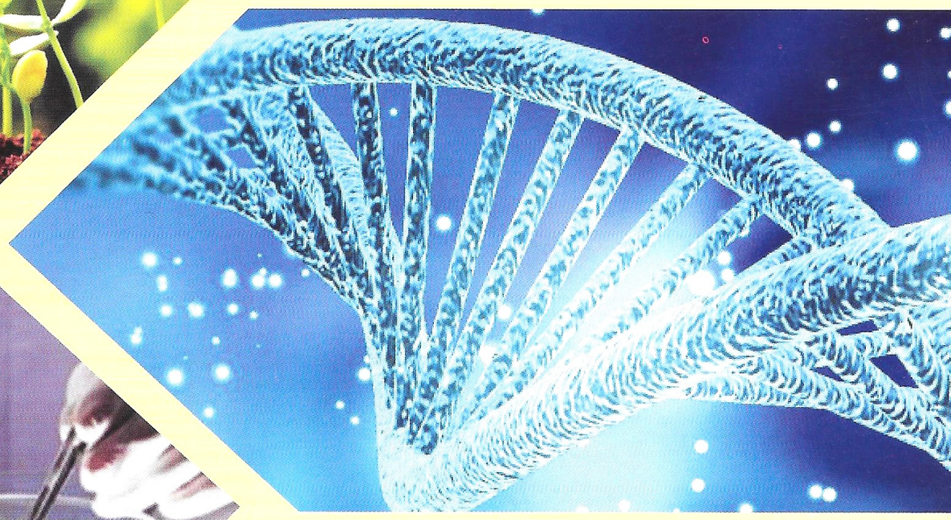
BIOTECHRONZZ

THE TECHNICAL MAGAZINE



2020 - 2021

DEPARTMENT OF BIOTECHNOLOGY

SRI SHAKTHI

INSTITUTE OF ENGINEERING AND TECHNOLOGY

(AN AUTONOMOUS INSTITUTE)

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai)

L & T Bypass Road, Coimbatore - 641 062, Tamil Nadu, India.

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National Assessment & Accreditation Council

Sri Shakthi Institute of Engineering and Technology (SIET) was established in the year 2006 by our honorable Chairman Dr.S. Thangavelu, with the zeal to provide quality Engineering Education to the young minds and to make them innovative employable Engineers.

Sri Shakthi is accredited by NAAC with A grade and also SIET is the youngest institution in India, accredited by National Board of Accreditation (NBA) for four courses namely Mech, ECE, CSE and IT. We have been consecutively recognized as the best industry connect institute with platinum ranking by the AICTE-CII survey of Industry- linked technical Institutions for the years from 2014 to 2017 and received awards under Established Engineering Institution for Electronics & allied courses in 2017 and in 2014 as Emerging Engineering Institution category as close competitor. Sri Shakthi symbolizes 'creative & progressive power' of dynamic youth and is ranked among top 10 percent of 3000 colleges across India to receive National Employability Award and The Times Group Award for Excellence in Education. We are the pioneer Institute in India, chosen by Indian Electronics & Semiconductor Industries Association to launch their premier courses on VLSI design and embedded product design

The inspirational leaders such as Padmashri A. Sivathanu Pillai, Padmashri R.M. Vasagam, Mylswamy Annadurai, Dr. Sandeep Garg, P. Venkat Rangan, Mr. Sanjeev Keskar, Mr. Srikantan Moorthy, A.K.Pattabiraman, Mr. Varadharajan, Ms. Hema Gopal, Mr. K. Ganesan, Madhusudan Atre, Mr. Vivek Pawar, Kamesh Namuduri, Mr. Jayaram Pillai, Mr. Veerappan, Mr. Parthasarathy, Mr. VA Shiva Ayyadurai, Kiran Bedi, Prof. John A Davis, KaviPerarasu Vairamuthu, Mr. Chetan Bhagat, Mr. Rajesh Nair, Mr. Kannan Ramamani and Mrs. Anuradha Srinivasan have visited our campus to inspire our students.

The institute is also collaborated with worldwide universities and industries to support our mission. Oracle, CISCO, National Instruments, Cadence, Xilinx, Infosys, Wipro, MindTree, AMI, Siemens, Dassault Systems, TTK prestige, HP Enterprise, Virtusa Polaris, Gyan Matrix, IESA, NASSCOM, IEI, ISTE, IEEE and ITB are few among them.

The institute currently offers ten bachelor's degree programs in the field of Agricultural, Bio Medical, Bio Technology, Electrical and Electronics, Electronics and Communication, Computer Science, Food Technology, Information Technology, Mechanical and Civil, and master degree programs in the fields of VLSI Design, Engineering Design, Structural Engineering, Computer Science and Engineering, Embedded System Technology

Message from Chairman

Dr. S. THANGAVELU

Chairman

Sri Shakthi Institute of Engineering and Technology

Coimbatore.

I am very thrilled that the Department of Biotechnology is yet to publish its third edition of its Technical Magazine for the year 2020-2021. I extend my heartiest congratulations to the students of Department of Biotechnology for their dedicated efforts, who are supported and headed by their enthusiastic faculty team. I am confident that this year's edition will be bringing out yet another efficacious issue.

My best wishes for the Team

Dr. S. Thangavelu
Chairman

Message from Principal

I am delighted to meet you through this page. Education is not only an act of acquiring knowledge but learning a skill to lead life and grooming ones' personality. Education of the highest order aims at guiding, inspiring, motivating and leading young men and women to become successful leaders to serve the country better.

Research is the key parameter to promote the individuality to horizon. In recent times, there is a rapid stride in all gamuts of modern branches of Biology. The students, faculties as well as the scholars ought to keep themselves abreast with the latest development to compete and emerge out successfully in the most challenging world.

Arranging International Conference as often as possible augurs well for the Sri Shakthi Institute of Engineering and Technology of higher learning especially in the Bioengineering and Technology for a wide range of exposure of new research finding and enrichment of knowledge and the most important is that their sequencial Technical Magazine release. Best wishes for the Team.

Dr. A. R. Ravikumar
Principal
Sri Shakthi Institute of Engineering and Technology
Coimbatore

PREFACE

Biotechronzz is the official technical magazine of the Department of Biotechnology, Sri Shakthi Institute of Engineering & Technology, a souvenir that showcases the myriad of talents possessed by the students. This year is the 3rd Edition and we are proud to introduce the 3rd Volume of Biotechronzz, a tradition that had taken roots since the first volume.

Right from the outset, we have been very meticulous with our planning, from the content we have received, to the layout and other particulars, to the final copy, we have all put in our hardest efforts to express the flair for science and language, shown by our students. Despite all the issues that arose throughout this roller coaster ride, we have made sure that the magazine fittingly reflects the magnificence that it deserves. This physical copy is the culmination of countless discussions, diligent efforts and the timely dedication of everyone involved. We hoped to achieve and maintain the highest calibre of the contents, and hope we did justice.

We hope this serves as yet another interesting edition. Our sincerest thanks to the Design Team for their committed efforts to breathe life to the vision we had in mind. Our heartfelt gratitude to our faculty advisors, staff, and teachers for supporting us in bringing together this edition, successfully.

We wish our readers a joyful reading experience. We hope you enjoy reading through it and draw as much inspiration from it as we did.

Editorial Board

EDITORIAL BOARD

ASSOCIATE EDITORS

Aducanumab: A Potential Cure

In recent times, despite rapid technological and medical advancements, the incidence of Alzheimer's disease has risen tremendously across the world.

Alzheimer's disease (AD) is one of the most common neurodegenerative disorders that predominantly targets people above the age of 65. It is a progressive illness that is caused by the atrophy of neurons leading to behavioral and psychological changes. Alzheimer's disease is the leading cause of Dementia. It not only causes memory loss, locomotive and cognitive decline but also shortens the average life expectancy of the individual due to the decrease in the quality of life, due to their inability to perform everyday tasks.

The neuronal degeneration can be attributed to various factors and one such reason is the hard, insoluble Amyloidal plaques. Beta-amyloid is part of a larger protein chain monomer called APP (Amyloid Precursor Protein) so when these protein fragments deposit in the extracellular matrix (spaces) and they are not degraded by the body's natural clearance mechanisms, they disrupt the communication between the neurons. They also generate free radicals of Oxygen causing lipid peroxidation of the membranes and depolarisation of synaptic membranes, eventually leading to the death of neurons.

As of date, there is no medication for AD that can reverse the plaque pathology, and cure the patients completely. These drug either treat cognitive symptoms like cholinesterase inhibitors which target cholinesterase, responsible for the hydrolysis of acetylcholine, an important neurotransmitter, involved in the chemical signalling pathways which improve memory. But these drugs only offer symptomatic relief.

Biogen, a US-based Biotech MNC developed a high-affinity IgG monoclonal antibody called Aducanumab. This protein specifically targets and preferentially binds to the neuronal plaques, and dissolves them thus slowing down the disease progression. In this Immunotherapy technique based on the structure-specific and antigen-antibody interaction, Aducanumab targets a conformational epitope of the aggregated form of the Beta amyloid which is normally inaccessible in the monomer thereby clearing the plaques and mitigating the neurotoxicity.

However, Biogen decided to halt the research on Aducanumab in March 2019 as the two-phase III trials suggested that that the drug had failed "futility tests" and wouldn't slow the patients' cognitive decline. But, in October 2019, Biogen announced it would restart the FDA approval process stating a new analysis of the database which indicated a reduction in the clinical decline of Alzheimer's patients when the drug is taken in higher doses. As of January 2020, the US Food and Drug Administration (FDA), has approved a re-dosing study of Aducanumab to be conducted. This has fuelled the hopes of a lot of patients suffering from AD, and their families, who are hoping for this miracle breakthrough to work and save them.

Elakiya R V
III Year
B.Tech Biotechnology

Ancestral Genome From A Chewing Gum

A chewing gum, made of birch tar and other natural substances have been preserved for 5700 years in Sylthom, Denmark. The water-resistant property of the gum preserved the DNA of a person who chewed it before 5700 years. The microbial decay was prevented by its antiseptic property which has helped the researchers from the University of Copenhagen to extract the complete human genome. It is the first time that the ancient human genome was extracted completely from chewing gum because mostly they were usually extracted from human bones, hair, etc.

Birch pitch is a black-brown substance that is produced by heating the bark of *Betulla pendula*, a tree. It was commonly used by prehistoric people for shafting tools and also as glue. The toothprints in the gum suggests that they were chewed now and then, to make it more malleable as it solidifies on cooling. The Gum was also found to relieve toothache and other ailments due to its antiseptic character and sometimes was even used to suppress hunger or just as chewing gum.

Based on the human genome obtained from these gums, researchers have interpreted that it had been chewed by a female – probably, a young girl- and they nicknamed her 'Lola'. Lola had dark skin, dark hair and blue eyes. She was genetically more closely related to the hunter-gatherers from mainland Europe. They also found that she was intolerant to lactose. That era's poor oral hygiene helped the researchers to find traces of animal and plant DNA, specifically hazelnuts and duck, which she must have feasted on presumably not long before discarding the gum. The women's diet also revealed that she belonged to a hunter-gatherer family.

Researchers also found traces of countless microbes that lived in her mouth and on comparing it with present day human oral microbiome, found it to be strikingly similar. Most of those microbes are still found in our mouth. The traces of oral microbiome is the key part of discovery which was absent in the human bones. According to the researchers, our ancestors lived in a completely different environment when compared with ours. They also had different lifestyles, health and diet which was deduced from the analysis. This helps to understand the evolution of important human pathogens, their virulent character when they acquired it to predict their traits in the future and ways in which it can be eradicated.

Reference: *"A 5700 year old human genome and oral microbiome from chewed Birch pitch" -17 December 2019 - Nature communications*

Harish.G.S
II Year
B.Tech Biotechnology

Animated Suspension

It is quite well known that few species of mice, bears, frogs, and animals belonging to several other genera and species prepare themselves to undergo a phase of inactivity called ‘hibernation’ during the winter season. When animals hibernate, the metabolism, breathing rate, heartbeat, and body temperature are depressed in order to reduce the need for the uptake of oxygen and nutrients. This helps in preventing the damage of body cells and tissues during the long term of sleep. Using this principle of hibernation, doctors recently have come up with a new surgical method called “suspended animation”.

Since the 1970's doctors and researchers are trying to induce hibernation artificially by subjecting the body to hypothermic conditions in order to achieve haemostasis before irreversible organ damage occurs. The primary aim of research in this area is to achieve the state of reduced physiological activity otherwise known as 'torpor' to buy time for operating on patients who are critically ill as in the case of cardiac arrest or an acute traumatic injury. This is also known as Emergency Preservation and Resuscitation (EPR). Many natural incidents have shown to prove the theory of animated suspension. One such incident occurred in 1999, when Anna Bagenholm, a Swedish radiologist, with a cardiac arrest was trapped under ice in a frozen lake for 40 minutes and survived with no apparent brain damage. This is also supported by the Arrhenius equation, which states that chemical activity is reduced by lowering the temperature of a substance, which is applicable to biological systems and processes such as metabolism as well.

Recently Dr. Samuel Tisherman has been carrying out clinical trials of animated suspensions at the University of Maryland Medical Centre, on human patients who have sustained severe injuries from gunshots or stabs in the heart. These patients are put to clinical trials only after conventional efforts of blood transfusion and open-heart surgery have failed. The chances of survival through these procedures is only around 5 percent. The procedure of animated suspension typically involves flushing out the patient’s blood by pumping freezing cold saline solution through cannula directly into the aorta at a rate of at least a gallon per minute, which causes cooling of the vital organs and reduces blood circulation and brain activity dramatically. Once the brain temperature falls to 10-15 °C, the saline pump is switched off and this gives the surgeons extra time to perform the surgery, while the patient is kept alive using a heart and lung machine. Once the surgery has been accomplished, the blood is pumped back and the heart is restarted. Once the pulse rates become normal, the heart and lung machine can be removed and the patients can be moved to ICU for further recovery.

