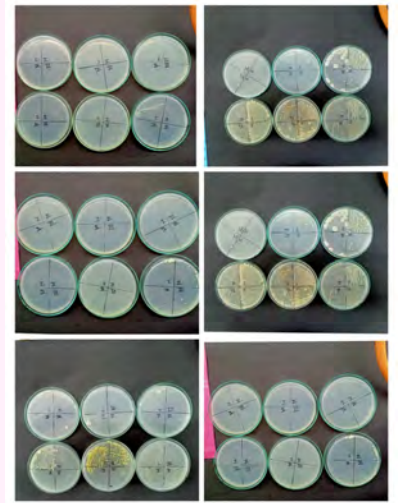
-Shubham Gautam



Microbial Cross Contamination using Multi-Dose Eye Drops

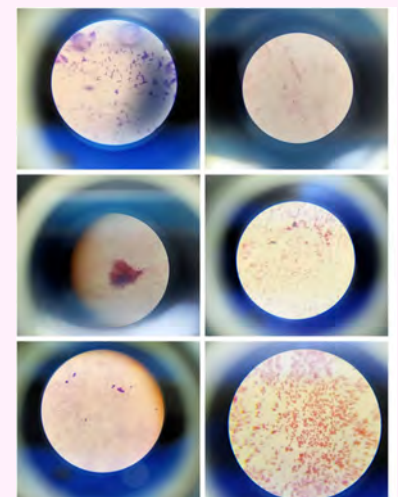


Contamination of eye drops is a major global cause of ocular illness and is linked to serious eye infections. Infected eye drops, usage of contact lens, recent eye surgery, previous ocular surface disease, dry eyes, deformed lids, impaired corneal sensibility, continuous use of topical steroids and systemic immunosuppressants are all possible risk factors. Five brands of eye drops were collected and tested for potential microbial contamination under sterile circumstances. Nutrient agar medium was prepared and cultured according to the standard procedures of streak plate method. Microbial analysis was performed on the dropper tip, cap, the solution and a sterile nichrome loop was used to inoculate on the culture plates.



After incubating plates for 72 hours, the growth of bacterial colonies and colony characteristics of the bacteria isolated were studied. This study found that the frequency of bacterial contamination increases as the number of days that a drug is taken increases. The dropper tips had a greater contamination rate than the remaining bottle contents. Gram-positive bacteria like *Staphylococcus*, *Bacillus*, *Micrococcus* species and gram-negative bacteria like *Roseomonas*, *Proteus*, and *Enterobacter* species made up the majority of the microorganisms that were found. The type of bacteria discovered in the eye drops suggests that the drugs may have come into contact with patients' eyelids or the hands of the applicator, in addition, they may have been left open. The connection between viral contamination and duration of usage as well as between brands that contain an antimicrobial agent and those that don't, has been observed in previous studies. This study looked into the potential for cross-contamination in multi-dose eye drop bottles and identified the bacteria causing contamination.

Optimising the angle at which eye drops are injected has major clinical implications and has the potential to prevent blindness and serious corneal surface infections. This study found that preservative-free eye drops are more likely to be contaminated than eye drops that contain preservatives. *Staphylococcus*, *Bacillus* and *Micrococcus* species were the predominant contaminants on the dropper tip, which was more contaminated than the whole bottle contents and the bottle cap. Longer-term drug use was observed to increase the chances of eye drops being contaminated. Single-drop disposable eye containers should be used and a unidrop dispenser should be used for any patient who might be infected or has an exterior eye condition.





WORD SEARCH TIME!!!!

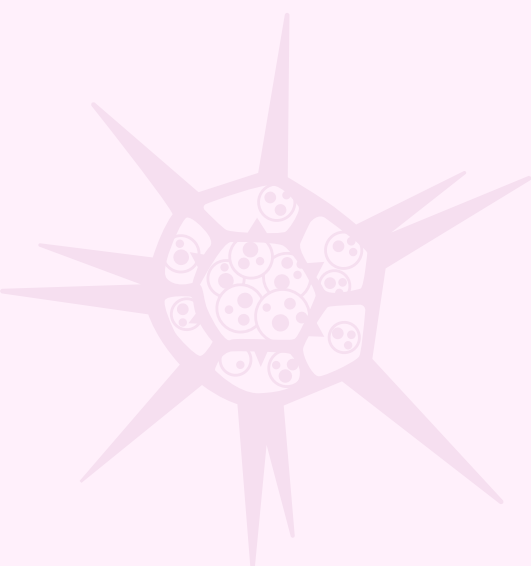
ENVIRONMENTAL MICROBIOLOGY



BIODETERIORATION
 CYANOBACTERIA
 DIATOMS ALGAE

ENDOSPORES
 EUTROPHICATION
 FLAGELLATES

HYPERTHERMOPHILES
 PSYCHROPHILES
 XENOBIOTIC





MOLECULAR BIOLOGY



Cell Division- Symphony of Life

In the very core of life, where the tiniest of forms reside,
A cycle of growth and renewal, a process we cannot hide.

Cell division, the magic that creates life anew,
A symphony of nature, that forever rings true.

It all begins with a single cell, so small and divine,
With its nucleus, cytoplasm, and everything just so fine.

It goes under four phases,
G1, S, G2 & mitosis, its life stages.

The G1 phase makes proteins and carbohydrates,
In the S phase, the DNA replicates.
G2 phase completes the pending,
And the mitosis is the ending.

Mitosis is the last step, where the nucleus splits,
The chromosomes align, with perfect little fits.
The spindle fibers pull, with such gentle force,
Ensuring that each cell receives an equal portion of the source.

The chromosomes divide, and replication ensues,
The cycle of life, a dance that forever renews.
Then comes cytokinesis, the final step of the dance,
Where the cell membrane pinches, with so much elegance.

The cytoplasm divides, and the cell is split in two,
Two new cells are born, each with something new.
This cycle repeats, over and over again,
A process so essential to all living things.

From a single cell, to a complex being,
Cell division, the key to life's meaning.
Through this process, our bodies grow,
And our cells multiply, with each ebb and flow.

From the beating of our hearts, to the thoughts in our mind,
Cell division is the magic that makes us so divine.

And yet, this dance is not always perfect,
Mutations can occur, and the cycle can disrupt.

Cancer is one such example, where cells divide unchecked,
A reminder of the importance of keeping our health in check.

In the smallest of worlds, where life is born,
Cell division is the essence that forever transforms.

The wonder of nature, in the tiniest of forms,
A symphony of life that forever warms.
So let us celebrate, the beauty of cell division,
A process so complex, yet with so much precision.

The essence of growth and renewal, that makes us who we are,
Cell division, the cycle of life, a wonder so bizarre.

From the embryonic stage to the aging process,
Cell division is the key to our progress.

It fuels our development, and repairs our wounds,
And allows us to adapt to the changing monsoons.
It's a cycle that never ends, from birth to death,
A cycle that's woven into every breath.

And as we marvel at the beauty of life's design,
Cell division remains, the miracle that forever shines.

So let us cherish the dance, that creates new life,
And embrace the wonder that comes with each strife.

For in the smallest of forms, lies the essence of being,
Cell division, the cycle of life, forever freeing.

-Hansa Sharma



Black Death



Plague is one of the deadliest diseases in human history which has incapacitated humanity for thousands of years. It is an infectious disease mainly caused due to a bacterium known as *Yersinia pestis*. *Y. pestis* affects mammals and is spread by fleas. This bacterial infection is usually found in rodents which are associated with fleas, which readily vault over to humans in close contact. There are three types of plagues, this depends on where the bacterium *Y. pestis* attacks, namely bubonic plague which infects lymph nodes, septicemic plague which infects blood and pneumonic plague which affects the lungs.

For a very long time, the precise origin of plague epidemics was unknown and wrapped in mythology. Yet in 1894, Alexandre Yersin made the discovery of *Yersinia pestis*, the bacterium that causes plague epidemics, as a result of rigorous observation and scientific advancements.

It is most probable that Genoese ships coming from Central Asia brought the flea-infested rats bringing the Black Death to Messina, Sicily, in October 1347. This was the start of a plague epidemic that swept over most of Europe like wildfire. Victims of the plague in Europe typically passed away a week or less upon becoming ill. From 1347 and 1352, the Black Death eventually claimed the lives of around 25 million people in Europe, at least one-third of the continent's population. Throughout centuries, especially in urban areas, the Black Death persisted. One of the epidemics was the Great Plague of London (1665-1666), which resulted in the deaths of 70,000 people.

The black death is a bubonic plague which is believed to have been a result of plague caused due to *Y. pestis*. This bacterium is virulent, rod shaped and is typically spread through the bite of infected fleas, causing bubonic plague. This bacterium injects its toxins into defense cells which are tasked to detect foreign substances or bacterial infection. This disables the immune system of the host. Small mammals like rodents, mice, squirrels, etc., act as a host for this bacterium. During its enzootic cycle (a disease or cycle occurring continuously among non-human animals in a particular region) *Y. pestis* circulates at low rates among the small mammals which is undetected as it does not cause any outbreak.

When the bacteria pass to another species, during the epizootic cycle (higher than average occurrence of the disease), humans face a higher risk of contracting plague bacterium. Fever, exhaustion, shivering, nausea, headaches, giddiness, sensitivity to light, back and leg pain, insomnia, apathy and delirium are among symptoms. Moreover, it leads to buboes, which are sore and swollen lymph nodes that typically develop in the groin or armpits. These buboes are filled with pus and blood.

Unlike many illnesses, which thrived over the winter, the Black Death was not an airborne infectious disease. As sanitation, hygiene, and medical technology improved, the epidemic subsided. Despite the fact that no one is quite certain of the cause or manner of the Black Plague's final eradication, scholars do have a few intriguing theories. According to a number of specialists, modernization was the most likely factor in the extinction of the plague.

-Aarya Bait



BioSentinel



The Earth's magnetic field shields space station crew from much of the radiation that can damage the DNA in our cells and lead to serious health problems. When future astronauts set off on long journeys deeper into space, they will be venturing into more perilous radiation environments and will need substantial protection.

With the help of a biology trial within a small satellite called BioSentinel, scientists at NASA's Ames Research Center, in California's Silicon Valley, are taking an early step toward changing results. BioSentinel will be the first long- duration biology trial to take place beyond the space station routeways near Earth. BioSentinel's spacecraft is one of 10 CubeSats set to launch aboard Artemis I, the first flight of the Artemis program's Space Launch System, NASA's important new rocket. The cereal box- sized satellite will travel to deep space on the rocket and also fly past the Moon in a direction to route the Sun.



Once the satellite is in position beyond our Earth's defensive glamorous field, the BioSentinel platoon will spark a series of trials ever, cranking two strains of the incentive *Saccharomyces cerevisiae* to grow in the presence of space radiation. Samples of incentive will be actuated at different time points throughout the six to twelve month charge. The primary ideal of BioSentinel is to develop a biosensor instrument to describe and measure the impact of space radiation on living organisms over long durations beyond low-Earth Route (LEO). The BioSentinel biosensor utilizes budding incentive *Saccharomyces cerevisiae* to query the natural response to ambient deep space radiation, including DNA damage like the conformation of double beachfront breaks (DSBs). The biosensor contains two genetically finagled incentive strains a wild type strain that serves as a control for incentive health and "normal " DNA damage form, and a rad51 omission strain, which is imperfect for DNA damage form, and will thus suffer differences to growth and metabolism as it accumulates radiation damage.

These changes will be detected by the biosensor cargo. Growth and metabolic exertion of the incentive cells will be measured using a 3- color LED discovery system and the metabolic index color AlamarBlue ®. The BioSentinel charge is funded by the Advanced Exploration Systems program within the Human Exploration and Operations Mission Directorate at NASA Headquarters. Partner associations include NASA Ames Research Center for the development of BioSentinel, and NASA Johnson Space Center for the LET spectrometer.

-Ketaki Akhave



Viral Complexity



Invisible to the naked eye, they reign,
A force of nature, a biological chain,
Viruses, they infect and spread,
A tiny but mighty life-form, born undead.

Their genetic code, a simple strand,
Ravages cells with a lethal demand,
A master of mutation, they swiftly adapt,
Evolving their way through each pathogen trap.

Some hijack the cells of living hosts,
Piercing the membrane like virus ghosts,
They insert their DNA, and they replicate,
Infecting the cells at an alarming rate.

Others invade our cells, with a viral key,
Forcing our bodies to bend the knee,
Influenza, HIV, and Ebola too,
Causing pandemics and devastation anew.

They come in all shapes and sizes,
From rods and spheres to twisted guises,
Some covered in spiky projections,
Others with filaments and flagellations.

Viruses, they challenge our immunity,
A constant threat to our community,
With vaccines and treatments, we fight,
To end their reign and restore our might.

They are a marvel of nature, a mystery,
An enigma that fascinates history,
But we must stay vigilant, stay aware,
For viruses, they will always be there.

From the depths of the ocean, to the highest peak,
Viruses dwell where life may seek,
Surviving in extreme conditions,
A testament to their resilient compositions.

Their role in evolution, a curious tale,
From the earliest forms of life, they did prevail,
Co-opting genes, shaping evolution,
Their impact on life, a scientific revolution.

From the Spanish flu to COVID-19,
Viruses have caused human suffering,

But in the depths of their deadly grip,
We've found new ways to work and coexist.
Their study brings forth a wealth of knowledge,
And advancements in science, we acknowledge,
For within their tiny frames we find,
New treatments, therapies, and hope of a kind.

As we battle with these invisible foes,
New technologies and knowledge grows,
To help us combat and overcome,
The constant threat of the viral outcome.

So let us continue to study and learn,
For viruses, they still have much to earn,
But with science as our guiding light,
We'll vanquish them, and win the fight.

As we delve deeper into their microscopic world,
New discoveries and insights are unfurled,
Their mechanisms of infection, replication,
Provide clues for a cure and a prevention.

From the antivirals and monoclonal antibodies,
To the RNA vaccines and gene editing therapies,
We are unlocking the potential of modern medicine,
To counter the impact of the viral demon.

And yet, viruses, they continue to evolve,
Adapting to the challenges we try to solve,
A constant battle, a never-ending war,
Against a foe that we cannot ignore.

But with a steadfast commitment to research,
And a collaborative effort from every perch,
We can stay ahead of the viral wave,
And ensure a brighter future, for all to pave.

For viruses, they are not just a scourge,
But a reminder that nature we must not urge,
For in our pursuit of progress and growth,
We risk unleashing a viral beast, a global oath.

So let us respect the delicate balance,
And take measures to prevent viral violence,
For only then, can we hope to achieve,
A world where viruses no longer deceive

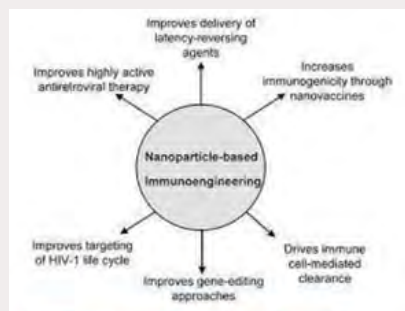
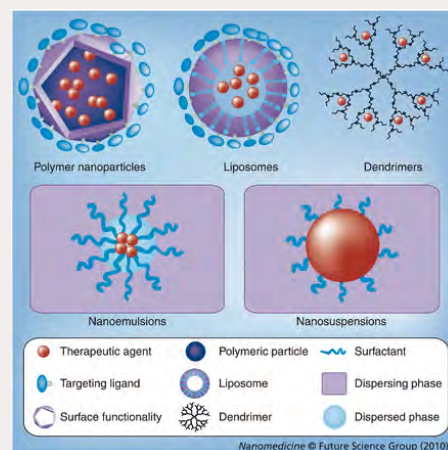
-Saiyyam Parikh

Nanotechnology Approaches for HIV/AIDS Treatment



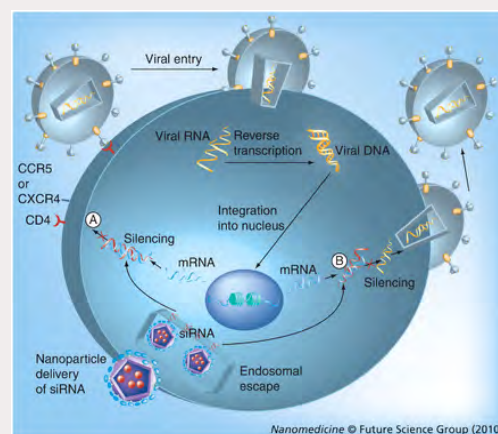
HIV is a virus that attacks the body's immune system. If HIV is not treated then it can lead to AIDS. Till now, there is no cure and no precautionary vaccine for HIV/AIDS. Antiretroviral therapy is the only treatment accessible, but it has to be taken for a lifetime. This therapy has major side effects and is unproductive in patients in whom the virus develops resistance. Nanotechnology is a new discipline of science and engineering that is progressing in many areas of medicine. Using nanotechnology, it has become possible to achieve amended delivery of poorly water-soluble drugs, targeted delivery of drugs to specific cells or tissues, and intracellular delivery of macromolecules. Specifically, targeted delivery of antiretroviral drugs to CD4+ T cells and macrophages as well as delivery to the brain and other organ systems could certify that drugs reach latent reservoirs.

Active targeting stratagems have also been working for antiretroviral drug delivery. Macrophages, which are the major HIV reservoir cells, have various receptors on their surface such as formyl peptide, mannose, galactose, and Fc receptors, which could be used for receptor-mediated internalization. The drug stavudine was encapsulated using several liposomes (120–200 nm) coupled with mannose and galactose, resulting in increased cellular uptake compared with free drug and producing significant levels of the drug in the liver, spleen, and lungs. Stavudine is a water-soluble drug with a very short serum with a half-life of one hour. The drug zidovudine, with a half-life of one hour and low solubility, was also encapsulated in a mannose-targeted liposome made from stearyl amine, showing increased localization in lymph nodes and spleen.



In a new method to target macrophage HIV reservoirs, a peptide nanocarrier was proposed as a model where a drug is coupled to the backbone of peptide-PEG and N-formyl-methionyl-leucyl-phenylalanine (fMLF), a bacterial peptide sequence for which macrophages express a receptor, is attached to the PEG for targeting.

The study found that fMLF-targeted peptide-PEG nanocarriers show increased cellular uptake and improved accumulation in macrophages of the liver, kidney, and spleen compared with those which are non-targeted. All the mentioned efforts are examples of the potential nanotechnology platforms hold for improving the targeted delivery of antiretroviral drugs to the cellular and anatomical reservoirs of HIV.



-Swati Patil



Behcet's Disease

Behcet's Disease (BD) is a very rare disease which results in inflammation of blood vessels in the body and thereby causing genital ulcers, oral aphthous ulcers and ocular damage. The inflammation caused in the eyes is known as uveitis. Thus, genital ulcers, oral aphthous ulcers and uveitis is together called as Behcet's Triad. Apart from this, it can cause skin lesions and damage to the central nervous system. The earliest mention of this disease was in the 5th Century which was made by Greek physician, Hippocrates in his book Epidemion. Later, in 1922, Dr. Hulusi Behcet, a Turkish dermatologist, described it formally. The etiology of this disease still remains unknown hence it is a poorly understood disease. Behcet's disease is very prevalent along the Silk Road. Silk Road extends from Eastern Asia to Mediterranean. Hence, it is also called as Silk Road disease. This disease is also prevalent in Japan, South Korea, Turkey, Iran, Iraq, China and Saudi Arabia.

A clinical feature which is most common in this disease is Oral Aphthous ulcers. These are mucosal ulcers and affect 98% to 99% of the patients. These kinds of ulcers are reoccurring and cause a lot of discomfort. Genital ulcers are the second most common clinical feature which occur in 80% to 87% patients. The third clinical feature is Uveitis. It is considered to be the most severe clinical feature out of the three. This is because it can lead permanent and sometimes irreversible ocular tissue damage. Up to 25% of the patients suffering from Behcet's disease can suffer from severe vision loss. This is more prevalent in males than in females. Patients show symptoms such as redness of eyes, Frequent tearing of eyes and blurry vision. In this condition, the entire uveal tract in the eyes is at great risk of inflammation and due to this the retina and optic nerve are severely damaged.

This causes a lifelong visual disability. At present there is no permanent cure for Behcet's disease but there are some treatments available which can reduce the risk serious complications. Corticosteroids, Colchicine, Azathioprine, cyclophamide and Apremilast can be used by the patients. Apremilast is considered to be an effective and safe option for oral ulcers and it is approved by the FDA.



-Shreya Karkate



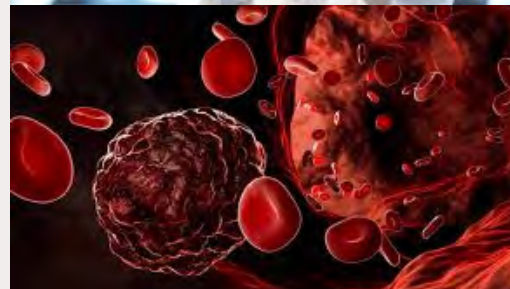
Early Detection of Cancer using a Blood Test

Cancer is a disease that negatively affects millions of people worldwide every year, with an ever-increasing prevalence rate. Early detection of cancer is crucial in reducing the morbidity and mortality associated with the disease. Despite advances in technologies for diagnosing cancer, early detection remains a challenge. Cancer arises when normal cells undergo genetic changes that allow them to grow and divide uncontrollably. Early detection of cancer is the key to successful treatment, but current diagnostic methods like imaging and biopsy have limitations, including cost, invasiveness, and potential side effects. Over the last few years, researchers have been working on developing minimal invasive testing methods that rely on blood samples for early detection of cancer. The idea behind such tests is that, as cancer cells divide and grow, they release fragments of their DNA, called circulating tumour DNA (ctDNA), into the bloodstream. The presence of ctDNA in the bloodstream could serve as an indicator of the existence of cancer within the body.

A recent study by a team of researchers at the University of Queensland in Australia evaluated whether cancer could be detected up to four years before conventional diagnosis using a blood test. The study involved analysing blood samples from 1,627 healthy college students, followed by monitoring for the development of cancer over the next four years.

The researchers analysed the blood samples using a high-resolution genome-wide analysis technique called AmpliSeq. The analysis revealed that 33 of the students developed cancers within four years of participation, with blood samples taken before the diagnoses. The test could identify early warning signs of cancer in the young adults with high accuracy, with the cancer detection sensitivity of the test

ranging from 84.6% to 100%. The researchers also found that the test could distinguish between different types of cancers based on the cancer-specific genomic alterations identified in the blood samples. Moreover, the test detected the presence of ctDNA in 96% of the students who developed cancer, with the average lead time of over two years before conventional clinical detection.



The study shows that it may be possible to detect cancers in the body up to four years before conventional diagnosis using a blood test. Such an approach would enable individuals at a higher risk of developing cancer to undergo early treatment, thus improving the disease's management and decreasing mortality and morbidity rates. Early detection of cancer using a blood test is a promising approach that needs further research and refinement with reduction in the cost, invasiveness, and potential side effects inherent in current diagnostic methods like imaging and biopsy.