EPR proved to be successful and effective on large animals such as dogs and pigs. They were subjected to the same processes of cooling, surgical operation, and resuscitation after which the brain functions were revived. The main disadvantage of EPR in humans is that it might pose long term health problems on the patients. Even though the biochemical reactions are slowed down by cooling, the brain cannot survive for more than five minutes without oxygen, hence it may cause long term damage to the brain. Tissues can be damaged by the sudden chemical reactions with oxygen that occur once the body warms up. This can also lead to multiple organ failure. Therefore, scientists are trying to come up with a mixture of drugs in order to decrease reperfusion injuries.

Ragavani.R
II Year
B.Tech Biotechnology

The Mystery of the Millenniums

Let's consider a man who is about to fall down from a sidewalk. He needs to stick to his balance but he can't and at last, he falls down. It sounds familiar. Most of the people would have undergone this kind of dream a lot more times which makes them move their arms and legs rapidly. Why is this particular type of dream coming to most of the world's population and what's really causing this fall? Is there a secret thing that a person from another dimension or something paranormal is trying to say?

Actually, there is no secret thing that is said through this dream. This is due to the involuntary muscle twitching called Hypnic Jerks, which are sudden non-stereotyped myoclonic contractions of all or most of the body muscles (especially the axial and the proximal muscles). Hypnic jerks are often associated with sensations of tripping, falling through space, or electric shock. Vocalizations can be associated with hypnic jerks. The experience varies from person to person. Although the real reason for this jerk is not clear, there are many interesting theories given by many scientists around the globe for this jerk.

Some say that it is due to a misunderstanding of the brain which mistakenly thinks the muscle relaxing as death or as the fact that the body is falling. So it gives a sudden jerk (sends signals to the muscles to wake up) to check whether the body is alive or safe and not falling down. This falling down theory arises around a few thousand years ago from our ancestors, the Primates. This hypnic jerk would have helped them to stay gripping onto the tree as the brain mistook the feeling of muscles relaxing as falling. So these jerks would have made our ancestors scream.

The hypnic jerks are caused during Stage 1 and rarely in Stage 3 of Non-REM (Rapid Eye Movement) sleep cycle and mostly during the REM (Rapid Eye Movement) sleep cycle. Stage 1 is the lightest stage of NREM sleep. It is often defined by the presence of slow eye movements. This drowsy sleep stage can be disrupted easily causing awakenings or arousals. Muscle tone throughout the body relaxes and the brain wave activity begins to slow down from that of a wake. Occasionally, people may experience hypnic jerks or abrupt muscle spasms while drifting in and out of Stage 1.

Stage 3 is the deepest stage of NREM sleep. Awakenings or arousals are rare and it is difficult to wake someone in this stage. REM sleep, also known as rapid eye movement, is most commonly known as the dreaming stage. Eye movements are rapid, moving from side to side and brain waves are more active than other stages of sleep. Awakenings and arousals can occur more easily in REM. Being woken during a REM period can leave one feeling groggy or overly sleepy. It is also shown that hypnic jerks can cause insomnia to the ones who experience it on a daily basis.
Hypnic jerk is caused by a variety of causes including anxiety, caffeine, stress issues and even exercises at late in the night. Drugs and alcohol also cause hypnic jerks. It is also caused due to brain lesions and is a symptom of Parkinson's disease. Being tired and exhausted is also a cause for the hypnic jerk.

Gowri D
II year
B.Tech Biotechnology

Ayahuasca

Ayahuasca is a psychoactive brew that has been used for thousands of years by South American priests or 'Shamans' for spiritual and mental healing. It is a bitter brew made from the leaves of *Psychotria Viridis* and the vines of *Banistropis caapi*. Neither of them have hallucinogenic properties of their own. The leaves of *Psychotria Viridis* have DMT(N, N- Dimethyltryptamine) which has a structure similar to that of serotonin. Its main effect is visual and auditory hallucinations, euphoria and an altered sense of time and body

How is it used for spiritual healing?

Ayahuasca can be used by people when they are in crossroads to find answers to certain questions that might be lingering in their mind, after half an hour the hallucination starts and it usually lasts for 4 to 6 hours. Ayahuasca hallucinations are unpredictable and the experiences can be positive or negative but it never puts a person through an experience one can never handle. If the first experience of a person is negative, the second experience has the possibility of being positive. The hallucinations seem like a real experience. A person usually experiences a feminine or a masculine form guiding through the trip (experience). They get the opportunity to revisit their childhood and their past and experience certain events in detail. It gives a new perspective where one passes through all the layers of pride, ego, and judgment accumulated as one grows up, and look things in greater depth through the eyes of a curious, innocent child. This way it is very useful for healing people who have experienced trauma in their lives. Most of the questions get answered through the course of the trip. This is an example of a positive experience.

Ayahuasca can be used to cure various psychological problems such as depression, anxiety, PTSD, addictions and also cancer. It does not cause addiction. Depressed patients who were not able to cure their illness using any form of counseling or medication (antidepressants) can try it. The default mode network in the brain causes depression and anxiety if overactivated. Ayahuasca is used to lower its activity thereby causing the person to enter into a calm, meditative state. When DMT reaches the stomach, it is usually deactivated in the stomach by gut enzymes (for e.g. monoamine oxidase) but alkaloids like Harmaline and Harmine from the vines of *Banisteropsis caapi* inhibit the enzymes and it is absorbed by the gut and reaches the blood. DMT activates the 5-hydroxytryptamine receptor and causes hallucinations. Those receptors are found in the Endoplasmic Reticulum and DMT helps it to make proteins that are responsible for long term memory and neuroplasticity. After the trip one experiences vomiting and diarrhoea. It also can destroy cancer cells. It helps in the removal of wastes from the body and removes alcohol and drugs for people with addiction.

Ayahuasca can cause dangerous effects for people who have schizophrenia, heart disease or a simultaneous intake with shrooms, cannabinoids, and alcohol. Only time will tell if Ayahuasca is a potential cure to be explored or not.

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Harshini S
I Year
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Biotechnology and Serendipity

Serendipity is the phenomenon by which an unexpected yet rewarding or fortunate event occurs. In science, it takes the disguise of remarkable discoveries. The realization of the natural phenomena by the earliest humans was in itself serendipitous in many ways. To cite a few: the 'Eureka moment' of Archimedes that led to the discovery of buoyancy, the 'Newton's Apple' that bonked the legend's head leading to the formulation of the laws of gravity, etc.

In the current scientific society, however, such an event is uncommon because the modern scientific methodologies are undertaken in a more focused, systematic and controlled manner. A serendipitous discovery may thus happen when a deliberate change is made in the proposed protocol either knowingly or unknowingly. Such a pursuit is risky as it may lead to a failed experiment but it is also what leads to a serendipitous discovery.

The most popular and significant serendipitous discovery in the field of biotechnology is the Nobel Prize-winning discovery of 'Penicillin' by Alexander Fleming in 1928. At that time, Fleming was investigating Staphylococcus aureus which he cultured on Petri plates. He reportedly observed his plates to be contaminated with molds around which he also observed clear zones with no colonies. Instead of discarding the contaminated plates, he chose to investigate the clear zones. He discovered that it was due to an antibiotic secreted by the molds which were later identified to be Penicillium notatum. The antibiotic was thus named Penicillin. Fleming realised its potential to be used in the treatment of bacterial diseases and published his findings.

Another praiseworthy serendipitous discovery in health science is the discovery of cisplatin as a chemotherapy drug. Cisplatin, also known as Peyrone's salt was first described by Michael Peyrone long back in 1845. However, its medicinal value remained unknown for over a century. In the 1960s, researchers at the Michigan State University led by Barnett Rosenberg were investigating the effect of electric current on the growth of E.coli cells. The cells were cultured in a nutrient broth through which electric current was passed using platinum electrodes. They observed that the cells elongated up to 300 times their original length and cell division was arrested. Such an observation was unexpected. The curious team further investigated and found that the electrolysis of the platinum electrodes generated a soluble platinum complex (cisplatin) which allowed cell growth but inhibited cell division. Rosenberg prospected its use in cancer therapy and its administration in mouse models successfully regressed tumors. This led to its clinical trials and its subsequent approval as a cancer medication by the FDA in 1978.

The discovery of the food sweetener aspartame was also serendipitous. It was discovered by James Schlatter in 1965 when he was working in G.D. Searle Company to find a medication to treat stomach ulcers. He was trying to synthesize a tetrapeptide of gastrin for the purpose and as a first step, he made a dipeptide aspartyl-phenylalanine-1 methyl ester which is now called aspartame. Some of this intermediate compound had stuck onto his hand. His habit of licking his finger before picking up a paper made him the first person to taste aspartame which is 200 times sweeter than sucrose. Two other sweeteners, sucralose, and saccharin were also found serendipitously.

Another remarkable discovery by chance is that of Helicobacter pylori and its role in gastric ulcers & gastritis. Gastritis was thought to have been caused by stress and spicy food before the 1960s until the discovery of its causative agent H.pylori by Barry Marshall and Robin Warren. It is reported that several of their attempts to culture the bacteria isolated from the stomach of

patients went in vain until they decided to take a break for Easter weekend which extended the incubation period. Once they returned, they were able to visualize the bacterial colonies. This discovery revolutionized the treatment of gastric diseases as it suggested the use of antibiotics which was well known at that time. The two scientists were awarded the 2005 Nobel Prize in Physiology and Medicine for their contribution.

One of the recent yet serendipitous discoveries is Crispr Cas 9. Jennifer Doudna and Emmanuelle Charpentier were studying the systems that bacteria use to defend themselves but eventually ended up discovering the most powerful DNA editing technology we know of! In 2015, Cas9 was used to modify the genome of human embryos for the first time.

These examples clearly indicate that serendipity is a fruit of hard work. It depends on the attitude of the scientist such as his/her perseverance to troubleshoot mistakes, shrewdness and also obvious human tendencies like excitement & carelessness. Psychologists, Kevin Dunbar, and Jonathan Fugelsang believe that, "Scientists are not passive recipients of the unexpected; rather, they actively create the conditions for discovering the unexpected".

Gautham Siddharth S
III Year
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Pranav.K
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Role of CBD As A Drug

WHAT IS CBD?

Cannabidiol (CBD) is one of the naturally existing cannabinoids found in cannabis plants. It is a 21 carbon terpenophenolic compound which is formed by decarboxylation from cannabidiolic acid precursor, it can also be produced synthetically. In humans, CBD exhibits no effects which affect the lifestyle. It has been approved as an effective treatment of epilepsy in many clinical trials. It is generally well associated with a good safety profile. Till now, there is no evidence of the diversional use of CBD or any public health-related problems associated with the use of pure CBD. WHO reported that CBD can *potentially* treat Alzheimer's disease, Parkinson's disease, Huntington's disease, Crohn's disease, multiple sclerosis, psychosis, anxiety, pain, depression, cancer, hypoxia-ischemia injury, nausea, IBD, inflammatory disease, rheumatoid arthritis, infection, cardiovascular diseases, and diabetic complications.

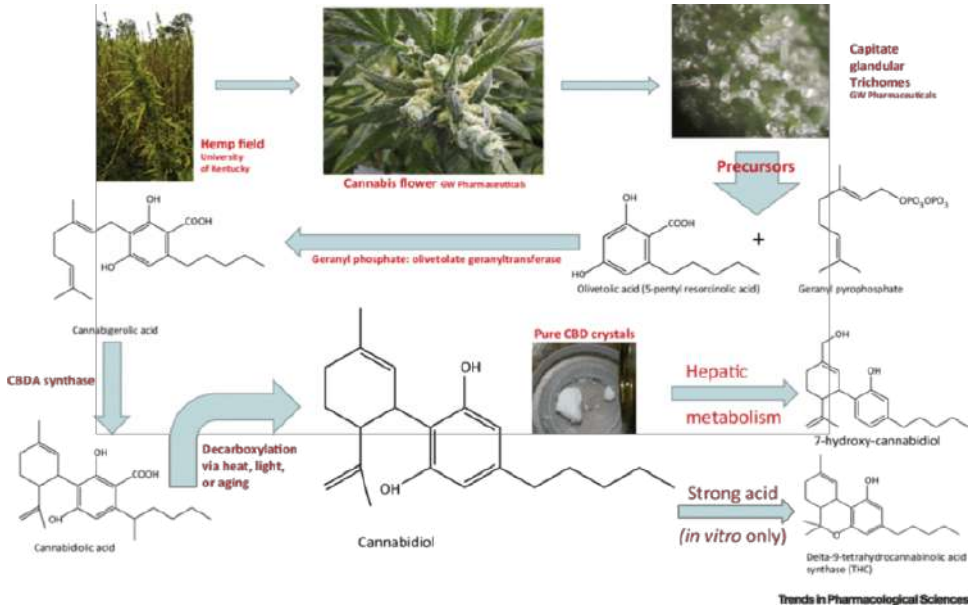
WHAT IS THC?

Tetrahydrocannabinol (THC) is a chemical compound (phytocannabinoid) found in cannabis plants. It is known to treat a number of diseases and they are very effective. THC is the key mind-altering (psychoactive) substance in marijuana. It acts on specific brain receptors, causing mood changes, depression, suicidal thinking, memory issues, and disruption to normal learning abilities. It may also produce dependency. In some people, THC may reduce aggression.