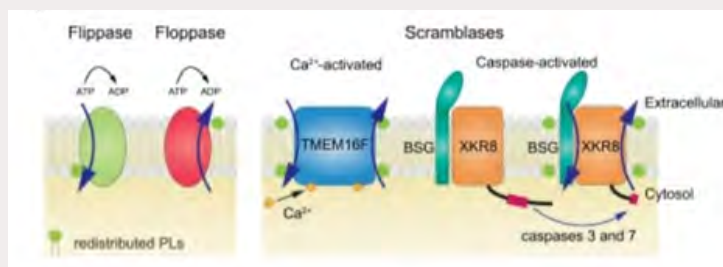
-Shyambhavi Arya



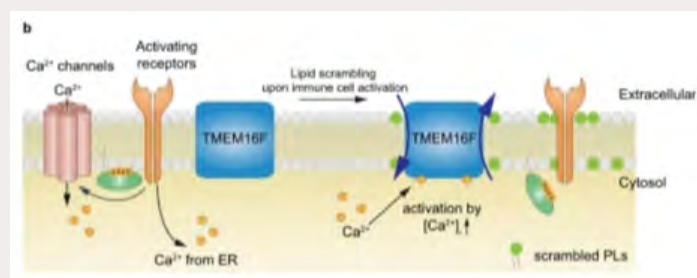
Lipid Scrambling in Immunology

Asymmetric plasma membrane lipid distribution is one of the fundamental characteristics of living cells. Lipids are organic compounds such as fatty acids and other such derivatives that are soluble in organic solvents but insoluble in water and serve as structural constituents of the biophysical structure of the plasma membrane that preserves cell integrity and also participates in signaling. The randomization of lipids in plasma membranes involving specialized enzymatic machinery is called lipid scrambling. It is carried out by lipid scramblases that function as both a non-selective ion channel and redistribute phospholipids vertically between the distinct inner and outer leaflets of membranes for ion and phospholipid transport.

Flippases and floppases mediate the redistribution of phospholipids in one direction across the plasma membrane and involve ATP. Scramblases are independent of ATP, bidirectionally transport acidic phospholipids, and are activated by conformational change.



The study of lipid scrambling is important in immunology. Research shows plasma membrane scramblases such as TMEM16F are vital for a number of physiological processes in non-immune cells, such as blood coagulation, trophoblast fusion, bone mineralization, and membrane repair. It is also evidently useful for embryonic viability due to its involvement in trophoblast fusion which is a key process in embryonic development.



Lipid scrambling has been shown to regulate signaling by diminishing acidic phospholipids on the inner side of the plasma membrane, enabling membrane repair and affecting cell-to-cell communications leading to phagocytosis. It is also associated with viral infections and tumor-mediated immunosuppression.

Other specific scramblases are also constitutively active for lipid scrambling, and as a result, they are essential for maintaining lipid homeostasis in response to constant lipid biosynthesis. Certain scramblases have different lipid selectivity, including cholesterol. Further lipid scrambling and newly defined scramblases studies in immunology will present useful clues to understand more about their molecular mechanisms and are warranted to better understand the roles of scramblases in immune cells and will likely lead to fresh insights in immunology.

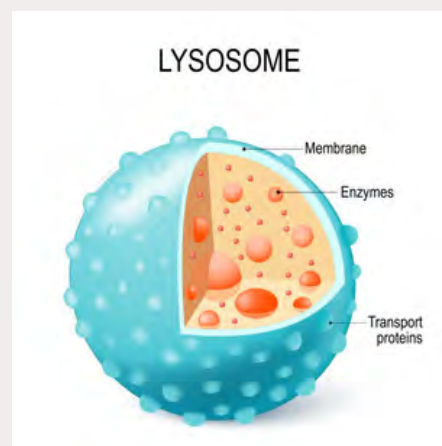
-Taiba Khan

Special Agents of the Kingdom of Cytoplasm: The Life Story of Lysosomes



Long ago in the Quantum Realm, there was a kingdom called 'Cytoplasm' which was a part of the bigger empire- 'The Cell Empire'. This beautiful kingdom was semi fluid unlike others. The citizens of this majestic empire were known as 'organelles'. Every organelle strived to excel at work to serve their nation. Most of them worked in harmony with each other while, a few preferred solitary.

One fine Sunday morning, a Belgian Human Christian René de Duve was pondering on his thoughts when suddenly he had a notion of exploring the Quantum realm. He got himself prepared for this thrilling adventure not knowing what lies ahead yet curious about it. The Kingdom of Cytoplasm was an intriguing site for him. He began observing the deeds that were being carried out and the distinguished citizens of the location. Different species were responsible for different chores but the ones to catch his eyes were the Special Agents who would work to clean their home by getting rid of the wastes or even help with the dead people however, also act as assassins when the time calls for it.



These Special Agents were specially designed by the sophisticated technology to protect the kingdom from foreign invasion which also came in handy to keep the residence clean. They were named 'Lysosomes' but were also called as 'Digestive bags' or 'Suicide bags' by other organelles. The Lysosomes were made when the Endoplasmic Reticulum- the entrepreneurs of the Cytoplasm kingdom who create essential things and store materials, transported a toxic chemical to the Golgi Complex- the transport fellows who would nicely pack the orders before transporting them. The Golgi then gave rise to the Lysosomes- The Special Agents who had a part of the Endoplasmic Reticulum as well as the Golgi made into a new being which were given the status of an Organelle. The toxic chemicals received from the ER had to be bound to something for the safety of others so the Lysosomes wore an armoured suit perfect for a soldier which was called a membrane. If any alien species like Bacteria dared to enter the Kingdom, the Lysosomes would get inside them, remove the suit and reveal the toxic chemicals and called this move 'Acid Hydrolyze' which would start degrading the intruder from the inside resulting into a grave death. This is how they have been protecting their nation since a very long time.

This is their primary duty however; their secondary chore is to make sure that the surrounding is clean. So, whenever any organelle died, they would use the same technique which is now done as a ritual. When they find any waste, this technique comes again thereupon giving them the title of 'Digestive Bags'. Talking about the allocated tasks, this is not all... They were programmed to reveal their toxic chemicals to everyone in the kingdom if the Cell Empire is in desolate times and helping it get a quick and painless death. Consequently, their alias is also 'Suicide Bags'.

De Duve was mind-blown by the things he witnessed in this kingdom and decided to return to his realm not wanting to be a prey of the Lysosomes- The Special Killer Agents.

-Laiba Khan



Artificial Intelligence in Medicine

The most important aspects of this work are the challenges and possible paths of artificial intelligence in medicine. The validation of AI-based technologies is a major problem, as studies comparing the effectiveness of AI vs. doctors are untrustworthy and lack primary reproducibility. Furthermore, constant reevaluation and calibration should be needed following the deployment of algorithms accused of overfitting in order to adapt software to changing patient profiles. Medical technology is one of the most hopeful sectors of the twenty-first century, with a market valuation of nearly \$1 trillion anticipated in 2019. The Internet of Things (IoT) is redefining health as a combination of quantified self (personal indicators captured in a smartphone or wearable) and wearable-provided living factors.

The ethical implications of continuous medical monitoring with medical devices via the Internet of Things are frequently debated, with the potential to increase stigma around persistently ill or impoverished citizens and penalize those who are unable to adopt new healthy lifestyle standards. Several schools have created new medical classes to prepare future medical executives for the challenges of artificial intelligence in medicine. Ambient Clinical Intelligence (ACI) is a digital environment that surrounds the physician and the patient and is capable of analyzing the conversation and populating the patient's electronic health data in real time. Despite worries



about medical dehumanization, modern technology such as ACI and Natural Language Processing are certain to reduce administrative duties and enable physicians to focus more on the patient. Healthcare employees are in a unique position to accept digital transformation and create change, but a major revamping of medical education is needed to prepare future leaders with the necessary skills.



The challenges and possible future paths of AI in medicine are addressed. The validation of AI-based technologies is a major problem, as studies comparing the effectiveness of AI vs. doctors are untrustworthy and lack primary reproducibility.

-Neha Sharma



Teeny-Wenny Cell Organelles

A cell in you, and a cell in me,
It's the frosty thing the drink(main) you gotta agree.

Accredit us with the antecedent and look in the zoom,
The turn of phrase cell Latin for 'A little room'
Robert Hooke contrive a cell in 1665 that wasn't alive
And portrayed it's a nitty-gritty unit of life

Without further ado let's contemplate outside the cell,
A group of cell makes a tissue,
And profuse tissues get palsy-walsy, to form an organ and add to the issue.
The organs manifest to have a hand all around a system they form
And when multifarious systems collect they coerce an organism as a norm

A cell in you, and a cell in me,
It's the frosty thing the drink(main) you gotta agree

Its the teeny weeny portion and the most feisty too,
If it didn't endure, neither would it be me nor you
Looking within the cell, copious things dwell,
Its like a whole body with abundant things to tell

The membrane's a gate keeper, controls all that comes in,
The fluid mosaic structure is what cares for it to be unerring.
Mitochondria's the way,
It's makes energy to live every day
A power plant in you bod-ay

And the whereabouts of respiration
All the time its binary fission
Maybe it could fill up a nation
Endo-plasmic reticulum.
That whole name seems a tad ridiculous

A cell in you, and a cell in me,
It's the frosty thing the drink(main) you gotta agree

But forbye the name it does just fine
Being the cell synod line

Their surface can be smooth as a steroid to get rid
And the smooth one produces lipids,
Or they can be rough with ribosomes to blame
Rough ones make protein through biogenesis frame the cell membrane.

That releases enzymes to help digestion
Lysos are also called suicide bags to reduce depression
Digesting mangle organelles with aggression.

A cell in you, and a cell in me,
It's the frosty thing the drink(main) you gotta agree

Let's not forget the construction crew ,
Who builds protein in cells you knew

They are called Ribosomes
Which are not chromosomes
That makes you different from me.

Well that's called talent!
Taking DNA from your parents
And pass you those genes
Which are enunciated in your teens

A cell in you, and a cell in me,
It's the frosty thing the drink(main) you gotta agree

At the heart is the nucleus that is beyond your imagination
Causing cell productivity,it also contains information
About the cells heredity
Which is full of sincerity

But big in a plant cell
Felix Dujardin named them vacuoles to the world he tell
Now remember them well

These are the organelles,
The teeny-wenny parts inside of all your cells
They float in a (cytoplasm) cozy cocoon
That's full of fluid like tiny water balloon

A cell in you, and a cell in me,
It's the frosty thing the drink(main) you gotta agree

-Daniyah Shirgaonkar

Application of GFP Derived from Bioluminescence of Jellyfish in the Medical Field



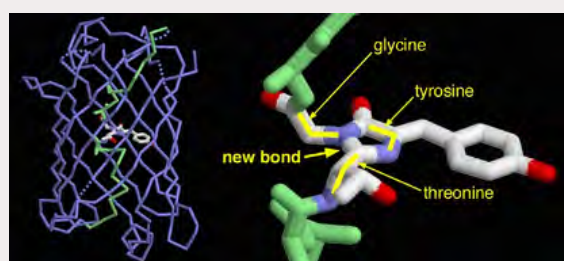
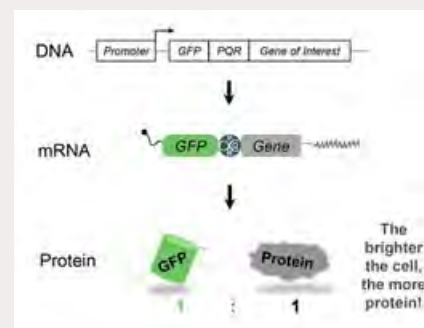
Green fluorescent protein (GFP) is a protein derived from the jellyfish *Aequorea victoria*, that emits bioluminescence in the green zone of the visible spectrum. It is used as a marker for gene expression in cell biology. This protein was first discovered by Dr. Osamu Shimamura in the early 1960s. GFPs are a versatile class of fluorescent proteins used in the field of microbiology, biotechnology, cancer treatment, environmental engineering, etc. They can be used to detect tumours, determine the level of arsenic traces in water, and also track the growth of Alzheimer's disease.

GFP in cell biology and biotechnology: It is used as a scientist's agent as it needs only oxygen and an energy source to function. It is used in the process of protein fusion, transcriptional reporters, and imaging of whole organisms. It is used as a major tool for detection in indefinite areas.



GFP in host-parasite interaction research: It has potential use in bacterial pathogenesis. GFPs are used to study host-parasite interaction in bacteria like *Salmonella typhimurium*, *Yersinia pseudotuberculosis*, and *Mycobacterium marinum*. It is widely used in this field as it is a low-toxic cytoplasmic protein, capable of synthesising continuously and therefore, decreasing the fluorescence-signal dilution effect in bacterial replication. It acts as a biological tracer that permits the colonization, proliferation, and spread of pathogens in living organisms.

GFP use as a reporter gene: It is considered the most powerful tool to detect gene expression in different types of cells. It is often used as a reporter gene as it does not require any additional substrate to function. GFP is used for mapping *mec-7* gene expression in *Caenorhabditis elegans*. It has a favourable way of determining the efficiency of gene transfer in transgenic animals.



GFP use in oncology: GFP technology is widely used for real-time imaging of tumours in the colon, liver, lymph, brain, breast, etc. It can be visualised externally by the use of quantitative transcutaneous whole-body fluorescence imaging. It is also used for imaging of metastases in mice and rodents.

Overall, GFP can be used to detect specific cell types in different organs and tissues. This prospect is significantly useful in fields such as immunology, neurobiology, and carcinogenesis. The use of GFP has resulted in the discovery of other GFP mutants of many coloured variants. GFPs are seen as a great advantage in the field of drug discovery, cellular and molecular biology.

-Pehel Shah



WORD SEARCH TIME!!!!

MOLECULAR BIOLOGY



APOPTOSIS
 BIOPSY
 DNA MICROARRAY

GENOMICS
 KLENOW FRAGMENT
 ONCOGENE

DNA POLYMERASE
 PEPTIDE
 PLASMID





NEUROSCIENCE

Addiction and its Effect on the Central Nervous System



Hello, I'm the latest trend,
I'm pretending to be your friend,
I can be the one you blame,
Addiction is my name.

My work is clingy,
I function to make my friend dizzy,
Not of a drowsy kind,
But a reward that's blind.

I'll be honest, I am not loyal,
I find people in a bad stage,
Pretend on being their friend,
And push them towards their end.

It's a sadist behaviour,
I'm not a saviour,
Your brain gets triggered,
I'll speak and let you out figure.

Binge intoxication is how I begin,
Your mum tells you, "Stop", you don't listen,
You enjoy me firstly,
I start hijacking the basal ganglia ecstatically.

I trigger the reward systems,
I start acting like a piston,
Under pressure, you seek dopamine,
I provide it in the form of cocaine,
amphetamines or nicotine.

Fond of rewards, you crave me,
After my effects have been diminished,
These urges are called incentive salience,
You come back to me; I give you some radiance.

My next step is withdrawal,
Your body now needs the reward trivial,
Basal ganglia's reward is diminished,
Extended amygdala's stress systems have been hit.

I trigger your dopamine receptor, D2,
Its antagonists have now increased too,
You have abused yourself by using me,
Now you'll need more of me, to get the reward
as it used to be.

While you crave more of me,
I inhibit the reward's degree,
Corticotropin-releasing factor (CRF),
norepinephrine, and dynorphin,
Some neurotransmitters due to which stress
dwells in.

The urge to get this stress out,
Makes you want me even more,
But as you know now, I abuse,
I would for once ask you don't use.

I'll tell you, give me chance,
Prefrontal cortex is where I now took a glance,
Your brain has lost the gap between conscious
and subconscious,
You have to suffer, since you were oblivious.

The Go System in the part I mentioned,
To control the habit – response system of the
dorsal striatum, it intentioned,
Now you seek me habitually,
Your prefrontal cortex isn't working
individually.

The Stop System of the same,
Is what can be put to blame,
It controls the nucleus accumbens,
The part that was triggered in the beginning of
addiction.

I work in a cycle now you see,
I start as a reward and become a bee
Bee without which the ecosystem won't
function,
Without me your brain cannot distinguish
between its junctions.

From a party to a rehab,
Is what I can do to you.
I lie to you when you use me,
But I'm honest in this conversation,
And I mentioned how I mess with the part
protected by the cranium.

-Naef Khatri



Self Repair Capabilities of Brain

The human brain is a remarkable organ with amazing self-repair capabilities. The brain is the control center of the body, and it is responsible for all the functions. The brain is made up of billions of neurons that are constantly firing and communicating with each other, allowing us to think, feel, and move. Despite its complexity, the brain has the ability to repair itself after injury or damage, and this is due to the brain's ability to reorganize itself and form new connections.

Neuroplasticity refers to the brain's ability to reorganize itself by forming new neural connections and pathways. This process occurs throughout life and is influenced by a variety of factors, including genetics, environment, and experience.



If someone suffers a stroke that damages a particular area of the brain responsible for movement, the brain may be able to reorganize itself and form new connections that allow other areas of the brain to take over that function. This process can take weeks or months and requires a lot of effort and rehabilitation, but it is possible.

Similarly, if someone experiences a traumatic event, such as a car accident or a fall, the brain may be able to repair itself by forming new connections and adapting to the changes caused by the injury. When the brain is injured, whether it is due to a traumatic injury, stroke, or disease, the neurons in the affected area can die, causing a loss of function. The brain has the ability to compensate for this loss by reorganizing itself and forming new connections between neurons. In this neuroplasticity work to adapt and recover the damage. In some cases, the brain can even grow new neurons to replace those that have been lost. Neurogenesis occurs primarily in the hippocampus, a region of the brain that is involved in memory and learning. The brain also has the ability to adapt to changing environments and experiences.

Despite its incredible capabilities, the brain is not invincible. It can be damaged by injury, disease, and age-related decline. However, by understanding its self-repair capabilities and taking steps to promote brain health, we can optimize its function and potentially prevent or delay cognitive decline. With further research and understanding of neuroplasticity, we may be able to unlock new treatments and therapies for brain injuries and diseases. By taking care of our brains through healthy lifestyle choices, we can help optimize its function and potentially prevent cognitive decline.

-Khushi Singh



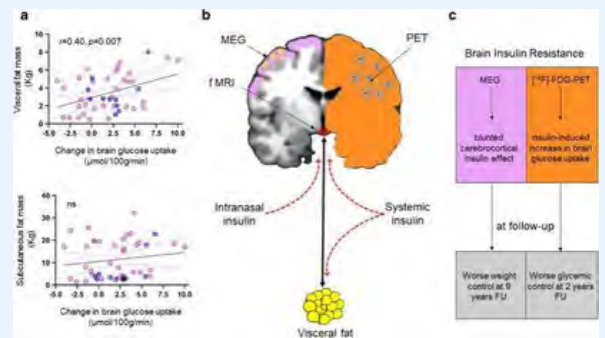
Brain Insulin Sensitivity is Linked to Adiposity and Body Fat Distributions: (How and Why)



The body's energy flow and eating behaviour are controlled by insulin action in the brain. Instead, the definition of systemic insulin resistance is based on tissue-level studies that have found several molecular defects, the characterization of human brain metabolism is based on various in vivo neuroimaging techniques, such as Positron Emission Tomography (PET), Hemodynamic Imaging, Functional Magnetic Resonance Imaging (fMRI) and neuromagnetic procedures (Magnetoencephalography or MEG). Similarly, the definition of cerebral insulin resistance varies depending on the method used: that is, reduced cortical insulin action on MEG, reduced inhibition of intranasal insulin-induced hypothalamic blood flow in fMRI, and insulin-induced increases in brain glucose uptake (BGU) [18F]-Fluorodeoxyglucose-PET ([18F]-FDG-PET) studies. Unfortunately, multiple measures are rarely used in a single study, and due to lack of baseline brain insulin resistance, integration of these results is difficult.

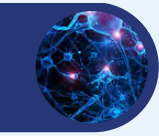
Therefore, it would be important to evaluate the consistency of these procedures (MEG, fMRI and [18F]-FDG-PET) when applied to the same group of subjects. Second, complementary data are obtained from the same subjects, since each of these methods characterizes different aspects of brain function: MEG measures the net effect of neuronal ion currents during synaptic transmission, BOLD fMRI measures a combination of cerebral blood flow and cerebral metabolism, oxygen velocity, while [18F]-FDG-PET measures brain glucose at the level of the whole brain and also in certain parts of the organ. In addition, the three techniques target at least a few different cell types. MEG collects neuronal ion currents, while in brain PET studies the FDG signal is likely driven by astrocytes, and fMRI is thought to measure a combination of both.

Previously reported in two different data sets of subjects undergoing bariatric surgery that brain substrate (glucose or free fatty acid) increased preoperatively as a predictor of poorer glucose control at follow-up. This finding is consistent with the longitudinal findings of Kullmann and colleagues: brain insulin resistance and/or higher brain substrate uptake at baseline predict negative metabolic outcome at follow-up.



Furthermore, we show here using [18F]-FDG-PET that the insulin-induced change in BGU correlates with visceral but not subcutaneous fat mass. Data from 44 subjects (11 male/33 females, age 45 years [SD 10], BMI 35 kg/m² [interquartile range 8]) studied with [18F]-FDG-PET in fasting and euglycemic hyperinsulinemic clamp with insulin infusion. Analysed mU m⁻² min⁻¹. BGU was quantified by dynamic PET imaging, and abdominal visceral and subcutaneous fat mass was measured by MRI as described in original publications. Each participant provided written informed consent prior to participation.

-Sachin Gupta



WORD SEARCH TIME!!!!

NEUROSCIENCE



ALZHEIMER'S
 APLYSIA
 COGNITION

NEUROPLASTICITY
 NEUROTRANSMITTERS
 NOCICEPTION

LIMBIC SYSTEM
 PSYCHIATRIC
 TELENCEPHLON





ZOOLOGY





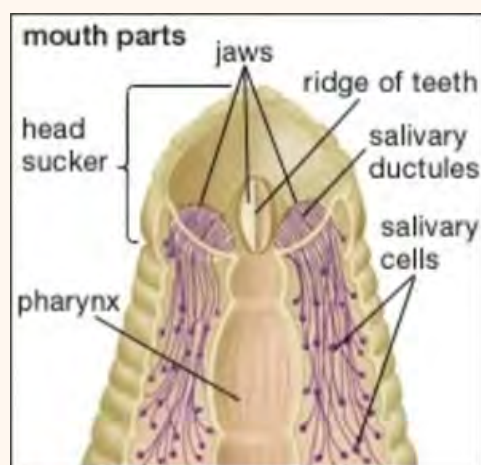
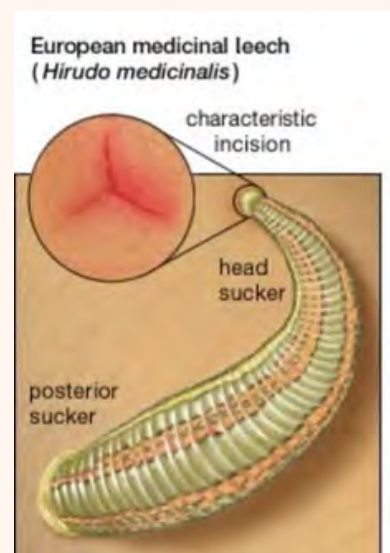
Medicinal Leech Therapy



Leeches are hermaphroditic parasites that belong to the phylum Annelida and class Hirudinea. There are more than 600 species of leeches. They are segmented, carnivorous worms found in freshwater. Some species are sanguivorous, meaning, they consume and survive on the blood of other animals. They have anterior and posterior suction discs which help the organism with their movement and adherence to the host. The anterior sucker additionally enables feeding.