CBD AND THC IN HEMP AND MARIJUANA

HEMP- Hemp plants consist of a smaller amount of CBD and THC (0.3%) leading it to not cause any psychoactive effects like creating "high" or "stoned' feeling, a general change in perception, heightened mood, and an increase in appetite. Most of the medicinal CBD is extracted from hemp plants because of its less THC content.

MARIJUANA- Marijuana plants have more THC(5-25%) content which causes psychoactive effects and that can lead to short time side effects (decrease in short-term memory, dry mouth and feelings of paranoia or anxiety as well as long-time side effects (addiction, behavioural problems and decreased mental ability).



The figure shows the Cannabidiol(CBD) Production, biosynthesis and Metabolism.

PHARMACOLOGY OF CBD

1. Bioavailability from oral delivery was found to be 6% because of its significant first pass mechanism.
2. A new study found out that CBD, when given at dose can cure Darvet syndrome which is mostly seen in children
3. Aerosolized CBD has found out to yield better bioavailability than oral administration.

CONCLUSION:

1. Marijuana has high CBD as well as THC content. Because of its high THC content, it will lead to various psychoactive effects mentioned above.
2. Hemp has both CBD and THC in less amount; therefore, it should be cultivated in a larger amount in order to extract the CBD which is a very useful drug for the above mentioned diseases.
3. CBD will be a great alternative for many drugs that cause side effects and complications.

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Sudeep.R
II Year
B.Tech Biotechnology

Palani Kumar M

I Year

B.Tech Biotechnology

COMPLEMENTARY AND ALTERNATIVE MEDICINE (CAM)

WHAT IS CAM?

A group of various medical and healthcare systems, practices and products that are presently not considered to be a part of conventional medicine comes under “Complementary and Alternative Medicine” (CAM). It is being increasingly used by people all over the world. When a non-mainstream practice is used together with conventional medicine, it is said to be “complementary” and when a nonmainstream practice is used in place of conventional medicine, it is said to be “alternative.”

INTEGRATIVE HEALTH CARE

When conventional and complementary approaches are put together in a coordinated way, it is considered as integrative health care. It focuses on a holistic, patient-focused approach to health care and wellness often including mental, emotional, functional, spiritual, social, and community aspects and treating the entire person instead of one organ system. The two categories of complementary and integrative health practices are natural products (Vitamins and minerals, herbs and probiotics) and mind/body practices (Yoga, meditation, acupuncture). There are some other complementary approaches that do not neatly fit into either of these groups such as the practices of traditional healers, Ayurvedic medicine, homeopathy, naturopathy and functional medicine.

WHY IS CAM USED?

CAM is used for the prevention and treatment of diseases that are considered to be chronic and incurable such as breast cancer, arthritis, asthma, HIV infection, etc. Patients choose CAM because they may be dissatisfied with allopathic healthcare as it seemed to be ineffective, have side-effects, is impersonal or too expensive. Apart from the dissatisfaction, other reasons are that it is in accordance with their personal values as well as religious and health philosophies.

SAFETY OF CAM

A medical product or practice may not be fully safe, there can be risks involved in using them which depend on the particular product or practice. However, for a specific product or practice used, the following general suggestions can help you think about safety and minimize risks:

- Try learning about factors that affect safety. For a practice that is administered by a practitioner, such as chiropractic, factors like training, skill, and experience of the practitioner are important. For a product like dietary supplement, the precise ingredients and the quality of the manufacturing process are important.
- Choose the practitioner as carefully if you decide to use a practice provided by a complementary health practitioner.
- We should be aware that individuals respond differently to health products and practices which is based on the usage, personal belief and state of health.

CONCLUSION

The main concern is the safe and appropriate use of CAM, especially when used concomitantly with other medicines. This usage may have a negative impact including side-effects, unchecked progression of an underlying illness and unnecessary expense. These side-effects and interactions may impact the effectiveness of allopathic medicines. Thus, patients and physicians must have knowledge about various CAM and know whether a CAM can be used with allopathic medicine, it's side effects and treatment.

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Priyadharshini.C
II Year
B. Tech Biotechnology

CRISPR Technology

A CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats which are the hallmark of a bacterial defense system that forms the basis for CRISPR-CAS9 genome editing technology. The term is often used loosely to refer to systems that can be programmed to target specific stretches of genetic code and to edit DNA at precise locations as well as for other purposes such as for new diagnostic tools. When a virus attacks one of the bacteria, the CRISPR system captures a piece of the virus's DNA and slides it into a section of its DNA, which lets the bacteria's virus fighting machinery use it like a "wanted" poster to identify and destroy the virus it came from the next time it attacks.

CRISPR “spacer” sequences are transcribed into short RNA sequences capable of guiding the system to match the sequences of DNA.Cas9 is one of the enzymes produced by the CRISPR system. When the target is found, Cas9 binds to the DNA and cuts it, shutting the targeted gene off. Using the modified version of Cas9, researchers can activate gene expression instead of cutting the DNA. It helps the researchers to correct the mutations at precise locations in the human genome in order to treat the genetic cause of disease.

CRISPR genome editing allows scientists to quickly create cell and animal models which researchers can use to accelerate research into diseases like cancer and mental illness since it can be applied directly in the embryo. CRISPR reduces the time required to modify target genes compared to other gene targeting technologies.

APPLICATIONS:

- It is also used to modify yeasts to make biofuels and to genetically modify crop strains.
- CRISPR has been used as a tool to remove the genetic diseases that are abound in purebred dogs like in Dalmatians.
- It is being used in the treatment of genetic diseases like cystic fibrosis, Huntington’s chorea, hemophilia.
- It is also being utilized in the creation of transgenic animals to produce organs for transplants into human patients.

Other systems such as CRISPR-Cas13 that target RNA provide alternate avenues for use. Agricultural companies are interested in the technology's potential to edit crops to make them drought resistant and faster growing. Between 2014 and 2015, scientists reported the successful use of Cas9 in mice to eliminate muscular dystrophy and cure rare liver disease and to make human cells immune to HIV. Continued searches through bacterial DNA have revealed new enzymes that improve CRISPR'S performance. Summing it all up CRISPR has its advantages and disadvantages ranging from ethical concerns to being known as the fastest, cheapest and most precise way of editing genes. This scientific breakthrough can eliminate the disease, solve world hunger, provide unlimited clean energy.

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Curcumin In Turmeric – A Health Capsule

Curcumin is generally perceived as the purified extract of the well-known spice, Turmeric. Scientifically defined, Curcumin, derived from Curcuma longa plants is the principal curcuminoid (natural chemical compounds) of turmeric, a member of the ginger family (Zingiberaceae). Curcumin is responsible for the distinct yellow colour of turmeric and is used as a herbal supplement, food flavour, food colour and cosmetics ingredient. Curcuminoids have been approved by the Food and Drug Administration (FDA) as 'Generally Regarded As Safe'.

Turmeric, a key ingredient of Indian cuisine, packs several benefits borne out by numerous studies that vouch for their antioxidant, anti-inflammatory and anticancer properties. The purpose of this article is to undertake a critical analysis of the beneficial properties of curcumin found in turmeric.

ANTICANCER PROPERTIES:

Empirical evidence supports findings that Curcumin can prevent digestive cancers like colorectal cancer and that it can reduce metastasis, which is, spread of cancer. The cause of cancer explained in a lucid manner, is simply an imbalance between cell death and cell proliferation. When cells skip death due to absent apoptotic signals there is a subsequent increase in the count of proliferation. Curcumin possesses the ability to induce apoptosis (programmed cell death) of tumour cells. The anticancer activity of curcumin is achieved by the suppression of cellular signalling pathways.

ANTI INFLAMMATORY PROPERTIES:

Curcumin has been established as a strong anti-inflammatory compound without major side-effects, as seen in other drugs. The mechanism involves the inhibition of a nuclear factor-kappaB and Toll-like receptor-dependent signalling pathways and activation of a peroxisome proliferator-activated receptor-gamma pathway. Simply put, the nuclear factor-kappaB is the molecule that travels to the cell nuclei and activates the genes related to inflammation. Osteoarthritis, a major disease associated with inflammation can be controlled using turmeric extracts containing curcumin. Scientific data prove that that 8-12 weeks of standardised turmeric extracts (curcumin) treatment can reduce arthritis symptoms and alleviate inflammation-related manifestations.

ANTIOXIDANT PROPERTIES:

The antioxidant character of curcumin stems from its ability to scavenge different forms of free radicals such as Reactive Oxygen and Reactive Nitrogen Species (ROS and RNS). Also being a lipophilic compound (readily dissolving in lipids/fats), it actively scavenges peroxyl radicals.

OTHER BENEFICIAL PROPERTIES:

1. Curcumin is known to improve the function of the endothelium (blood vessel lining), thereby reducing the risk of heart diseases.

2. Research has shown that Curcumin is as effective as Prozac in alleviating symptoms of depression.

3. Studies are being conducted to prove the potential importance of curcumin in reducing the risk of Alzheimer's.

CONCLUSION

There are overwhelming evidences of numerous potential benefits of this compound in treating various lifestyle-related conditions associated with chronic inflammation, including atherosclerosis, heart failure, obesity, diabetes and other related diseases, such as dementia. Nevertheless, clinical tests have revealed that “curcumin is an unstable, reactive, non-bioavailable compound and, therefore, a highly improbable lead “, and hence there have not been any confirmed medical use of this research data. Reduced bioavailability in humans is attributed to poor absorption, rapid metabolism and chemical instability. As a solution, several drug delivery systems (polymer nanoparticles, chitosan nanoparticles, colloidal nanoparticles) have been developed. Further research will provide greater clarity and affirmation.

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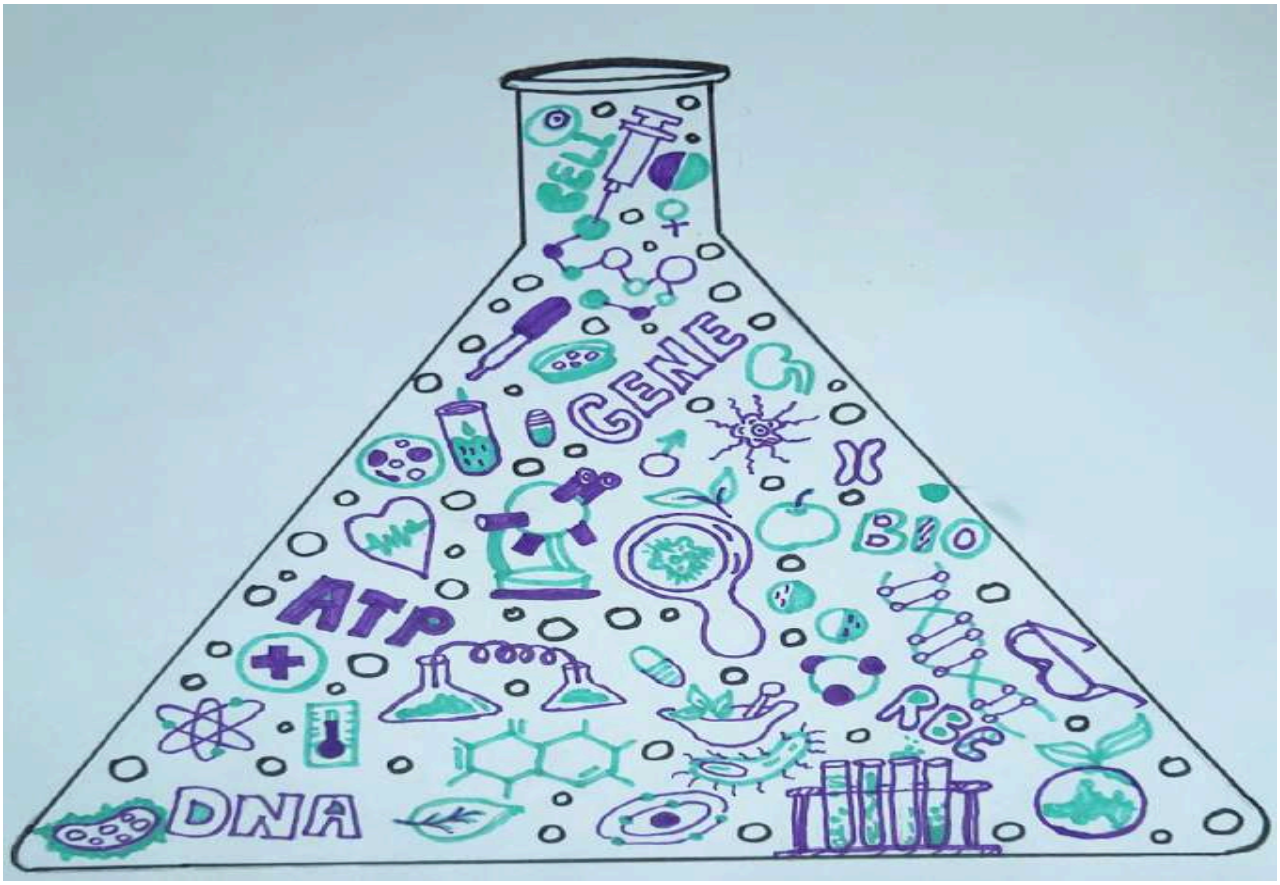

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Effect Of Indian Carnatic Music On Neural Network

This article is a lucid narrative that aims to take one through a musical journey touching on various beautiful destinations in the human brain and thereby helping one to get to know the amazing responses by our biological system to the melodious notes of Carnatic music.

Music can be biologically defined as a positive stimulus made of three main components – melody, harmony and rhythm, to which every tiny cell and atom in the creation responds to. There are different genres of music – western, jazz, rock, Indian Carnatic, Hindustani and so on. But the unique aspect of music is that, despite showing such variability in composition, language and, expression, music can be thought of as the universal language that binds together the whole world in unison.