Medicinal Leech Therapy (MLT) or Hirudotherapy is a treatment method which makes use of blood-sucking leeches. The aim of this treatment is to take advantage of the saliva that is secreted while the leech is feeding on the problematic area. These secretions are found to have various bioactive molecules which have analgesic, anti-inflammatory, anticoagulant and antimicrobial effects. Most commonly used species are *Hirudo medicinalis* and *Hirudo troctina*.

Immediate release of Hyaluronidase and Collagenase enzymes is followed by the bite so as to facilitate tissue penetration and spread of the bioactive molecules secreted by the leech. Antistasin and hirustasin released have analgesic and anti-inflammatory effects which helps the organism avoid detection by the host. Antistasin was identified in a Mexican medicinal leech, *H. officinalis*. It was found to be a factor Xa inhibitor. Factor Xa is a serine endopeptidase, which plays a key role in the coagulation system. Antistasin is also known to have inhibitory effects on Kinin-kallikrein system, which has a major role in inflammatory response. Thus, antistasin has anticoagulant and anti-inflammatory properties. Molecules like histamine and acetylcholine cause endothelial muscle relaxation and vasodilation. Destabilization and chloromycetin show antimicrobial activities. Destabilase exhibits glycosidic enzymatic activity, which directly disrupts β 1-4 bonds that are important in the peptidoglycan layer of the bacterial cell walls.



Leech therapy is used as an alternative remedy for the treatment of vascular disorders, as the secretions can temporarily improve blood flow and ameliorate connective tissue hyperalgesia. MLT is used in patients with phlebitis, 4-6 leeches are directly applied to the affected area. It is also used for the healing of hypertension, varicose veins, haemorrhoids, and secondary ischemia-related dermatosis. MLT has proved to be a successful remedy to improve blood flow and relieve venous congestion after microsurgery.

There can be some complications with MLT. Allergies to leeches and their secretions should be considered before application along with the infections that can be caused. While MLT has a long history, the mechanisms have only begun to be clarified.

-Samiksha Johari



Bone-Storming



Can you imagine a body
without bones?
Won't it look like a melted
ice-cream on a cone?
Or like a cloth apart
thrown?
Or simply a dome?

Imagining is hilarious,
But I am serious!
My part is tremendous,
And I'm jealous!

Because of so much work
pressure,
I'm often getting a suture,
A fracture or a torture.
But I'm still erect,
Standing straight and
perfect!

Let me ask you a question,
Do you know my
proportion?
206 is exertion,
Still with complexion!

Do you know my height?
My strength and fight?
Protection is my work,
Your vital organs stuck.

Providing shape and sizes,
Playing role in
homeostasis.
Producing a variety of
cells,
In the marrow and
muscles.

I can enlarge or become
smaller,
Can be flat or irregular,
Can grow stronger or
weaker,
Can grow tiny or thicker.

Do you know my radius?
My ulna? my humerus?
My clavicle? my tibiae?
Fibulae or metacarpals?
Metatarsus or phalanges?
Or your strongest bones called
femurs?

Do you know my Sesamoid
bones?
Carpals and tarsals bones?
Patella the knee bone?
The mandible, the Scapula?
Ribs and the sternum?
The skull, the cranium?
A lot of bonium!

The vertebrae, the coccyx,
The sacrum and hyoid bone?
Are the bones irregular!
But all these are intermolecular!

Blood cell production,
And storing calcium,
Cortical bone trabecular
overall,
Composes human adult
skeleton!

Cortical bones dense and solid,
Surrounding the marrow space!
Trabecular bone is honeycomb
like,
Plates and rods in marrow hive!

Bones of middle ear,
Are of minimum strength,
But play a role in Hearing and
stand!
I can model and remodel,
changing shape,
Thus, making you a different
style of drape!

I'm Hollow pocket,
With blood vessels and
socket,
Rich in Calcium and
phosphate,
I'm an inorganic bucket!

Of course, being living,
I'm not immortal!
But to break me,
You should be harder!

Pain in me?
Arthritis can be seen!
Imbalance in my activities,
Characterizes Paget's
disease!

If I do extra growth,
You will be a giant boat,
And if I do under growth,
You will be stout and short!

I carry your marrow,
To keep you narrow!
If you transport it,
It will Give a twin repeat,
Or help you to fight,
Cancer or fatal bite!

The work which I do,
Is indeed true.
With all the specialities,
I know my capabilities.

How much in all you know,
What your bones actually
do?
Vertebrates vertebrates
Skeleton,
Are you original or a clone ?

-Sakshi Sah



HEARTY HEART



It's not your tongue nor your lungs, eyes or your hearing, It's your spirit.

Your heart is the only portion of you that exists, One of the indispensable organs in the body it assists.

It's just about the artistic style, how the bodily fluid is pumped around.

Your heart makes an amusing lub-dub sound.

Did you admire your heart as nothing but a lump?

Attributed with the four chambers pump!

At the outset, ascend the Atria divided into left and right,

At the pedestal core the Ventricles carve up again into left and right.

The 3 o'clock side streams the blood into the lungs to take up the oxygen.

The sinister side pumps the blood cascading it into the transcortin.

Your arteries pump your blood distant alias pulmonary arteries.

Your veins pump your blood snap back into the heart alias pulmonary veins though in size it varies.

Arterioles diversify from the arteries.

Whereabout it cleaves into capillaries.

Here dawn the adventure of my itsy-bitsy red blood cell heading for the heart.

The inferior vena cava is where this adventure starts.

Commencing with low levels of O₂ as redeems my muscles. In the legs albeit

I was rushing itsy-bitsy energizing my hustles.

Here and now in the right atrium, chamber number 1.

Utterly my blood turns up, doesn't matter where it's from.

Superior vena cava exclude the arms and head.

It's deoxygenated blood, cherry dark red.

Itsy-bitsy journey over a valve when the atrium contracts.

This valve's got two names, here about the facts.

You might know it as atrioventricular.

Or Tricuspid if you want to be particular.

Now to the succeeding chamber itsy-bitsy makes its way to the right ventricle.

Still enduring as it has low oxygen precipice.

Through the pulmonary valve, it first gets lungs.

Right ventricle contracts, leading to the lungs.

Now, the itsy-bitsy locus is the pulmonary artery.

Which branches left and right towards the system respiratory.

Through trivial arteries to a lung capillary.

Finally CO₂ goes out of her and oxygen into her "It felt so great. I'm oxygenated" exclaimed itsy-bitsy

Henceforth flowing to the pulmonary veins, she was elated.

Cause she was heading back to the heart which is thumpin.

To the left atrium as the heart was pumpin.

Left atrium sends itsy-bitsy through the AV valve.

Left atrioventricular or bicuspid valve.

To the left ventricle, as it contracts.

Sends through the aortic valve allocating her on track.

Proceeding to the aorta, the giant vessel.

From there to any artery or capillary miniature vessel.

Maybe liver, bones, kidney, brain, small intestine.

Wherever itsy bitsy is destined.

Heart you're amazing for all this just took 0.8 second of your time.

Let's donate O₂ to all the cells in the body line.

-Mohammed Anas Khan



THE NEW BUZZ IN TOWN



A cloud emerged of black and yellow,
From a hive beyond the meadow.
On a new tree, the swarm landed,
For the old hive was to the new queen handed.

The scouts came forth from the cluster,
“A new hive for the swarm to muster.”
With such an aim did they fly around,
And left the queen with the buzzing mound.

A few found a place in the harbour,
Few others, a home at a farmer;
Some found space in human society,
A tenth, among trees of another's territory.

To find a place before the peak of summer,
All Scouts returned to reveal to the gather.
All stood among the crowd,
All proud of what they have found.

One by one they had begun,
A traditional dance called the waggle.
Some jostled to tell of the vast region,
Others boasted of better protection.

The Scouts then investigated the claims of each other,
Even the ones who danced with such fervour.
They all returned to dance for one,
But the relocation has just begun!

All at once the swarm flew,
To start their colony anew.
Entering the door sprayed with scout scent,
Secreted by the Nasonov gland.

The Queen took her seat at the centre
With 7-day-old workers to assist her.
The Empress, in brood cells, laid;
The eggs, 2000 each day were raised.

Such a task for the queen would be much torture
Thus, the nurses took the job to nurture.
Their Hypopharyngeal gland secreted royal jelly,
To fill the growing larval belly.

To feed each cell they go,
Three thousand times or more,
Until each larva enters the pupa stage,
Then seal the cocoon-bearing cage.

After 21 days in the cocoon nest,
The worker bee leaves her life of rest.
To clean each nook and cranny of the hive,
And remove the carcasses of those who do not survive.

As the worker grows older,
She has more things to shoulder,
Nursing the babies, her next chore,
Later tending at the queen's door.

Packing up pollen and filling in honey,
Storing the necessities to live life cosy.
Producing wax from the abdominal gland,
Building duties are also in hand.

When the heat of the summer gets them sweating,
They cool the hive with their wings by fanning.
Then at the entrance be a guard against danger;
Her final task is to become a forager.

Spreading her wings for her orientation flight,
Zig-zagging away with the hive in sight;
Collecting nectar and pollen grain,
They fly back home again.

The nectar is churned into honey,
By glucose oxidase within their tummy.
Then stored in chambers of gold,
Such things never grow old.

“Her majesty is now getting old”,
The bees to each other told.
Nurse bees prepared for the throne,
The other is to be overthrown.

They pampered one with much nutrition,
For such was their ambition,
And from among the Young Sterile,
One emerged a full-fledged fertile.

With the old Queen dead and gone,
And the new virgin born,
The lady gave birth to drones,
Fertile males will be known.

Such is the life of Bees,
Of which a glimpse is seen;
Their world must always thrive,
For our world to survive.

-Mrinal Arangaden



WORD SEARCH TIME!!!!

ZOOLOGY



ANTELOPE
DEUTEROSTOME
EMBRYOLOGY

GASTRULATION
GRADUALISM
OVIPAROUS

FECUNDITY
SYSTOLE
TROPISM





GENETICS



Human Age vs Hearing Age

As we age, our physical abilities decline, and our senses are no exception. Hearing is one of the senses that can be negatively affected by means of age. Some humans can maintain their hearing nicely into their golden years, while others can also experience large hearing loss at a tremendously younger age. It's essential to recognize the distinction between a person's chronological age and hearing age. Chronological age is virtually the range of years an individual has been alive, whilst hearing age is the age at which a person's listening abilities shape the common competencies of men and women in their chronological age group. For example, a character who is 50 years old may additionally have the hearing capabilities of an average 60-year-old, meaning their listening age would be 60. It can also be used as a tool to determine when the hearing loss may also be taking place and to track changes in hearing competencies over time.

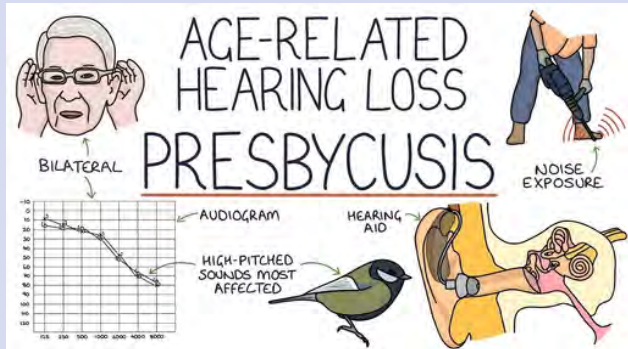
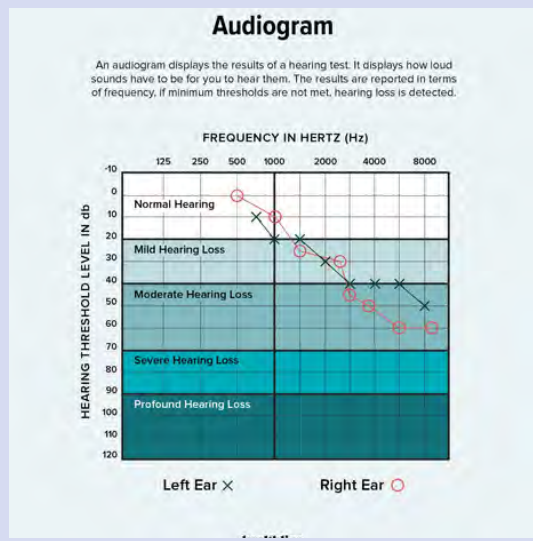
Several factors can affect a person's listening age, along with genetics, publicity to loud noise, and ordinary health. Genetics play a vast function in listening to abilities, and some humans may be predisposed to listening to loss regardless of their publicity to environmental factors. Exposure to loud noise is every other element that can negatively impact hearing.

Similarly, people who oftentimes attend loud live shows or listen to tracks at high volumes can also additionally be at threat for listening to loss.

Importance of Hearing Age:

First, it can help men and women take steps to shield their hearing and forestall in addition to damage. For example, if a person's hearing age is appreciably higher than their chronological age, they may prefer to keep away from loud environments or wear earplugs to shield their hearing. If a person's hearing age indicates that they are experiencing listening loss, they may additionally favor seeking advice from listening professionals to discover therapy options, such as hearing aids. Finally, monitoring adjustments in hearing age over time can assist humans to reveal their listening skills and perceiving practicable issues early on.

Hearing age is a necessary thinking that can assist people to apprehend their listening abilities and screen changes in their listening over time. In summary, understanding your listening age is just as vital as understanding your chronological age when it comes to retaining your typical health and well-being.



-Vibha Jaiswal



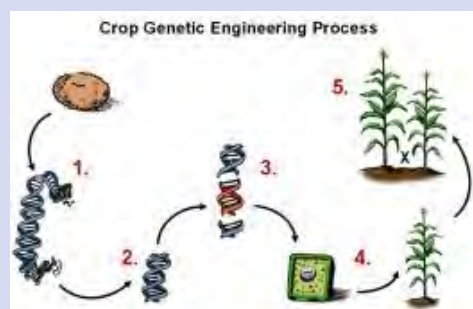
The Perils Ahead: Should Animal and Plant DNA Research be Performed?

Genomics of plants and animals is a diverse field in terms of the biological issues addressed because it deals with the structure and function of genetic material that underpins all living organisms. Genetic engineering admits scientists to move wanted genes from individual plants or animals into another. Genes can likewise be transported from an animal to a plant or vice versa. Another name for this is innately changed structures or GMOs. One of the questions with discriminating training is that it can likewise influence traits that are not asked. Genetic engineering allows physicists to select an individual particular gene to insert. This avoids presenting added genes accompanying undesirable characteristics.

Why do scientists need to extract DNA from plants and animals? The capability to extract DNA is of basic significance to learning the ancestral causes of ailment and for the incidence of interpreters and drugs. It is further essential for completing activity legal erudition, sequencing genomes, detecting microorganisms and viruses in the atmosphere along with deciding the beginning of incidence.

Well, there may be many ethical reasons. It can bring about devastation of Intellectual Property Rights (IPRs) . It is pretended that the land and fitness fields will visualize defeat in competition impact of the changes in biotechnological protected property. To address concerns of surroundings, change and impact on snack protection in addition to the growing union of land and health biotechnologies, pressure will increase on verdict cooperative machines to accomplish protected property created by original thought.

Domesticated bird investigators expand theories (which are accurately supported plans) about the attainable causes of afflictions and potential situations. These theories must be evaluated very painstakingly for fear that benefits and risks from the projected new approaches are apparently implicit. Biotechnology can be good for animals.



Selective breeding and genetic engineering can benefit animals in many ways like improving resistance to disease and breeding to remove characteristics that cause injury. For example- selecting cattle without horns. But biotechnology can also be bad for animals.

The good effects for the breeder can be offset by painful side effects for the animals. Modern pigs have been bred to grow fast. Some breeds now grow too fast for their hearts, causing discomfort when animals are too active. Broiler chickens are bred to grow fast. Some now grow too fast for their legs.

-Hrishika Neikhar



Dynamic and Scalable DNA based Information Storage

The tangible architectures of news storage structures frequently dictate how facts are encrypted, databases are systematized, and files are accessed. Here we learn that a natural construction covered by a T7 promoter and a distinct-marooned overhang rule (ss dsDNA), can solve vital DNA-based facts depository accompanying powerful potential and benefits. It increases hypothetical depository densities and capacities by extending the encodable order scope and simplifies the computational burden in plotting sets of four-sided file addresses.



What is DORIS?

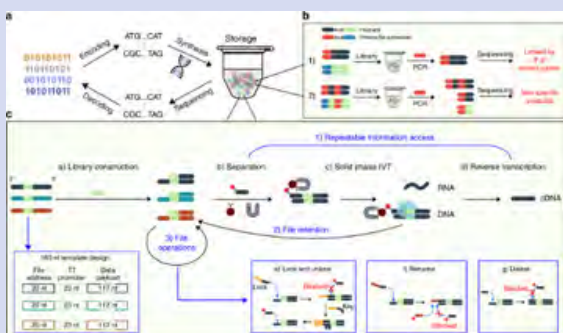
DORIS, in spite of blaring like your excellent aunt’s name, is really an electronic that helps us store facts on DNA. When we take a shrink away, we see that people are bearing WAY excessive dossier for our current sciences to handle. Every day, people produce 2.5 quintillion bytes! That’s a lot! This is the place DORIS comes in. Right now, DNA-located news is encrypted in an order of DNA sequences, and therefore, is decoded back into an electronically agreeable form. This reduces the reusability, scalability, and encrypting mass of the news.



What is so excellent about DORIS?

There are four main amazing features of DORIS; capably devising DNA ropes in individual “marijuana”, growing bulk and volume limits, repeatable file approach, and the skill to change the file well in the DNA!

DORIS utilizes a variety of approaches. Instead of utilizing double-abandoned DNA as a textbook-binding sequence, DORIS uses an “bulge” that resides in a sole fibre of DNA – like a tail that streams behind the double-abandoned DNA that really stores data. ss-dsDNA strands can be efficiently created in one pot.



Devoting resources and attention to such optimizations need to be balanced with the fact that the field of molecular information storage is nascent and that there are likely a wide range of new capabilities and physical innovations that could be explored and introduced into the field. Finally, we believe this work motivates a merging of work in the fields of DNA computation, synthetic biology, and DNA storage.

-Mohammed Faizan Anwar

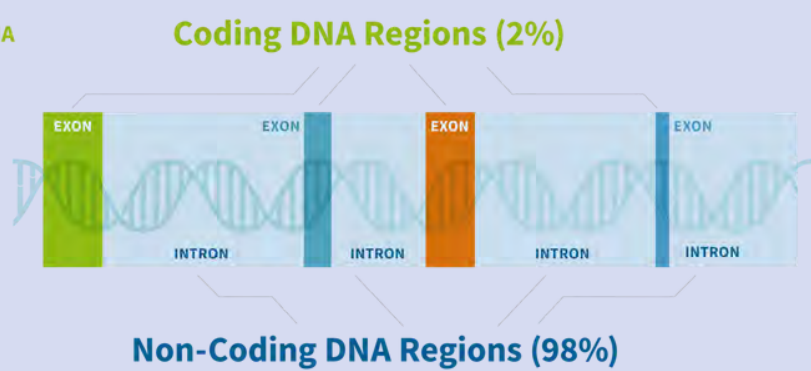
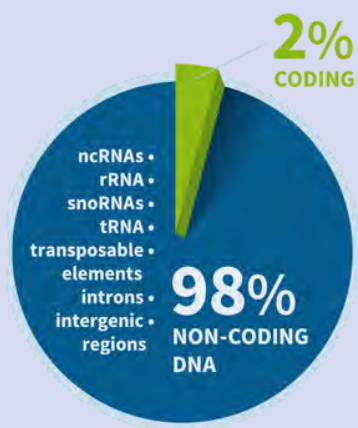


Junk DNA: The Aging Effects



DNA is a genetic material that contains all the information of a person's development and functioning. Out the whole DNA strand present in a human's body, only 10% of it takes part in protein synthesis remaining 90% of the DNA acts as a protective part and is called as Non-Transcriptional DNA or the Junk DNA.

It is seen that Junk DNA acts similar to the casing of shoe lace that helps us live long. It is seen that every time the DNA replicates, a portion of junk DNA gets cut off. This deletion of a part of DNA causes shortening of individual's life length and causes aging. This can be reduced to some extent by cutting down heat producing and excess fats containing food from our diet and by keeping fast for one whole day twice a month. Healthy diet proper exercise and good sleep help to retain this larger of portion of the Junk DNA and hence making us live longer. Although junk DNA does not have much life supporting activity but it is still important as it has life extending properties.



-Sushmita Burai



The 'Extra-X' – Klinefelter's syndrome through a sister's eyes



Never smart enough.
Never Athletic enough.
For me you ask?
He was the Bravest. The kindest.

This world tossed him aside.
They ignored his rights.
They judged him on myths they heard.
They hurted him.
All this for just that 'Extra X someone said,
the difference between extraordinary and
ordinary is just that 'extra'.
He felt that...
Through years he saw people move away,
Far away from Him.
All that for what? All of it for that 'Extra' X.

He never smoked, He never drank,
Never did he ever break a heart.
Still they broke his. Looked at him with disgust
Then they broke him.
All this for what?
All this for just that 'Extra' X.

The world thought of him as a fool.
For never understanding football,
For never being cool.
All this for just that 'Extra' X.
He was never enough.
' X.

For that extra X that was never his fault.
A random genetic error after conception.
That 'Extra' copy of X in the 23rd chromosomal
pair.
That X , which flipped his life.
He could never fit in.
"Oh My Dear", I said,
"You were born to stand out!"

'Low testosterone,' the doctors said.
'You aren't even a man!' This cruel world added.
'Low muscle mass' The study said.
'You aren't even a man!' This cruel world added.

He tried to please, But he was too slow.
Be like others his age, But his body didn't allow.
He hid his body during sports in changing rooms.
All this for what?
All this for just that 'Extra' X.

He was different. The world mocked him, The
world drove him out.
The world called him Names. All this for what?
All this for just that 'Extra' X.

He was never loved.
He was never accepted.
He was called lazy and a disappointment.
This is how this world defined him.
All this for what?
All this for just that 'Extra' X.

I sat him down one day.
Embraced him, he flinched.
Any form of intimacy foreign to him.
His soul too bruised for love.
I started, I said:

That X is just a part of you!
That X makes you Xtraordinary!
That X is just another chromosome you have. It
might define your Morphology,
But it doesn't define your life!

The world doesn't accept easily.
It might never will.
But you will stay strong,
Because that's who you are.
That 'Extra' X was an error But you aren't.

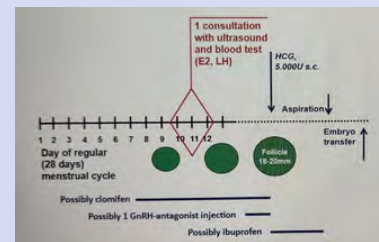
The world gave it bad name.
A weird identity.
So you and I my dear, We'll be the ones that
change that!
Give it another identity. A new out-look.
It's not a big deal. It shouldn't be.
It's just an 'Extra' X!!