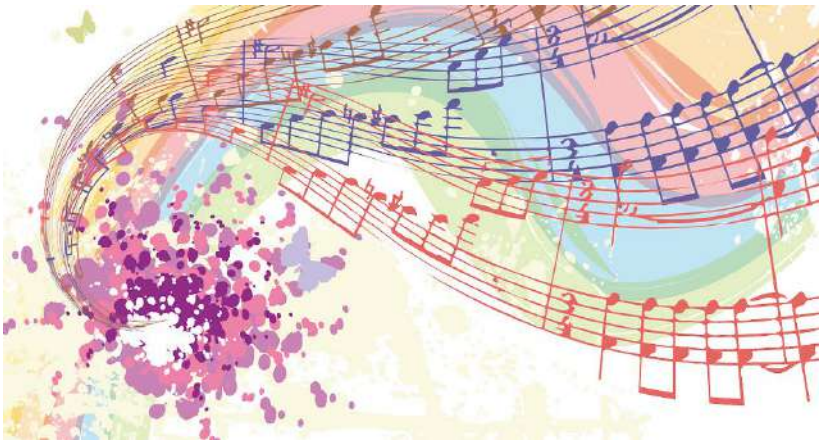
Indian Carnatic music among the other forms is one of the ancient and culturally rich forms of musical notes made up of 3 important ingredients - Raga (mood or the essence), Tala (rhythm) and Bhava (expression and feel). These ingredients when added in a suitable proportion and decorated with lyrics give rise to a delicious food called musical composition. Now that food is ready, how does it enter the biological system and affect it? The brain – control master of the body comes into play here. It can be thought of as a highly organized mass of neurons wound in a complex maze, through which music finds its way and has a direct impact on the auditory, frontal, cerebral, and motor cortices. These are the major regions that are involved in the processing of music in the brain. Musical food is unique in the aspect that it enters the system through the brain and not the buccal cavity (a sarcastic comment to connect music and biology!)

The stimuli enter the brain through the brainstem i.e medulla oblongata and then enter the limbic system. This system resembles a cortical ring and surrounds the brain stem. It is the limbic system which is responsible for the interpretation of emotional and brain signals by Electroencephalogram (EEG). Unlike western forms of music that depend heavily on peppiness, rhythm and josh, Carnatic music is more inclined towards melody, symphony and is tailored to produce a soothing effect. Ancient Indian texts tell that Raga Chikitsa (treatment with the help of Ragas) was an integral part of treatment in the Ayurveda system. The musical Ragas were used as adjuvants to enhance the recuperation process of the patient. Sama Veda, which is one of the four Vedas, is entirely based on musical hymns and compositions. Thus all the Yajnas and sacrificial worship were performed by our ancestors to ensure the mental well being of everyone in the world. These are instances from ancient times.

The situation today is that we are technologically advanced. But have the technological advancements been entirely beneficial? New diseases and new ailments are being identified nowadays and even teens suffer from depression, anxiety and stress! Mental issues and suicides are on the rise. Alzheimer's and Dementia have become dreaded words today. Is there any remedy to tackle these alarming problems? The answer lies in Carnatic music. Studies have found that the left and right halves of the brain are balanced and have good synchrony in people who sing and play musical instruments. Also, EEG data collected from brain signals of people listening to Carnatic music showed brain waves of high amplitude and frequency. This indicates that the brain produces waves corresponding to positive emotions of activity and energy for the period of time for which the person is exposed to music. These brain waves also act as mediators and activate certain regions in the brain. These activated regions, in turn, stimulate the production of peptide hormones, secondary messengers, atrial natriuretic factor (ANF) involved in blood pressure and heart rate regulation etc. Music stimulated brain signals have also been shown to play a major role in the renin-angiotensin mechanism, which again regulates blood pressure and the rate of excretion. The wonder of Carnatic music and its role in all the above-mentioned mechanisms is that its slow, melodic notes or Swaras anchored on complex rhythm patterns have differential effects on the

listening person's brain, based on his/her emotional stature and composure. There are also aspects of Carnatic music that rely purely on an individual's inherent creativity and intelligence rather than imbibed knowledge. This aspect is called *Manodharma* or presentation of Ragas and Swaras purely based on one's own discretion and innovation. However, there are certain rules and frameworks under which the *Manodharmic* improvisations must fall to be musically correct and aesthetically pleasant. Thus, complex mathematical calculations called *Kanakku*, intricate systems of Swaras called *Swara Lakshana*, minute musical shakes called *Gamakas* must be mentally worked out and put into perspective by the person rendering it. It can be inferred that listening to and practicing Carnatic music can increase mental capabilities and help in treating children with learning disabilities, autism and, hyperactive disorders. There have also been some interesting studies done, which suggest that exposing adults in the middle age group to Carnatic music for at least a few minutes every day lowers the chances of them being affected by Alzheimer's and Dementia in the long run. Carnatic music is also nowadays being used to remove the pain and stress of critically and terminally ill patients. With the advent of path-breaking discoveries and advancements in neuroscience, which have helped prove the power of Carnatic music, music therapy is gaining momentum all over the world.

Music is a gift given to the creation to make life on earth more lively and meaningful. Moreover, traditional Indian Carnatic music which has its roots in divinity is one of the purest forms of music capable of treating a large number of mental conditions and physical ailments as well. We humans, the so-called evolved species on earth are now in the process of exploring artificial intelligence and machine learning to create human-like robots. But one should contemplate deeper to realize that we are yet to uncover the many more underlying mysteries of the human brain, human intelligence and various aspects of brain response to music and other stimuli, which can help us live a better and active life. It is an important point for everyone to ponder upon. As a biologist my opinion is that it is better to be in tune with nature, make our lives simple, enjoy the various gifts of nature like music and find ways to channel nature's bounty in a manner that can be useful to all organisms if not only for the present but also for the future!



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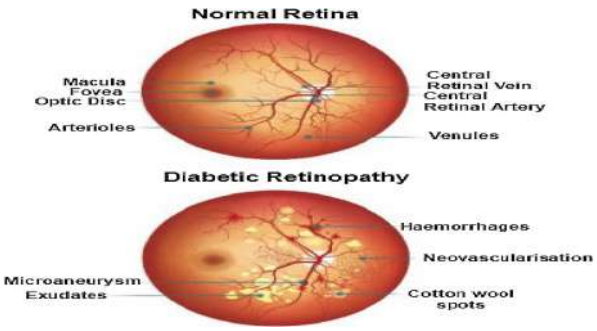
The Role Of Artificial Intelligence In Diabetic Retinopathy



Diabetic Retinopathy is a microvascular complication of diabetes mellitus and is a significant cause of new-onset blindness. However, it was not until 1943 that the work of **Arthur James Ballentype** provided evidence that diabetic retinopathy represents a unique form of vascular disease. Retinopathy occurs when blood vessels in the back of the eye, the retina become damaged, they can leak and these leaks can cause dark spots on our vision. The abnormal blood vessels associated with diabetic retinopathy stimulate the growth of scar tissue which can pull the retina away from the back of the eye. This may cause spots floating in your vision, flashes of light or serve vision loss. (GLAUCOMA).

The main cause of retinopathy tends to be sustained high blood glucose levels and high blood pressure as well. High sugar glucose levels can weaken and damage the small blood vessels within the retina. This may cause haemorrhages and swelling of the retina which then stares the retina of oxygen and abnormal vessels may grow.

There are four stages of Diabetic Retinopathy.

MILD NON-PROLIFERATIVE RETINOPATHY: The first stage is also called background retinopathy. It means that there are tiny bulges in the tiny blood vessels in retinas which are called microaneurysms. They may cause the blood vessels to leak a small amount of blood in the retinas.

MODERATE NON-PROLIFERATIVE RETINOPATHY: The second stage is also called pre proliferative retinopathy. At this stage, the blood vessels in the retinas swell. They may not carry blood as well as they used to. These things can cause physical changes to the retina. These changes can lead to Diabetic Macular Edema (DME).

SEVERE NON-PROLIFERATIVE RETINOPATHY: This is also called proliferative retinopathy. In this stage, the blood vessels become even more blocked. This means even less blood goes to the retinas due to which scar tissue forms. The lack of blood triggers a signal to the retinas to create new blood vessels. If the blood vessels close off completely, it's called Macular ischemia. This can lead to blurry vision with dark spots some people describe as Floaters.

PROLIFERATIVE DIABETIC RETINOPATHY: In this advanced stage, new blood vessels grow in the retinas and into the gel-like fluid that fills the eye. This growth is called neovascularization. These vessels are thin and weak and often bleed.

SYMPTOMS: Lethargy, Thirst (polydipsia), polyurea, Weight loss, increase appetite (polyphagia), Reduced visual activity.

Effective treatments have been established that preserve vision and dramatically reduce the risk of vision loss which includes Laser Treatments and Vitrectomy Surgery. On 11th April, the US Food and Drug Administration (FDA) announced the marketing approval for the first medical device to detect more than a mild level of diabetic retinopathy, the most common cause of vision loss among diabetic patients and the leading cause of vision impairment among the US working-age population. **IDx-Dr**, the device developed by IDx LLC can produce screening decisions without the need for clinician interpretation of retinal images allowing the device to be used outside specialist centres, such as by primary care physicians.

FACTS:

- Retinopathy (DR) is the major cause of new blindness among adults aged 20-74 years.
- Approximately 700,000 persons in the United States have proliferative diabetic retinopathy.

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Human IPSCs In Cardiovascular Applications

A pluripotent stem cell is a cell that can differentiate into any specialised cell types of the body. Induced pluripotent stem cells are derived from the adult skin or blood cells that have been reprogrammed back into an embryo-like pluripotent state that enables the development of an unlimited source of any type of human cell required for therapeutic purposes. This is done by forcing the skin or blood cells to express genes and factors and modifying their genetic set-up such that they turn pluripotent.

INDIA AND CARDIOVASCULAR DISEASE

Cardiovascular diseases are the number 1 cause of death globally, taking an estimated 17.9 million lives each year. It is estimated as 31% of all deaths worldwide. CVDs are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart disease and other conditions. Cardiovascular diseases have now become the leading cause of mortality in India. A quarter of the mortality in India is attributed to cardiovascular disease. Countering the epidemic requires the reinforcement of health systems, with an emphasis on prevention, early detection techniques, and treatment with the use of both conventional and innovative methods. Several ongoing community-based studies are testing these strategies.

STEM CELL THERAPY:

Stem cell therapy promotes the repair response of diseased, dysfunctional or injured tissues using stem cells or their derivatives. It is also called regenerative medicine. Most stem cells used for regenerative therapy are isolated either from the patient's bone marrow or from adipose tissue. In a stem cell transplant procedure, stem cells are first differentiated into the necessary adult cell type. Then, these mature cells are used to replace the damaged tissues. The stem cell therapy could be used for the treatment of various diseases like replacing virtually any tissue or organ that is injured or diseased. Stem cells are studied in people with severe heart diseases. Some preliminary clinical trials achieved only moderate improvements in heart function following the use of bone marrow stem cell therapy.

Type of Stem Cell	Hematopoietic stem cells	Embryological stem cells	Induced pluripotent stem cells
Site	Bone marrow	Umbilical cord blood	Human keratinocytes, peripheral blood cells, renal epithelial cells
Function	Differentiate into blood cells, Multipotent in nature	Differentiate into any type of cell	Genetically modified and hence, used to model human disease. Advantages: Avoids ethical concerns, less painful, lowers immune rejection, convenient.
Disadvantages	Painful procedure, require high maintenance, risk of immune rejection, inflammation, life long procedure.	Self cells can only be used else cross reactions can take place, requires maintenance. Ethical concerns.	

Stem cell therapy for the treatment of myocardial infarction usually makes use of autologous bone marrow stem cells, but adipose-derived stem cells can also be used.

Possible mechanisms of recovery for cardiovascular diseases include:

- Generation of heart muscle cells
- Stimulating the growth of new blood vessels to repopulate damaged heart tissue
- Secretion of growth factors

Induced pluripotent stem cells have unlimited self-renewal and proliferation properties as well as an ability to differentiate into mature cell types of all three embryonic germ layers. Currently, patient-specific iPSCs can be achieved by reprogramming adult somatic cells by ectopic expression of pluripotency-associated transcription factors including OCT4, SOX2, KLF4, and c-MYC. The reprogrammed iPSCs have similar characteristics as human embryonic stem cells in terms of their self-renewal and differentiation potentials. These patient-specific iPSCs can bypass previous limitations including immunological rejection and ethical barriers that impede the use of it. In addition, they would allow a better understanding of mechanisms underlying several human genetic, malignant, and non-malignant diseases. Recently, genome editing technology has been applied to correct the mutation of disease-specific iPSCs resulting in gene-corrected iPSCs, which can be used for autologous cell-based therapy.