-Ramsha Shaikh



Natural Cycle IVF

Wolff M. (2019), suggested that the practise of Natural Cycle IVF (NC-IVF), both with and without modifications, is growing. NC-IVF and traditional gonadotropin-stimulated in vitro fertilisation (cIVF) should not be viewed as antagonistic but rather as complimentary therapies with various purposes and target populations. Couples looking to save money, those seeking a procedure with minimal risks, and ladies opposed to embryo selection and cryopreservation may find NC-IVF particularly appealing. Hence, NC-IVF supports the idea of personalised, patient-centered therapy. Compared to traditional IVF, it takes a little longer to get pregnant. Women with very low ovarian reserves and younger women should use NC-IVF in particular.



The idea of natural follicle recruitment and selection as well as an unsupported luteal phase forms the foundation of NC-IVF. By doing this, luteal phase support and gonadotropin injections are avoided. Perhaps as a result of improved egg quality and unchanged endometrial function, the implantation rate per fertilised oocyte appears to be greater. It must be emphasised, nonetheless, that the high number of oocytes recovered in the majority of cIVF cycles can outweigh these drawbacks, resulting in a quicker time to pregnancy in cIVF. In addition, the term "natural" solely refers to the menstrual cycle, but the insemination or intracytoplasmic sperm injection procedures used in cIVF are also necessary throughout the oocyte fertilisation process (ICSI).

Mumusoglu S. et al (2021), suggested that the best patients for performing t-NC and modified NC are those with regular menstrual periods. To schedule FET in t-NC, the precise period of spontaneous ovulation must be determined, which calls for routine endocrine and transvaginal ultrasound monitoring. Hence, NC is less adaptable than HRT and modified-NC. Modified-NC is regarded more patient-friendly than t-NC since it requires less endocrine and ultrasonographic monitoring and triggers when the leading follicle is between 16 and 20 mm in diameter and schedules accordingly.



On days 2 or 3 of menstruation for t-NC, transvaginal ultrasonography is done to rule out any corpus luteum or cyst left over from the previous cycle. Although this technique has been extrapolated from fresh embryo transfer cycles, cycle cancellation is typically used in cycles with serum P4 >1.5 ng/ml on day 2 or 3 of menses.

The day of ovulation is accurately noted after regular endocrine and ultrasonographic monitoring, either daily or on alternate days, to plan the timing of FET. It is debatable where in t-NC endocrine monitoring should take place. The hCG trigger acts as both an early LPS and an ovulation trigger in modified-NC; since, it not only stimulates ovulation but also causes a rise in serum P4 production during the early and mid-luteal phase. In theory, the lowest effective dose to induce ovulation will result in a lower early serum P4, which should reduce the risk of endometrial advancement, known to have a detrimental effect on endometrial receptivity. However, to our knowledge, no study has compared various doses of hCG for triggering in modified-NC. It is debatable where endocrine monitoring should be done in modified-NC.

-Mishsika Walia



WORD SEARCH TIME!!!!

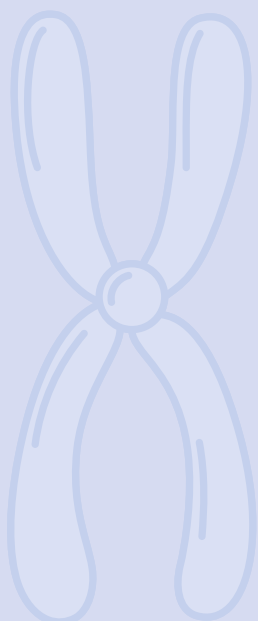
GENETICS



EPIGENETICS
GENETIC COUNSELLING
GENE EDITING

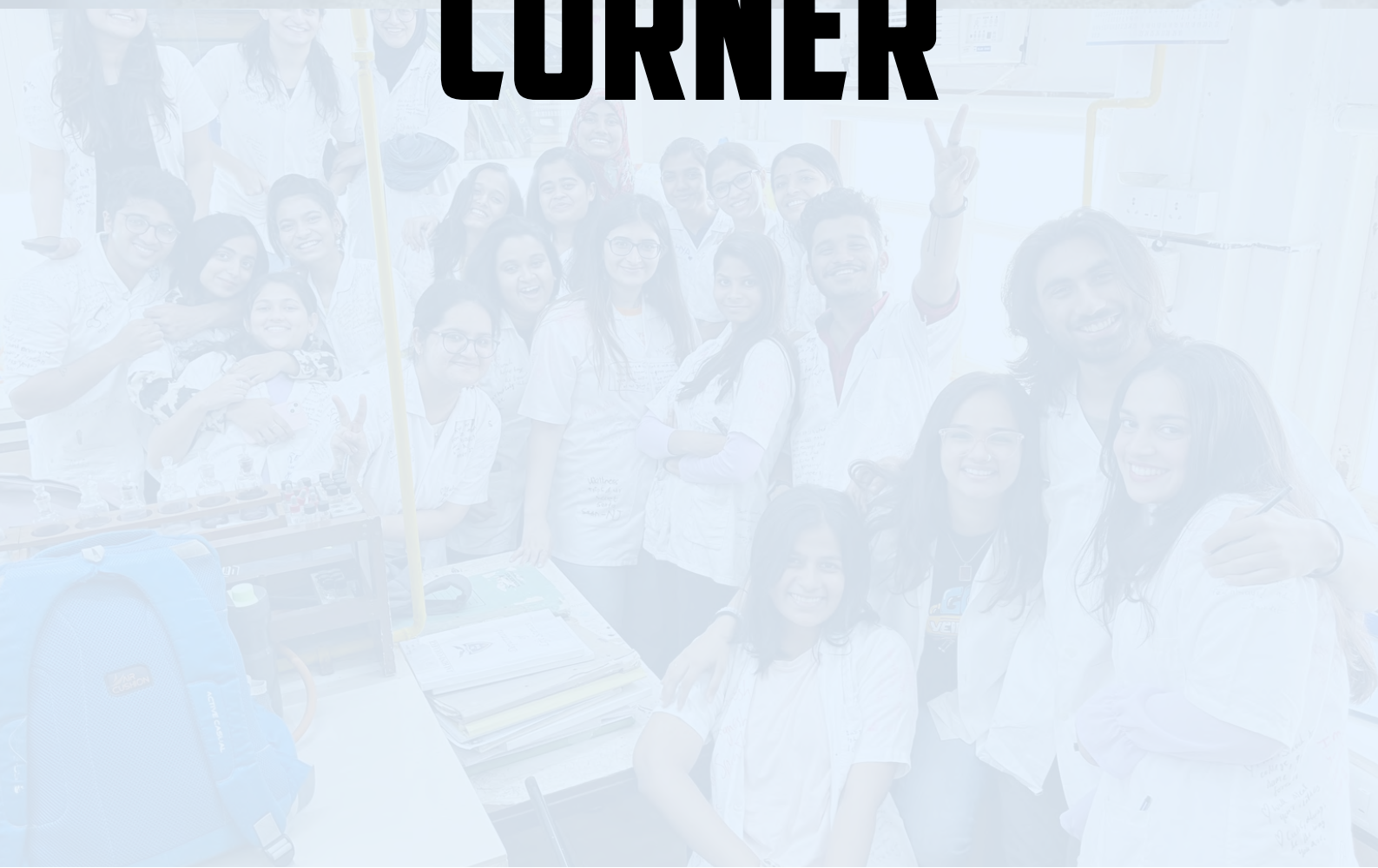
GENOME SEQUENCING
HEREDITY
MOLECULAR DIAGNOSTICS

GENETIC ENGINEERING
PHARMACOGENOMICS
MUTATION





STUDENT'S CORNER

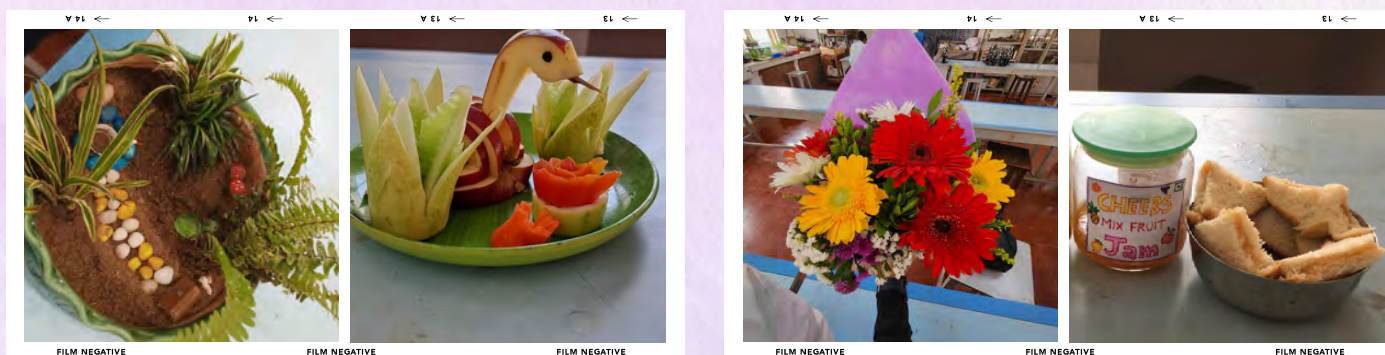


FROM PLANTING TO PICKLING: LIFE SCIENCES STUDENTS DIG INTO THE HORTICULTURE WORLD



Horticulture, an amazing subject that lets you get in touch with nature while having fun and engaging in creative and rewarding activity. It's an excellent way to improve your physical and mental well-being, for instance; the satisfaction of growing your own food is priceless! Luckily, the students of Third Year Life Sciences had the chance to experience all these benefits while studying the subject.

The course started with the basics of planting, including depot-ting, which turned out to be a therapeutic experience for the students. There's something about getting your hands in the soil that makes you feel grounded and relaxed. They also learned important techniques like cutting, budding, grafting, and layering, as well as the proper use of tools to make careful cuts under their experienced teachers.



The fun didn't stop here! Students also got to unleash their creativity by learning how to create beautiful indoor gardens, like bonsai, bottle gardens, terrariums, hanging baskets and dish gardens. Using tiny figurines and plants, they brought life to their mini-scenery! However, Horticulture is more than just pretty plants. Learning about garden planning, exposed students to the practical applications of landscaping, including different styles and plant selections. This knowledge inspired them to consider horticulture as a potential career choice.

The course also expanded to flora. The students explored diverse floral design techniques, including Japanese Ikebana, Western and Indian flower arrangements. Learning how to make 'Gajras' to beautify one's hair was the most enjoyed by students. They even learned how to cook up delicious jams, squashes, pickles and sauces, which could easily beat the big brands in the market.

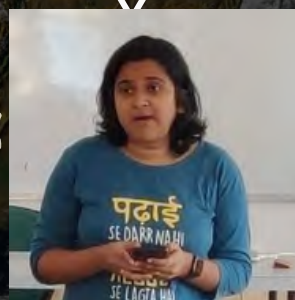
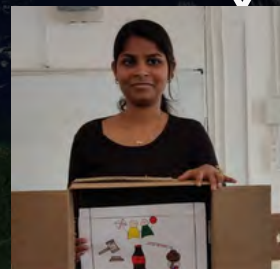
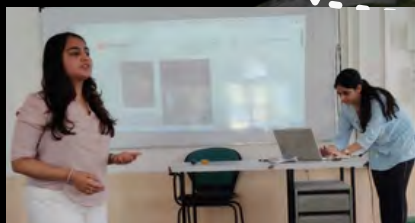
The fun continued! The students had the opportunity to refine their abilities and create stunning designs from fresh produce by learning the art of fruit and vegetable carving. This experience not only elevated their appreciation for the aesthetics of food but also revealed the potential for imaginative expression on the dining table. Finally, the practical on crafting bio-jewellery using grains and pulses was a fantastic way to end the semester and fuel the students' artistic expression and nurture their design sensibilities. They had a blast creating eco-friendly fashion accessories, demonstrating again the endless possibilities that horticulture offers.