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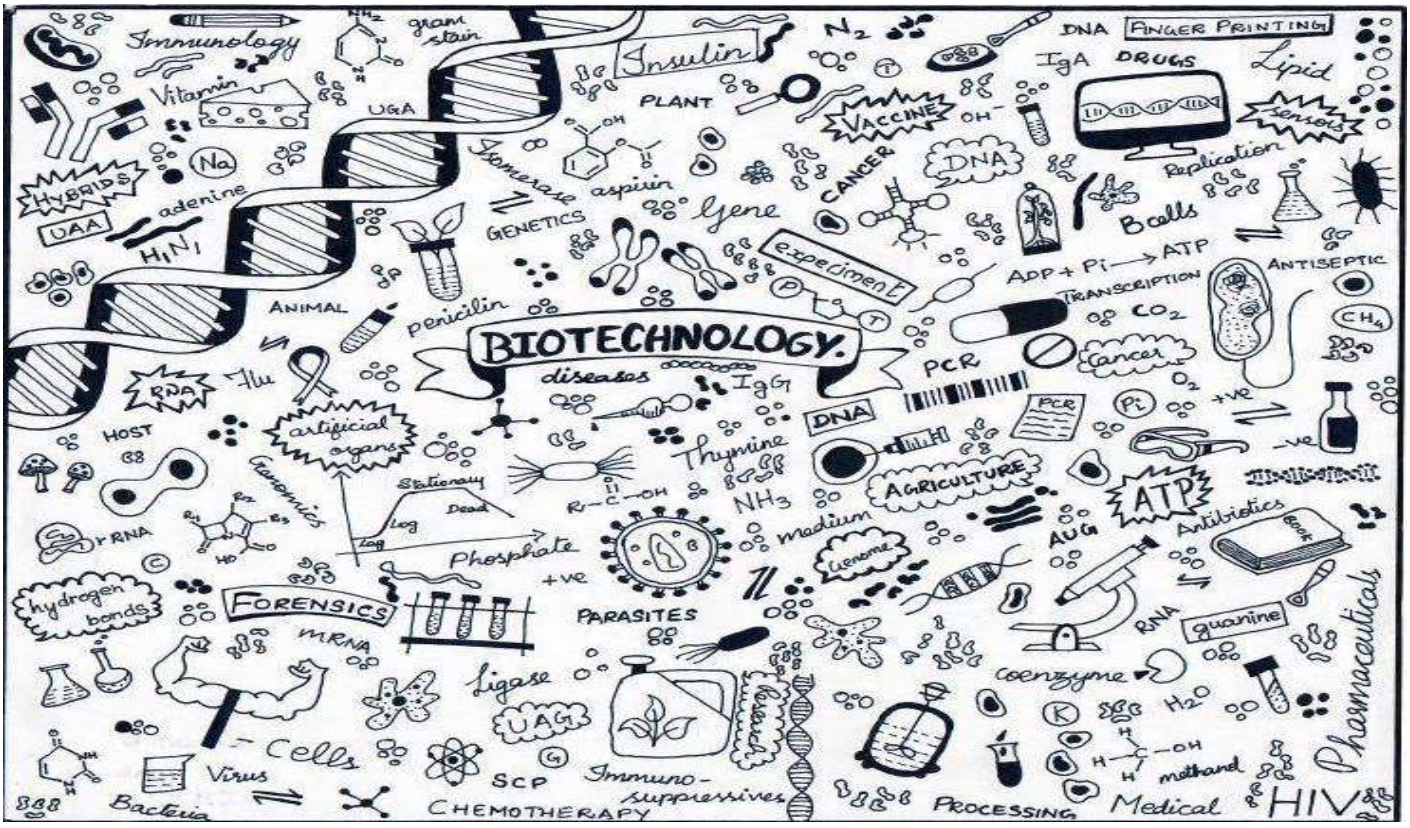

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Nanoparticles In Cancer Treatment

Several types of research have been undertaken by many scientists all over the world for cancer treatment but with limited progress in regards to patient's survival especially for certain types of very aggressive cancer, so there is a need for some changes because what's been done so far has not been working.

The major reason behind this is that over 99% percent of cancer drugs never make their way to the tumor because they lack transportation and tools to take them to the location they are aiming for. Thus we need some tools to take them to the location of the tumor and for this purpose, the *nanoparticles* can be used as an effective tool to load the cancer drugs. Nanoparticles have specific receptors that recognize tumor cells and healthy cells and enter only into the tumor cells. Cancer drugs are too small so that they are easily washed up by the kidney and they don't reach the tumor. But if we conjugate them with nanoparticles, they can't be washed away from the body and these particles protect the drugs from being degraded by enzymes. They release cancer drugs at the target site which enables them to do their job effectively. Currently, there are 10 clinically approved nanoparticles for cancer that are given to patients all over the world like gold nanoparticles, etc . But even then cancer isn't cured on administration because the major challenge against currently approved nanoparticles is the liver. As we know, the liver functions as the body's filtering system, it recognizes and destroys foreign particles such as bacteria, viruses, and also nanoparticles. The immune cells in the liver will phagocytize the destroyed matters. Hence only some of the particles reach the tumor. So the better strategy to improve the action of nanoparticles is to temporarily disarm the immune cells in the liver.

Recently, the scientific fraternity has ended up with an idea of using the body's own nanoparticles to load the cancer drugs since they can't be labelled as foreign particles by the liver. These biological nanoparticles are present in saliva, in blood, in urine and even in pancreatic juices. But the major challenge behind this is to isolate them in large quantities without damaging them. Research is still in the process to produce highly concentrated and high quality formulations of biological nanoparticles from a large quantity of liquids from the body. But this method is not yet in clinical use as it is only under laboratory trial. Therefore, in the coming years, these nanomedicines will save future cancer patients.

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LADA (Type 1.5 Diabetes)

Are you a person with a healthy weight range, have an active lifestyle and have been diagnosed with type 2 diabetes? Then there's a chance that what you actually have is LADA! Type 1 and Type 2 diabetes are quotidian forms of diabetes which are pervasive among the general public. Of these, type 1 diabetes accounts for 5% of the diagnosed hyperglycaemic patients. Notwithstanding that, type 2 diabetes is at the helm of 90 to 95% of the diagnosed victims for diabetes, around 15 to 20% of them may have type 1.5 diabetes or LADA (Latent Autoimmune Diabetes in Adults).

What is LADA?

Latent Autoimmune Diabetes in Adults (LADA), in adults, is a genetically linked hereditary autoimmune disorder that results in the body mistaking the pancreas as foreign and responding by attacking the beta cells of the pancreas. To understand what causes type 1.5 diabetes, it is important to know the difference between the other main types of diabetes.

Type 1 diabetes is an autoimmune condition in children, which results from your body destroying the pancreatic beta cells, and hence it's called juvenile diabetes. The patients need to inject insulin to survive.

Type 2 diabetes is characterized in adults by an insulin resistance that is caused by genetic and environmental factors such as diet high in carbohydrates, inactivity and obesity. Type 2 diabetes can be managed with lifestyle interventions and oral medications.

In type 1.5 diabetes, the symptoms begin to develop in adulthood and are caused by the body not producing insulin, rather than learned insulin resistance. Because this form of diabetes seems to span both type 1 type 2 diabetes, it's called type 1.5 diabetes.

Many researchers believe that LADA is a subtype of type 1 diabetes, while others don't recognize it as a distinct entity. Other researchers believe that diabetes occurs on a continuum, with LADA falling between type 1 and type 2 diabetes.

Genetics and Immunology:

People with LADA often have the tissue typing HLA genes and immune changes, which are associated with, type 1 diabetes. The presence of Glutamic Acid Decarboxylase (GAD) antibodies partly defines LADA. GAD is an enzyme that catalyzes the degradation of glutamic acid, a part of the cycle for the disposal of ammonia in the body. The presence of the self-antibodies to GAD in the blood is an early marker of the process that leads to the destruction of the beta cells. But people with LADA also have other auto-antibodies such as islet cell (IA-2) autoantibodies. Those with GAD and IA-2 autoantibodies progress more rapidly to insulin dependency than those with GAD autoantibodies alone.

Misdiagnosis:

Since LADA occurs in adults, misdiagnosis as having type 2 diabetes is common. Hence, medications designed to reduce the insulin resistance don't work as people with LADA have little or no resistance to insulin.

Why is it important?

If doctors recognize LADA early, they may be able to slow down the progression of damage to the beta cells based on the oral medications they prescribe or move to insulin sooner to prevent long- term complications. Controlling carbohydrate intake and exercising may also help protect the beta cells from further damage.

Treatment:

Type 2 diabetes treatments like Metformin, can work to manage the symptoms of type 1.5 diabetes until your pancreas stops making insulin. That's the point at which many people discover that they were dealing with LADA all along. Typically, the progression to needing insulin is much faster than type 2 diabetes and the response to oral hypoglycemic drugs is poor.

Conclusion:

One reason a type 1.5 diabetes can be confusing to some in the medical fraternity is that it doesn't fit in the traditional definition of type 1 or 2 diabetes- it has many of the traits of type 1 diabetes, but it's diagnosed in adults. Scientists who performed the largest ever genetic study on this puzzling type of adult onset diabetes thus have uncovered its connections to the two major types of diabetes offering intriguing insights!

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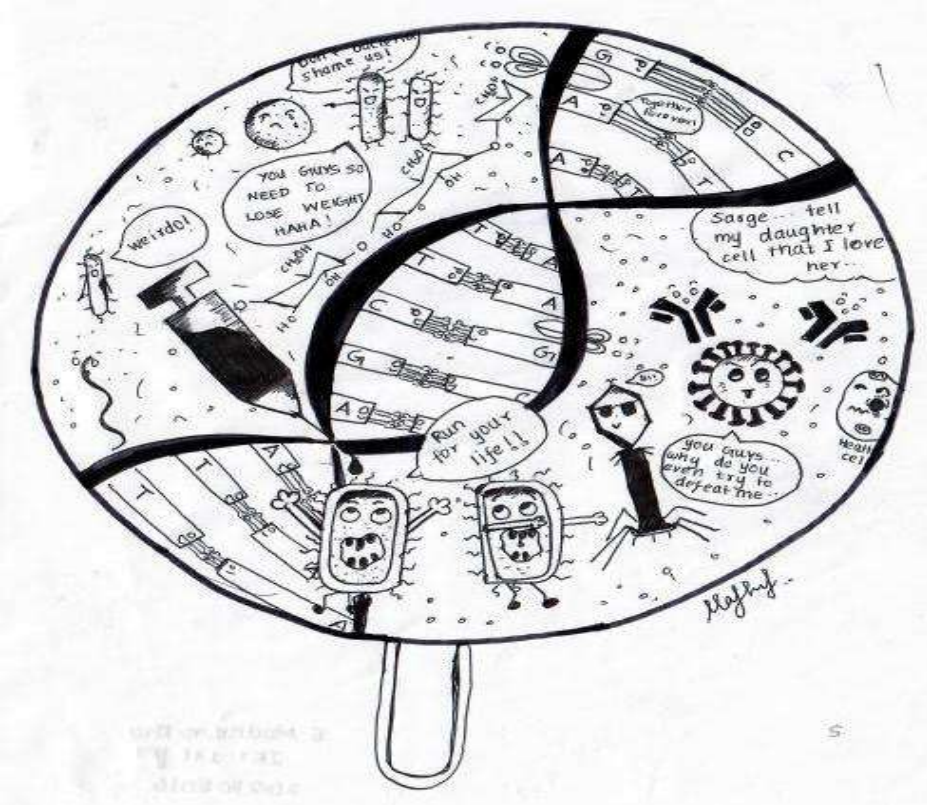

Monish Kumar. R
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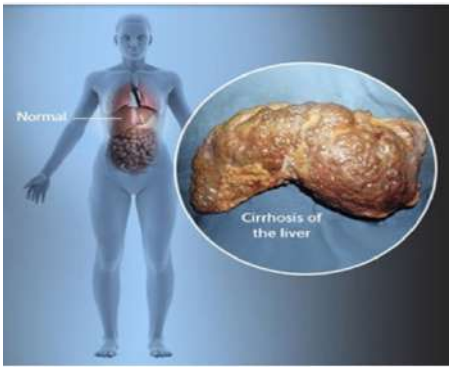
Liver Of An Alcoholic



Excessive alcohol intake may cause liver damage and it is called alcohol related liver disease (ARLD). It may also cause liver cirrhosis which is the scarring of the liver. Cirrhosis is the final stage of liver disease. Signs of alcoholic liver disease also include jaundice which is the yellowing of the skin and white sclera of the eye. Alcoholic hepatitis also includes fatigue, low-grade fever, loss of appetite, nausea, vomiting, tenderness in the right abdomen and weight loss. Some alcohol-related liver damage can be cured by stopping the drinking of alcohol for a while. Healing can begin a few weeks after stopping alcohol. First, the alcohol in the blood starts affecting the heart and brain, so that the people become intoxicated. It destroys the liver cells then it causes liver cirrhosis, alcoholic hepatitis, cellular mutation which may lead to liver cancer.

STEATOSIS (fatty liver) is also developed in an individual consuming a large quantity of alcohol over a large period of time and this process is reversible. Among heavy drinkers, 90% develop fatty liver in which about 25% develop the more severe alcoholic hepatitis and 15% cirrhosis according to a survey.

Women are mostly affected by alcohol related liver disease than men in shorter durations and doses of chronic consumption. It is common in people of age group 40-50 years. To overcome this, they should not take foods high in fat, sugar and salt and avoid alcohol. They should take grains, fruits, vegetables, meat, millets and beans. COFFEE promotes liver health which was identified by scientists recently. Tea, grapes, blueberries, cranberries, beetroot also promote liver health.

Blacks and Hispanics might be at higher risk of alcoholic hepatitis. Ascites is the fluid that accumulates in the abdomen might become infected and require treatment with antibiotics. Liver disease is also related to the kidney and will cause kidney failure.

There are several ways to determine the potential life expectancy of someone with cirrhosis. Two popular methods are followed: CTP and MELD.

Child Turcotte Pugh(CPT): The doctor uses someone's CPT score to determine class A, B or C cirrhosis. For class A, it is mild cirrhosis and there is a longest life expectancy and for class B it is moderate and class C it is the most severe cirrhosis.

CPT score chart

Score	Class	Two-year survival rate
5–6	A	85 percent
7–9	B	60 percent
10–15	B	35 percent

MELD(Model for End stage Liver Disease): It is used to determine the risk of death in people with end stage liver disease. Values from laboratory tests are taken to create a MELD score. Bilirubin, serum sodium, serum creatinine used to take this test. It helps to determine three mortality rate which refers to someone's likelihood of dying within three months and it helps the doctor to give a better idea of someone's life expectancy waiting for a liver transplant.

MELD score chart

Score	Three-month mortality risk
Less than 9	1.9 percent
10–19	6.0 percent
20–29	19.6 percent
30–39	52.6 percent
Greater than 40	71.3 percent

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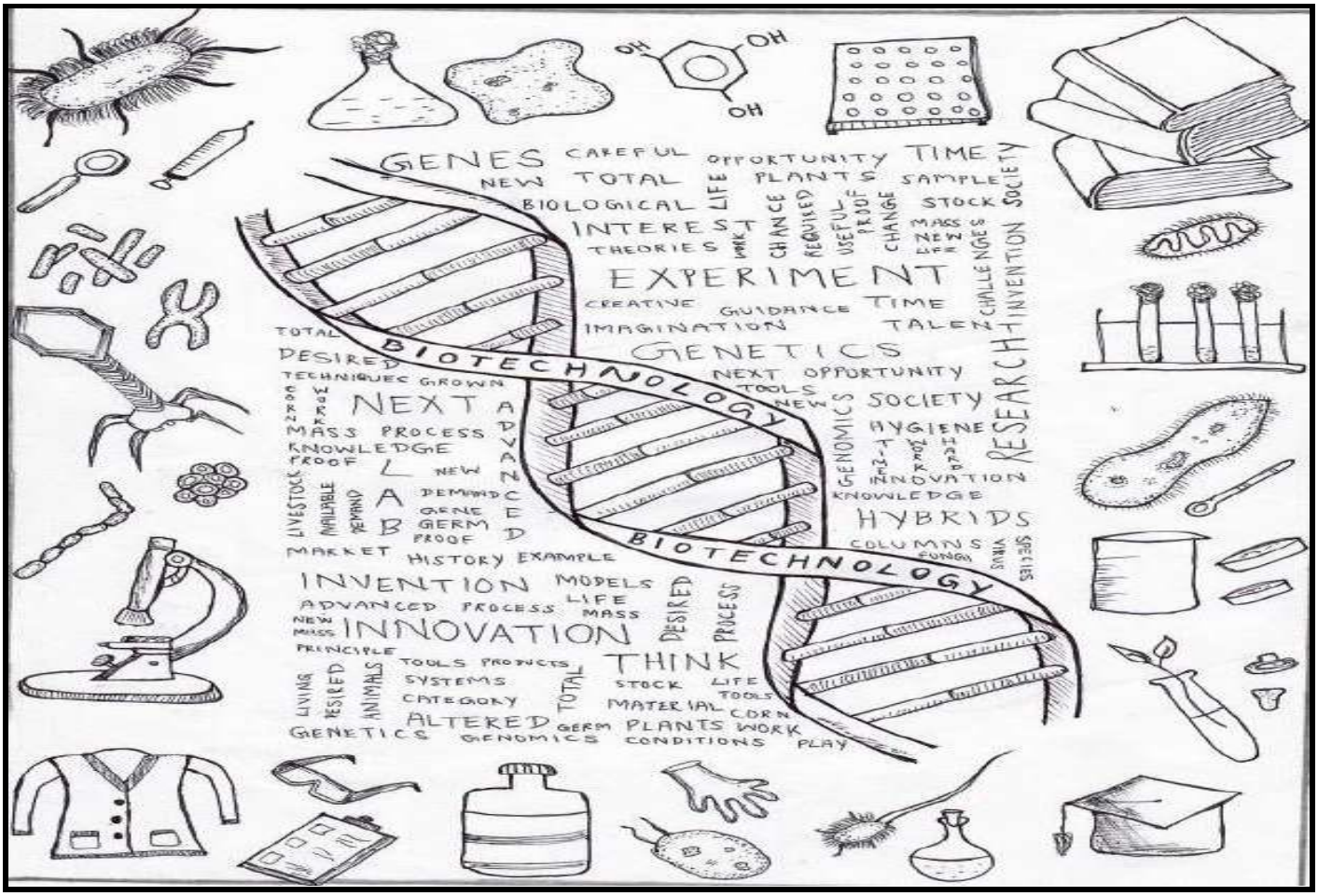

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Organ-On-A-Chip

INTRODUCTION:

Animal testing plays a crucial role in predicting pharmacokinetics as the preclinical test in drug discovery. The efficacy and toxicity of a drug candidate in the human body are predicted based on the information previously obtained by animal testing. However, errant pharmacokinetic predictions caused by species differences between humans and experiments have led to the abandonment of some candidate compounds before clinical trials and directly affect the efficiency and costs of new drug development. Currently, the in-vitro test with human-derived cells is used as an alternative to animal testing. These cell-based assays are an effective means for preliminary screening such as cytotoxicity. However, these methods have problems such as cells cultured using Petri dishes and multi-well plates may markedly lose their responsiveness, function and interactions between organs cannot be directly evaluated. In this decade, organ-on-a-chip based on microfluidic technology has been proposed as a novel cell-based assay tool in the research field.

LUNG-ON-A-CHIP:

The most famous organ-on-a-chip is the lung-on-a-chip known as breathing lung. This device has a two-layer channel structure separated vertically by a microporous membrane made of stretchable silicone, polydimethylsiloxane(PVMS). They cultured alveolar epithelial cells on the upper surface of the membrane, vascular endothelial cells on the lower surface, and used flowing air and culture medium, respectively, to replicate the lung structure on a fluidic device. The physiological expansion and contraction movements of the alveoli during respiration were mimicked by changing the internal pressure of the channel on both sides of the main channel at a specific cycle to extend and contract the porous membrane. The reproducer inflammatory reactions in which vascular endothelial cells highly express the integrin ligand (ICAM-1) after exposure of cells to tumor necrosis factor(TNF-alpha) and bacteria using the device. In addition, neutrophils flowing in the side channel attached to the vascular endothelial cells following the expression of ICAM-1, then migrated to the alveolar epithelial cell surface side, through the vascular endothelial cells and the membrane's pores, and phagocytize the bacteria. A toxicity test using nanoparticles demonstrated that the amount of nanoparticle uptake into the blood vessel side of the device was increased by stretching movements of the membrane. When a low molecular weight drug was used for the treatment of pulmonary edema in this disease model, inhibition of extravasation was observed similar to that absorbed in a pulmonary edema model animal. This device format has been widely applied to other organs such as the gut and kidney.

KIDNEY-ON-A-CHIP:

The kidney is an important organ responsible for metabolism and excretion in the body. During drug discovery, drug candidate efficacy and toxicity in the kidney are evaluated exclusively by animal testing because there are no suitable in-vitro models. In the simplest kidney-on-a-chip devices, Mardin-Darby canine kidney epithelial cells(MDCK) and human kidney-2 cells were adhered to the bottom surface of a microchannel and loaded with physiological shear stress. The authors showed increased cell thickness, expression of Na-K ATPase and promotion of cilia formation on the cells by the shear stress using this device. These data suggest the physiological behavior of kidney derived cells that can be replicated using the appropriate controlled shear stress load. To model the reabsorption of renal tubules two-layered kidney-on-a-chip devices with a porous membrane where proposed. In these studies, the physiological responses related to changes in sodium concentration and osmotic pressure of the apical channel were reproduced by introducing hormones such as vasopressin and aldosterone into the basal channel of the device. The shear stress not only alters cell orientation but also promotes P-glycoprotein expression, cell polarity expression, cilia growth and albumin/glucose absorption in the cells. Thus, the kidney can be effectively modelled using organ-on-a-chip technology and is an extremely effective approach for reproducing in-vivo tissue structure and function.

CONCLUSION

Organ-on-a-chip is an effective tool in drug discovery. Unfortunately, there are no concrete examples in which organ-on-a-chip technology has been fully utilized in the actual drug discovery process. For the practical use of this technology, active and organic collaboration among different research fields such as medical, pharmaceutical, biological and engineering sciences is necessary. If collaboration occurs properly and wisely, then we may hope for Organ-on-a-chip to become a reality.

Shrihastini V
III Year
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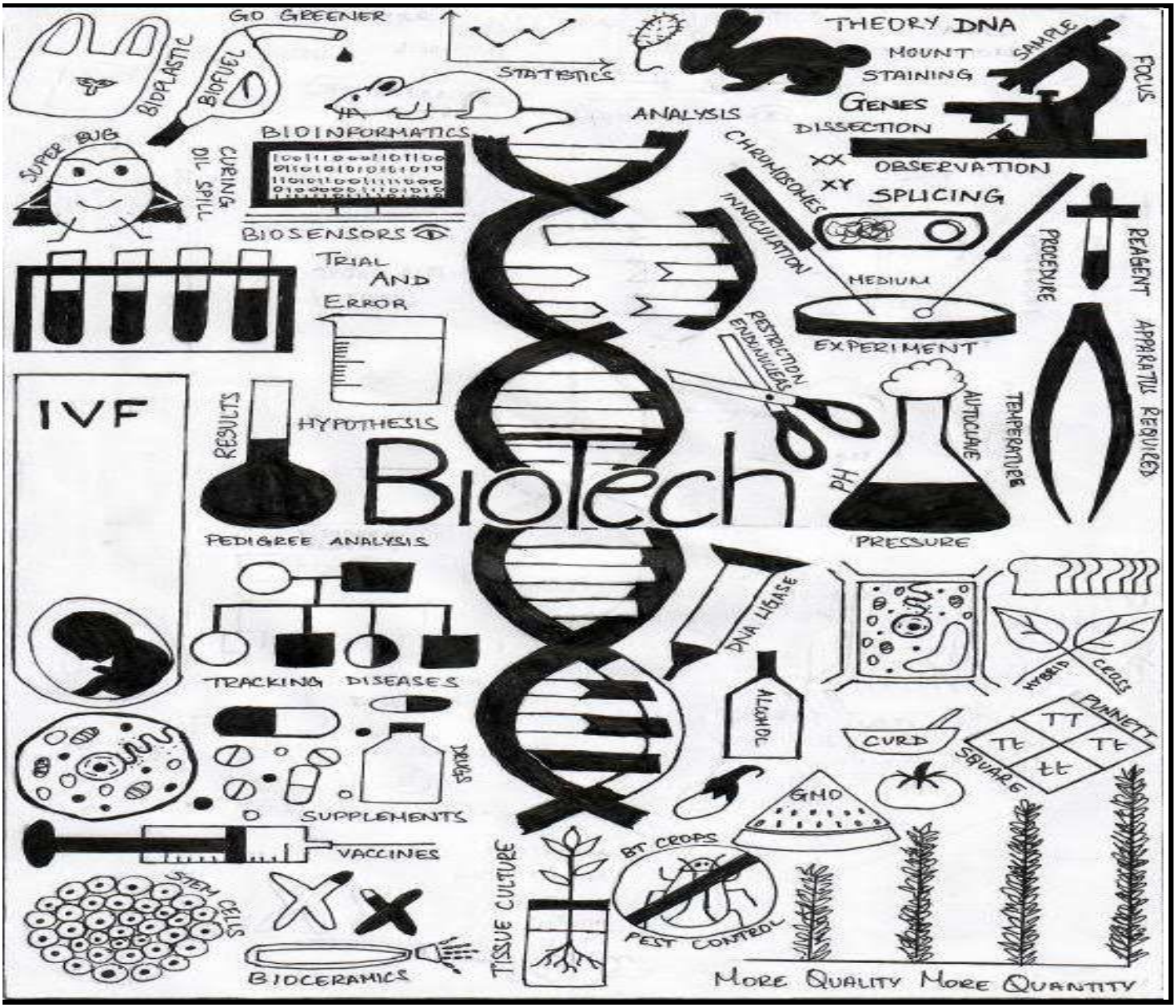

Raja T
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Plastic Eating Mushroom

Fascinating right? Have you ever thought that mushrooms break down plastic and turn into food? The secret is in the rare fungus called *Pestalotiopsismicrospora*. Designer Katharina Unger led such a study with Utrecht University in the Netherlands, in partnership with another designer Julia Kaisinger. This variety of mushroom was isolated from the Amazon rainforest by a group of researchers as part of Yale's annual rainforest expedition. It is capable of consuming the key component of plastic, polyurethane. These mushrooms can survive in anaerobic conditions. It kicked off the research exploring how fungi can degrade plastic without retaining the toxicity.

Unger and Kaisinger came up with a setup that cultivates edible plastic digesting fungi, a striking combination of creativity, science, and design. You are right; you can eat mushrooms that eat plastic. They created a prototype called Fungi Mutarium, a means of growing food from plastic waste. They used mycelium which is a threadlike, vegetative part of two mushrooms, Pleurotusostreatus (Oyster mushrooms) and Schizophyllum commune (Split gill mushrooms).

To convert plastic into edible products, it is first placed in an activation chamber where UV light sterilizes the material and activates the plastic's degradation process making it easier to digest. The plastic is then placed in an egg-shaped pod made from agar-a jelly-like substance made from seaweed. These pods are called FUs. The diluted mycelium stored in a holding tank on one side is delivered into each FU via a large pipette. The growth process is thus initiated. These cultures develop over the agar, eventually consuming the plastic and growing into a fluffy mushroom-like structure. While the process takes place, the pods are left in a growth sphere covered by a transparent domed structure to regulate the humidity levels. It takes a couple of weeks to months (depending on the plastic material and control settings) for the mycelium culture to consume the plastic. Researchers are working on accelerating the rate of fungal growth and plastic digestion. Once the samples are fully grown, the agar pods (FU) and their contents are removed.