In conclusion, the horticulture course allowed students to connect with nature, express their creativity, and learn valuable skills that can serve them well in the future!



ENVIRONMENTAL SCIENCE

ACTIONS SPEAK LOUDER THAN WORDS!



HUMANS OF LIFE SCIENCES

Humans of Jai Hind College Life Sciences is a seminar series dedicated to showcasing the experiences and stories of alumni of the prestigious Jai Hind College. Under this initiative, we invited two speakers, Imaan Javan and Mehershad Wadia, who are making a significant impact in their respective fields.



Imaan Javan, the Director of Operations of Suntuity Renewable Energy India LLP, is a passionate advocate for renewable energy. During the seminar, Imaan discussed her current solar energy project and the performance of her company in the field of renewable energy. She shared her journey from Jai Hind College to her present occupation, which has been marked by hard work and dedication. Imaan's work in the renewable energy sector is inspiring, and she is paving the way for a cleaner and greener future.

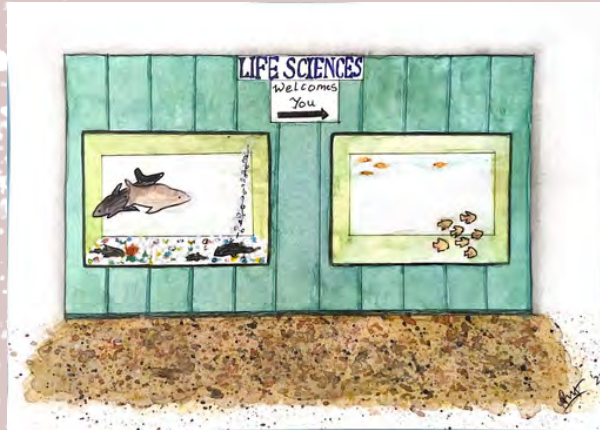
Mehershad Wadia, a Research Assistant at the UQ Queensland Brain Institute, spoke about his experience as a researcher and the importance of focusing on the right things. He talked about his recently published illustrated book, "Pluto Gets a Vaccine," which aims to educate children about the importance of vaccines in a fun and engaging way. Mehershad emphasized the need for scientific communication and the importance of reaching out to the general public with scientific information.



Both Imaan and Mehershad are exemplary individuals and their talks were not only informative but also inspiring, as they shared their journeys and experiences. They provided valuable insights into the worlds of renewable energy and scientific research. This provided us with a unique perspective on their respective fields. Their journeys have inspired us to work towards a better future.

The Life Sciences Department of Jai Hind College is proud to have such outstanding individuals among its alumni and we look forward to hearing more from them in the future.

THE ART IN SCIENCE



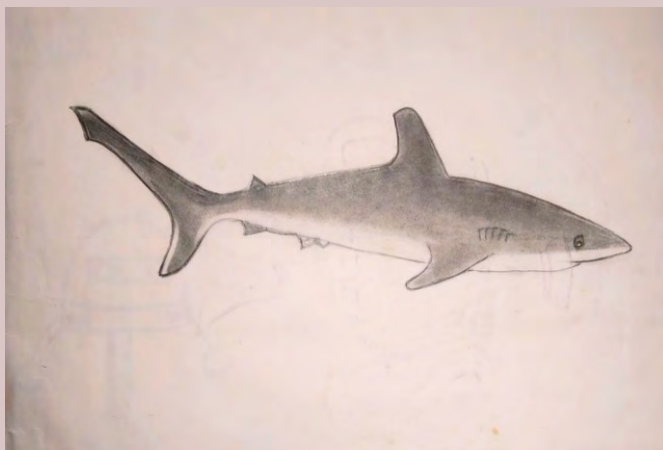
-MUDITA ADANIYA



-NAEF KHATRI



-SANIKA NAIK



-ROSHANI GUPTA

I.R.I.S.



The Biological Society was founded by the Department of Life Sciences in 2005. After much thought, the society was given the name "I.R.I.S." for the following reasons:

I stands for Insight

R stands for Resilient

I stands for Innovation

S stands for Success

Every year, a topic fundamental to the current situation and the most recent global trends is chosen, and students are educated on it. To keep our young minds informed of the latest advancements in a variety of related fields and pave the way for their future advancement. Prominent speakers and senior scientists who have excelled in their fields and have national and international reputations are invited to share their expertise and knowledge with our young minds. This year the article was about Emerging trends in health and life sciences. The department had 2 speakers for the seminar Dr. Usha Padmanabhan and Dr. Roshan D'Souza. Dr. Usha Padmanabhan currently heads the Department of Cell Biology at Haffkine Institute. Dr. Roshan D'Souza is the Head of the Zoology department at Sophia College Mumbai.

Dr. Usha discussed her research on the effects of BCG vaccines in patients infected with Covid-19. The study found a reduction in oxygen requirement from the third or fourth day and improved X-rays and CT scans from days 7-15. There were no deaths in the arm that received the vaccine shot while there were two deaths in the group that got standard line of care. The findings showed that the vaccinated group had higher Covid-19 antibody levels. A subset of 20 patients who never received a BCG shot showed that BCG was safe even in the elderly population.

Dr. Roshan D'Souza talked about *C. elegans* as a model organism. *C. elegans* is a species of nematode worm that is often chosen as a model organism to study human diseases. Its transparent body consists of three layers: an epidermal layer, an intestinal layer, and a muscle layer. Dr. D'Souza also stated that *C. elegans* is an excellent model for Parkinson's disease, which is an age-related neurological disorder that affects movement. Studies have found that overexpressing wild-type and mutated synuclein in dopaminergic neurons resulted in dopaminergic neuron loss.

Additionally, *C. elegans* can be used as a model organism to study the innate immune response to pathogens, such as *Salmonella enterica*, which has various serovars.

CLASS OF 2023



A TRIP DOWN THE MEMORY LANE



Go Green Nursery, Panvel



**Maharashtra Nature Park,
Mahim**



Horticulture Practicals



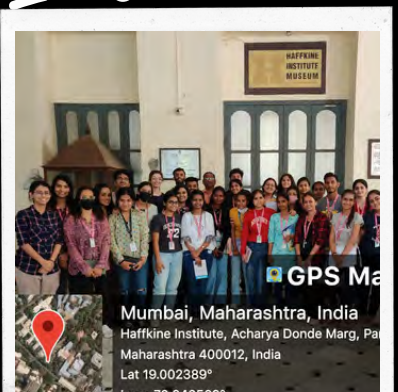
Christmas Celebration & Secret Santa



Lab Coat Signing



Humans of JHC Life Sciences

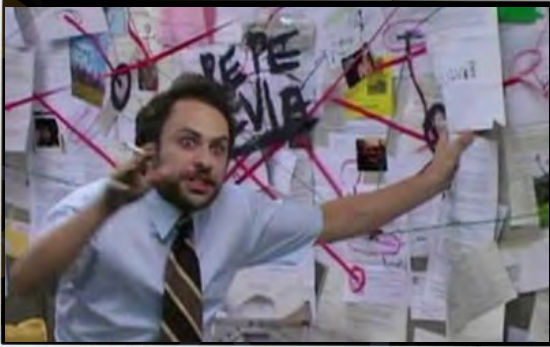


Haffkine Research Institute, Parel

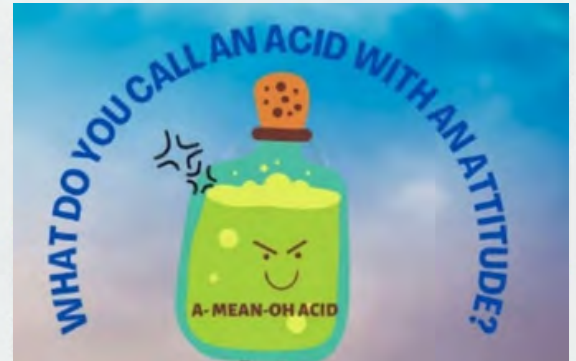


Life Sciences Practicals

THE FUNNY BONE



Me trying to explain my Research Project to External examiner



Amino Acid



Dense particles in a centrifuge



Mitochondria is the power house of the cell.



Oxidative phosphorylation takes place in the mitochondria of the cell



After I perform the same experiment 5 times and get different results



Me to the Lab assistant when they suggest a simple tip and my experiment works

A photograph of four young women standing in a room decorated for an event. They are wearing dark blue school jackets with a crest on the chest. The room is decorated with pink and white balloons, a banner that reads "ALWAYS BE THE BEST", and a table covered with a white fringed cloth. The background shows shelves with various items and a window.

TEACHER'S TALK

Puntastic HOD



What did the cell say when he ran into the table?
Mitosis!

Why wouldn't the scientist go into the haunted house?
He was too petrified.

Where did the viruses go?
They flu away.

What do biologists post on Instagram?
Cell-fies.

Why was the amoeba sad?
His parents just split.

Why did the scuba diver fail biology?
He was below "C" level.

Why was the mushroom so popular?
He was a fun-gi.

-Ms. Niloufer Kotwal



Hotspots of Jai Hind 2

So!

I am back with my "short term course" of "what the term retrospect means". I had tried explaining it last year (Catalyst; Vol 2; 2021-2022; pg 86) but I think probably 2 people read it (that includes me and the poor 'head of creatives', as it was a compulsion for her. Sorry Avani!). So I am hopeful that the readers double this time (yes, to 4 people).

As I had mentioned previously, I was introduced to JHC when I couldn't pronounce 'Jai Hind College'. My official entry to JHC was as an awkward 16-year-old. Time flew by, I finished my HSC and then my BSc (The Awkwardness. Still. Persists.)

So coming back to it, 'Retrospect' makes everything sound good. I have had the opportunity to stick around for another year (lord have mercy on the kids... and me..), and somehow my attention, affection, admiration and association for this particular 'hotspot' has grown exponentially.

This attractive spot, is a 'glancing treat' as the aquamarine blue colored walls break the monotony from its surroundings. Probably the only aquarium in JHC, this place should ideally be termed as the "universal stress buster spot" (or the informal introduction of the Life sciences dept to the students). Everyone from teachers, students, non teaching staff across all streams are able to take a moment and marvel at the beauty of synchronised swimming of these jawed vertebrates (i.e the fishes).

As we progressed to BSc, this spot became our 'I want to break free' spot. (Ref: Queen). This was the place where we spent our 10min incubation time, our 5min break between lecs, and our 20min lunch break where we had a little bit from everyone's dabba.

It has seen our frustration (if our pracs wouldn't work out), our happiness (if our pracs got over by 1pm), our frantic cries (of journal submission), and our panic (of last min exam revision). We posed here as wanna be Doctors with our lab coats, played 'Quiz up' at every opportunity, sat there like homeless kids and started at the blank space wondering what we will do next in life, and ate Biryani as a class celebrating Eid together.

Now being on the other side of the fence, I still pass by this place several times a day. As I see the current crop of students sharing similar moments (and making Instagram reels), the retrospect sets in. This place has knowingly or unknowingly given an opportunity to students to make memories which we would only realise only after its long gone. But that the beauty of it, right? Cause it's these little things that pull us back to our fond times. It ain't our O grades, fancy accents (this generation calls it vibes) or 'a more expensive than my kidney' iPhone, it's these small, priceless moments...

At a risk of sounding like a Raymond add, (cue the saxophone tune) I would give anything to get back that moment where all 18 of my batchmates get a chance to sit at that spot and eat Biryani again. Lsc Batches will come and go, the fishes inside unfortunately will come and go, people taking care of the aquarium will come and go. But. Nothing. Will. Replace. That. Emotion. There will always be memory or a moment which will pull a few heart strings whenever we revisit this 'hotspot'!! :)

-Ms. Zeenia Avari





And it's a Wrap



CLASS OF 2023



Thank you