The end product looks surprisingly like something you might want to consume. Unger tells that the final product varies in flavor depending on the strain of the fungus. It's been described as sweet with the smell of anise or licorice. Though Unger herself ate the fungi and said it's quite neutral in taste. Additionally, you can flavor these cups in a multitude of ways. The team came up with a recipe, a mango carrot FU or a chocolate FU filled with yogurt and a set of utensils called fungi cutlery to eat them. However further research has to be done to ensure the safety of feasting on these mushrooms. If proven to be successful they could solve two problems in one go, hunger and the plastic pollution crisis. Mushrooms prove themselves to be capable of magic once again!

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Thomas.G
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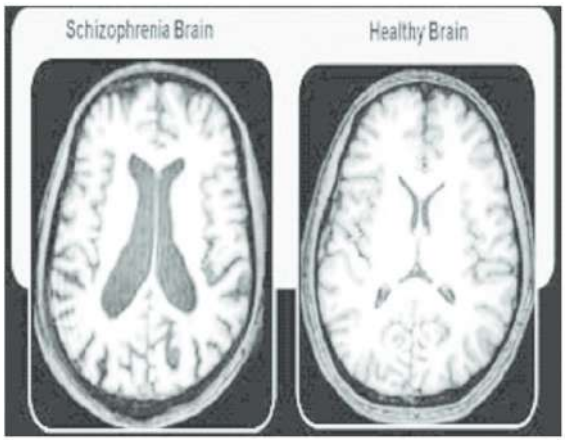
B.Tech Biotechnology

Schizophrenia: Disorder Affecting The Youth

This article would be focussed on explaining what exactly is schizophrenia, its myths and facts, its symptoms, understanding its exact known cause and finally providing a piece of information about the continued drug discovery to help cure this condition.

To understand the term schizophrenia, one needs to split the word into two i.e. *'schizo'* which refers to split and 'phren' which refers to the mind in Greek terminology. Schizophrenia does not mean split personality, rather it refers to split off from reality. It is a brain disorder that can alter the thought process and behavior of a person. Our society has come up with many myths associated with schizophrenia. Some of them include sidelining schizophrenics as violent people. To address these issues, we need to understand the symptoms associated with this disease.

Hallucinations and delusions form a major part of the positive symptoms. Delusion refers to the thought of constantly being controlled by an external force. Lack of motivation and inability to feel sensations of pleasure come under the category of negative symptoms. We may now understand that schizophrenics are not violent people. Their reaction to hallucinations and delusions just makes people feel they are violent but they are actually not.



Many neuroscience professionals have tried finding out the exact cause of schizophrenia but it still remains unknown. However, certain findings help us understand that genetic and environmental factors play a major role in this chronic brain disorder. The causes of schizophrenia can be explained under many branches such as neuroanatomy, neurochemistry and many more since all the branches are interrelated to each other. In this article, I would like to explain this disorder using neuroanatomy.

This picture shows the dissected brains of both normal people and schizophrenics. Enlarged ventricles (excess fluid in the picture) are often observed in patients suffering from chronic schizophrenia. Such patients also have reduced sizes of the prefrontal cortex area of the brain. This results in the loss of non-myelinated axons and dendrites in those regions of the brain. The loss of grey matter of the brain is also observed. The genetic factors which are responsible for this chronic disorder are Neuregulin 1(NRG1) and Disrupted In Schizophrenia (DISC). The environmental factors include stress from family and complete isolation of a person from his or her surroundings. Both of these factors combine to cause schizophrenia.

As we proceed to the final part of this article, it is important to know the general statistics of a disease before proceeding to the research of a particular drug to cure that disease. Schizophrenia affects about 1% of the total population of the world. Hence this disease is not rare and affects about 1 in 100 people. It affects men who are in the age group of 15-25 years and women in the age group of 20-30 years. By taking a look at the age groups we find that schizophrenia is indeed a disorder that affects the youth. Before naming the drugs, it is important to know their mechanism of action. Now, we take a look at the type of disease. Schizophrenia is a neuropsychiatric disorder. Hence the drugs in use to reduce its symptoms would be called antipsychotic drugs. Neurochemistry explains the in-detail mechanism of drug action. However, in this article, our discussion would be limited to a very basic understanding of the action of these antipsychotic drugs.

The antipsychotic drugs work by reducing the dopamine neurotransmission. There are two types of antipsychotic drugs namely typical and atypical drugs. The typical drugs block the D2 (one of the dopamine receptors present in the neuron) receptors (example- Haloperidol). They are tightly bound to the D2 receptors. The atypical drugs block D2 as well as serotonin receptors. They are loosely bound to the D2 receptors (example- Aripiprazole).

All these drugs can only reduce the symptoms of schizophrenia. No drug has been discovered that can provide a complete cure to this disorder. The development and approval of a drug take around 12-15 years. The latest drug to treat schizophrenia has just passed the Phase 2 clinical trials and experts believe that this drug if approved could be a game-changer for the entire pharmaceutical industry. The drug named KarXT is a combination of xanomeline and trospium wherein the former is a muscarinic receptor agonist and the latter is a muscarinic receptor antagonist. This drug works by stimulating the muscarinic receptors in the central nervous system. It has very few side effects. This drug would be ready for its Phase 3 clinical trials in the year 2020. As pharmaceutical technologists, we should learn and contribute our knowledge to this growing industry in the future.

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Meshach Sharan J
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Solution To Antibiotic Resistance

We, humans, develop many diseases from day to day and found several methods to cure those infections. One of the aid is what we found accidentally - Antibiotics obtained from penicillin. But nowadays, we are developing resistance to such antibiotics. What if we leave the condition as such? It leads to an increase in mortality rate.

Bacteria are habituated in most parts of our body. Most of the bacteria are good to us and even some help in our metabolism. But some bacteria cause deadly infections. We have done many types of research and found many antibiotics killing different bacteria with a variety of mechanisms like inhibiting cell wall synthesis, DNA synthesis, etc. Developed countries are using them without proper care and they are prescribed freely. It should be a last resort drug and not something you take because your cold is annoying. And many people in developing countries are not even getting access to it.

Continuous consumption of antibiotics may lead to the development of a superbug - A bacteria that cannot be killed by any antibiotic. Hospitals may be a growing ground for these superbugs. So bacteria evolved against the action of antibiotics and they may transfer their new evolved plasmids through the process of transformation. Another reason is that since animals are sheltered in very unhygienic conditions, they may develop the disease very easily. For this, antibiotics are fed to the animals in their feed. Bacteria residing in animals got evolved and food products from those animals also have the same which ultimately spreads to humanity. Example: antibiotic - Colistin (Last resort drug to cure complex infections that occur in the hospital). Shortly death due to these superbugs crosses death due to cancer.

Then what is the solution for this? The answer is a new research for better antibiotics. But there comes the deadliest being on planet earth - Bacteriophages. Are they deadliest? Yes, they are, but not to humans but to bacteria. There are many species of bacteriophages and they are specific to certain bacteria only and they kill only them. They mostly have icosahedron heads that have their genetic material. They have neck and tail fibers that are specific to the bacterial cell wall and it clearly shows that they cannot penetrate the human cell wall. They inject their genetic material into a bacteria and within a minute, they manufacture their parts and produce endolysin which lyses bacterial cell wall. Ejected ones begin to infect others. Bacteriophages act like specified missiles attacking only harmful bacteria leaving good ones rather than antibiotics to kill all good ones too.

The use of bacteriophage is successful with a patient infected by the bacteria 'Pseudomonas aeruginosa' in the chest cavity. This bacteria is naturally antibiotic resistant. On giving Bacteriophages in the form of IV, the person survives. But this treatment is still on experiment and pharma companies are not ready to invest in this. However, in the future, this technique may be followed. Bacteria may develop resistance against these phages and phages too may evolve to kill bacteria. Suppose in this battle bacteria wins and is completely resistant to phages, they have to give up their antibiotic resistance. And now we can use our old antibiotic to cure the disease!!

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Sruthi.S
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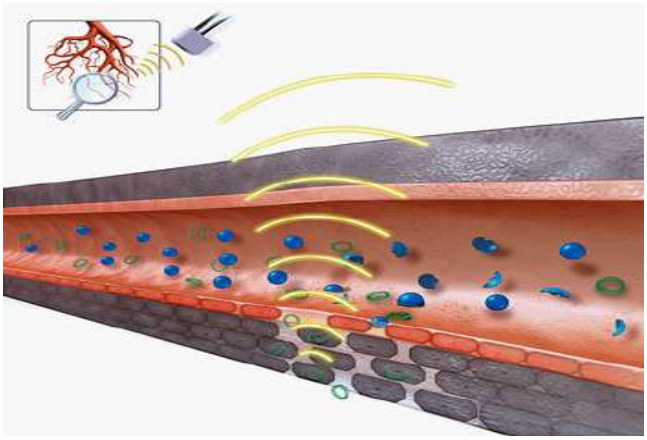
Sonoporation

Gene therapy is an experimental technique used to introduce genetic material into cells so as to compensate for abnormal genes or absent genes to treat or to prevent diseases. Gene therapy involves germline therapy, somatic gene therapy and non-viral gene delivery techniques such as electroporation, lipofection and more. Sonoporation, also known as cellular sonication is a gene delivery technique that uses sound for modifying the permeability of the cell plasma membrane. So this is a process that involves the formation of small pores in cell membranes by using ultrasound for the transfer of nucleic acid molecules.

Drug delivery with ultrasound was first reported by Tachibana K, Tachibana S, when they delivered insulin through ultrasonic vibration to mice in 1991. It was postulated that insulin absorption increased with ultrasound vibration after intradermal infection. This is interesting because this experiment demonstrates the potential of ultrasound as a method to improve the absorption of therapeutic materials. With ultrasound, chemotherapeutic agents get absorbed more efficiently in the mouse xenograft model of cancer. Transfection (the process of delivering nucleic acids and small proteins) of mammalian cells with plasmid DNA by scrape loading and sonication loading was performed by Fechheimer and others. They transferred plasmid DNA encoding the G418 resistance gene to cultured mouse fibroblasts by Sonoporation. G418 was added to the media and the colonies were then observed. This was the first report which demonstrated that plasmid DNA can be transferred to cells in vitro by using the ultrasound method. Sonoporation is performed with a dedicated sonoporator. It may also be performed with custom-built piezoelectric transducers that are connected to benchtop function generators and acoustic amplifiers.



This method uses microbubbles to enhance transfection significantly and in some cases is used for DNA uptake. Biophysical effects of ultrasound include cavitation, radiation pressure and microstreaming. Cavitation is the growth and collapse of microbubbles. Radiation pressure refers to the force in the irradiation field and microstreaming is the shear force that exists near the microbubbles.
To date, no clinical trials involving Sonoporation have been reported. It is a huge breakthrough in molecular biology but it harbors complicated aspects such as low gene transfer efficiency. This limitation is one of the main reasons that Sonoporation has not been applied clinically yet. Another limitation is the cell damage caused which may lead to apoptosis and change in enzymatic activity and mitochondrial membrane. It also delays DNA synthesis to arrest the cell cycle.

Sonoporation has the ability to introduce plasmids to cells and is less toxic compared to retro and adenoviral vectors because plasmids do not have the ability to give rise to benign or malignant tumors showing viable cells in immunologically non-responsive animals (tumorigenicity) and they hardly cause an immune response.

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Subhashini. B
I Year
B.Tech Biotechnology

The Paradox Of Life

O Chestnut tree, great-rooted blossomer,

Are you the leaf, the blossom or the bole?

O body swayed to music, O brightening glance,

How can we tell the dancer from the dance?

~ William Butler Yeats ~

Each of us, now fully functioning adults, were initially formed from tiny 5-day old embryonic stem cells. Religion may say we truly are only our souls, and everything surrounding us, a mere illusion. But to science, our genes define us. Ever wondered how our microscopic cells have the ability to retain information for a myriad of tasks, all with the same genetic material? Imagine the trillions of cells, that can sense, attack, and create biomolecules, and have evolved over millions of years to make you who you are today.

And there are so many possibilities for us to be crippled, be randomly afflicted by serious mutations. For the environment around us, holds the omnipotence to mutate our genes in an absurdly fascinating manner. Mutagens surround us, in every possible way, from the air we breathe to the food we eat, especially in the modern lives that we lead. Your genetic material could be undergoing a life-altering mutation, right here, right now, wherever you are reading this from, and you could never help it. Yet, despite all the opportunities available for you to be dead, or worse, a crippled vegetable, here you are – alive, thriving, breathing, sensing and functioning. And as cliché, as it sounds, the universe clearly has a purpose for you. You are here for a reason.

A simple example would be UV radiation. UV mutagenesis occurs at about 500-1000 reactions on the dermal layer, for every minute of exposure to the EM radiation. Imagine, if we were to be mutated at such an alarming rate, every one of us would have invariably ended with melanoma, for every minute that we spent playing outside, under the scorching heat of the day. But how are we still normal? Naturally, for every mutation, our cells have a DNA damage repair system, that identifies the specific point or region of aberration, and employs nucleotide excision repair enzymes that attack the modified nucleotides and replace them with the correct ones. This is only one of the amazing ways our cells repair themselves. Even during cell division, the cellular system constantly ensures the integrity of the DNA, before transitioning into the subsequent phases of the cell cycle. To think of it, it is quite amusing that we, who presume ourselves so mighty, are indeed only fragile entities clinging on to a few tiny biomolecules, to keep us alive.

Every problem in this world most conclusively arises from one insatiable need of man – the desire to be the alpha predator; the obsessive need to dominate and exploit not only members of our own species, but also make prey out of species from kingdoms across nature. If only, for even a millisecond, we realized the way we are always brushing arms with mortality, we would be able to not only cherish the sacred bubble that life is but also learn to respect our bodies. For the human body, in all its cellular glory, it is a mortifyingly fascinating instrument in itself.

Everything in this universe - from a little sapling the sprouts from the midst of barren rocks, to 9 billion-kilometer-wide stars evolving into being - always happens for a reason. There is always this unfathomable thread, looping through every entity in this universe, interconnecting our lives. Remember the marvels that your body performs on a daily basis, just to keep you functioning. To you and to every creation, life is an absolute wonder. So, treasure and make every bit count, while it lasts.

Dhivya D
III Year
B.Tech Biotechnology

The "Miracle Berry" That Could Replace Sugar

Miracle fruit is a red berry that comes from the synsepalumdulcifium or Richadelladulcifica. This is a shrub that is native to West Africa. When eaten, it can make bitter and sour foods taste sweet. This effect is caused by a protein contained within berry is called MIRACULIN. The berries themselves are not sweet but the miraculin binds with sweet receptors on the tongue and makes acidic food taste sweet such as lemons, limes,vinegar and more. Once you eat a berry, the effect can last between half an hour to 2 hours. The berries themselves, however, are very nutrient dense and therefore have some great health benefits too. They are great for diabetics to use as a natural sweetener, as it will make your food taste better without the need for sugar. They are also loaded with antioxidants and contain vitamins C, A and E.Leucine. This is an amino acid which helps to trigger muscle growth. This is great for bodybuilders. Those who are undergoing chemotherapy can use miracle fruit to get rid of the metal taste that often occurs in the mouth. The berries were traditionally used in Africa to enhance the flavour of food. Their staple diet consisted of sour foods such as staple bread gruel, beer and fermented palm wine. In foods, miracle fruit is used as a low-calorie sugar-free sweetener.

MIRACULIN STRUCTURE

It is a taste modifying glycoprotein. The molecular mass of the glycoprotein is 24.6 kDa, including 3.4 kDa(13.9% of the weight)of sugar consisting of glucosamine (31%), mannose (30%), fructose (22%), xylose(10%), and galactose (7%). The sugar is linked with Asp-42 and Asp-186. The native state of miraculin is a tetramer consisting of two dimers, each held together by a disulfide bond. Both forms of miraculin in its crude state have the taste modifying activity.

HOW DOES IT WORK?

Experts aren't sure how miraculin actually works. But there are three popular theories states that

- Miraculin temporarily suppresses sour taste receptors. Hence, when we eat acidic foods, they don't taste sour.
- Miraculin rewires the sweet receptors such that they begin to identify acids as sugars, thus making sour foods taste sweet.
- Acids cause miraculin to change its shape, causing it to bind to the sweet receptors more strongly and thus, making them over-activated,producing a sweet taste.

Now our technology has reached a marvelous growth. This type of protein is naturally present in berry plants. By using transgenic techniques, the production of miraculin from transgenic tomato plants and lettuces can also be done. The use of miraculin as food additives was forbidden in 1974 by the FDA. In 2011, the FDA declared it as an "illegal undeclared sweetener". Although this ban does not apply to fresh and freeze-dried miracle fruit, it is approved in Japan as a safe food additive, according to the List of Existing Food Additives published by the Ministry of Health and Welfare. Overeating these berries cause some side effects in our body such as degradation of taste buds, heartburn and other stomach issues. Just as the Greek physician Paracelsus said "A little bit of anything is divine medicine".

Prithika.V.S
II Year
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Thresholds Of Genotoxic Carcinogens

"The dose makes the poison" is a basic principle of toxicology. Coined by Paracelsus, who was a 15th-century Swiss scientist, physician, alchemist, and mysterious thinker, he is known as "the father of toxicology" because of this famous phrase. The adage means that any chemical can be poison if the dose is beyond a certain threshold and also that any poison can be non-toxic if the dose is below a certain threshold. Moreover, potential risks of various substances have been assessed using a dose-response model that determines a safety threshold; acceptable daily intakes (ADI) are calculated from the threshold below which no adverse effects are observed. These procedures are, however, problematic for assessments of genotoxicity. Therefore ADI cannot be determined, and health risks cannot be ruled out for the intake of any genotoxic substances.

What are Genotoxic and Non-Genotoxic Carcinogens?

The term "genotoxicity" is broad and ambiguous. Genotoxic agents damage DNA or the cellular component that regulates genome integrity. In contrast, mutagenic substances induce permanent transmissible changes comprising numerical or structural alterations of DNA or chromosomes. In the United States National Toxicology Program, chemicals were evaluated for their DNA reactivity, mutagenicity in Salmonella (Ames test), and carcinogenicity in rodents. The report indicated that genotoxic carcinogens, such as benzo and aflatoxin B1, induce tumors via DNA damage and mutations whereas non-genotoxic carcinogens, such as phenobarbital, carbon tetrachloride, induce tumors by chemically targeting the gene of the material cells.

Practical Thresholds of Genotoxic Carcinogens

There is no safe exposure threshold for genotoxic carcinogens. However, this policy was recently challenged by several environmental and theoretical approaches that claim that even DNA-reactive genotoxic carcinogens may have a practical threshold for their action. Indeed, for the consideration of the mechanisms through which a chemical induces mutation and cancer, several steps may suppress the induction of mutation and cancer. Genotoxic compounds are metabolically activated to reactive intermediates that induce DNA adducts and DNA lesions; subsequently, the DNA lesions become mutations after DNA replication. To counteract this adverse pathway, humans and other organisms have self-defense mechanisms such as antioxidants, detoxification mechanisms inactivate the genotoxic compounds, DNA repair removes the DNA adducts and error-free translation synthesis incorporates the correct base opposite DNA lesion during DNA synthesis, thereby suppressing the induction of mutations. From mutations to cancer, there are other mechanisms, such as apoptosis, that suppress the induction of cancer. These self-defense mechanisms may constitute a practical threshold for genotoxic carcinogens. In an examination of this possibility, the DNA repair enzyme 8-hydroxyguanine DNA glycosylase encoded by the *mutM* gene in *Salmonella typhimurium* was disrupted. This enzyme repairs 8-hydroxyguanine in DNA and reduces G:C to T:A mutation. Therefore, 8-hydroxyguanine DNA glycosylase appears to be a constituent of a practical threshold for oxidative mutagen.

Principles for Assessment and Control of Genotoxic Impurities in Pharmaceuticals

Residual impurities from the manufacturing and formulation processes or degradation of active pharmaceutical ingredients are often present in synthetic pharmaceutical products. Some of these impurities are potentially genotoxic and pose additional safety concerns. *Assessment and Control of DNA-Reactive(mutagenic) Impurities in Pharmaceuticals to Limit Potential Carcinogenic Risk* (ICH-M7) addresses various methods for considering potential lifetime cancer risks that are associated with patient exposures to genotoxic impurities during clinical development and after approval. The ICH-M7 guideline focuses on substances that have the potential to directly damage DNA when present at low levels and usually invokes the Ames mutagenicity. Computational toxicology assessment using Quantitative

Structure-Activity Relationship(QSAR) methodologies may be predictive of Ames mutagenicity. ICH-M7 guideline also uses the TTC to define acceptable intakes of unassessed pharmaceutical impurities that pose negligible risks of carcinogenicity or other toxic effects. Accordingly, the acceptable limit of mutagenic impurities in drug substances and drug products was set at 1.5µg/day and corresponds to a theoretical 10^-5 excess lifetime risk of cancer, which is 10x higher than that for genotoxic chemicals in food. Both the US FDA and ICH adopt the same value of 1.5µg/day as TOR(threshold of regulation) and TCC; however, the guidance indicates that highly potent DNA- reactive carcinogens such as aflatoxins like azoxy- or N-nitroso-carcinogens, are outside of the application of the TTC approach. These exceptional chemicals are sometimes called the "cohort of concern"(COC).

Future Challenge: Risk Estimation of Combined Exposure of Genotoxic Carcinogens at Low Level

Following the emergence of the TTC approach in several areas of chemical regulation, questions have been raised as to whether the public is adequately protected from multiple exposure or intake of DNA-reactive genotoxic carcinogens at low doses. The current regulatory policy for chemicals is the evaluation of the genotoxic and carcinogenic risk individually. Moreover, TTC is not an absolute threshold and thus some low level of cancer risk, e.g., 10^{-5} or 10^{-6}, exists, even below TTC. This is in contrast to the indication of an absolute threshold below which there is no risk on human health. Therefore, it is suspected that detectable carcinogenic risk may appear when people are exposed to multiple DNA-reactive genotoxic carcinogens, even below the TTC. Although chemicals are regulated by different authorities depending on their intended use, e.g., food-related chemicals, industrial chemicals, air pollutants, pharmaceuticals and the impurities, simultaneous exposure to these chemicals is unavoidable. Currently, there is no effective approach to evaluate genotoxic and carcinogenic risk from exposure to low doses of multiple DNA-reactive genotoxic carcinogens. One approach for the regulation of the total carcinogenic risks on a human would be to establish weighted allocations for each class of chemicals.

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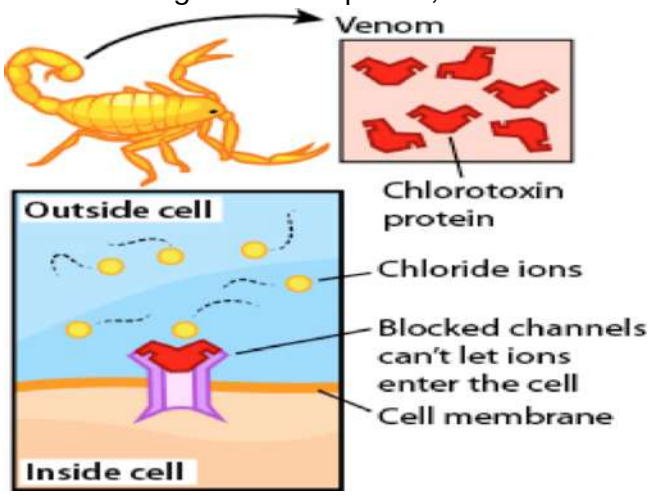
Venom-A Solution To Cancer

As we all know venom is a poisonous substance secreted by animals that can kill humans too. But most wonder how come this poisonous substance saves us from a chronic disease like cancer as it is a disease involving abnormal growth of cells inside our human body destroying human tissues. The World Health Organisation (WHO) also stated that Cancer is the second leading cause of Death disease globally and is responsible for an estimated 9.6 million deaths in 2018. Even though there are some treatments like Radiotherapy, Chemotherapy and Surgery for cancer treatment, all these therapies remain palliative rather than curative for the majority of cancer indications. The development of cancer involves 4 hallmarks which include, 1) Dysregulated cell proliferation 2) Sustained angiogenesis 3) Evasion of programmed cell death and 4) Tissue invasion and metastasis. But some biologists believe that Venom of certain Species can actually be a cure for cancer and carried out experiments to sustain that..

Before looking into the species, let's understand how venom reacts in our bodies. Animal venoms comprise of bioactive molecules that have a high affinity to multiple targets in the human body or any other organism. By eliminating the toxic substance in the venom biologists believe that it can be effectively used in the treatment of cancer.



Spiders and Scorpions are the two main species from which their venoms are taken for the treatment of cancer. Scorpion venom (species name-*Buthusmartensii*Karsch or BmK) consists of a list of enzymes, peptides and non-protein compounds (inorganic salts, lipids, nucleotides, water) produced by venom glands of species is experimented by Zhang Futong in 1987. An increasing number of Preclinical investigations and experiments have shown that crude scorpion venom and some purified proteins and peptides impair multiple cancer hallmarks. They are also used to trace cancer cells and help in differentiating that from normal cells too. The effect and efficacy of scorpion venoms are tested on Glioma, Neuroblastoma, Leukemia, Breasts, Lungs, Hepatoma, Pancreatic and some other cancer cases too and the experiments showed positive results for cases. On the other hand, the effect of Spider venoms on Cancer is not as broad as Scorpion venoms. Spiders are the most diverse groups of arthropods (around 38,000), but only a few toxins of spider venoms are experimented for cancer treatment making the opportunistic field for exploration.

Even though the use of venoms in the treatment of cancer is promising it is still in the development stage, it is believed that these animal venoms can be a revolutionary effect in the future for the treatment of cancer disease.

Reference:

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Harshini. M
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What Is Chimerism?

Ancient Greek mythology includes stories of a fire-breathing creature called a chimera. This fearsome beast was a mix between a lion, goat and serpent. But chimeras are not just a part of mythology. In real life, chimeras are animals or humans that contain the cells of two or more individuals. Their bodies contain two different sets of DNA.

OVERVIEW:

A genetic chimerism or chimera is a single organism composed of cells with distinct genotypes. In animals, this means an individual derived from two or more zygotes which can include possessing blood cells of different blood types and also this may lead to intersexuality. Animal chimeras are produced by the merge of multiple fertilized eggs. In plant chimeras, the distinct types of tissue may originate from the same zygote and the difference is often due to mutation during ordinary cell division..

OCCURRENCE OF CHIMERISM:

In animals, chimerism can occur by organ transplantation, giving one individual tissue that developed from a different genome. In humans, chimerism most commonly occurs by microchimerism, twin chimerism, tetragametic chimerism and artificial chimerism.

HOW CHIMERISM IS DIAGNOSED:

People most often discover they are chimeras by accident. Most chimeras will go through life without realizing they are chimeras. Normally genetic chimerism is not visible on casual inspection, however, it has been detected in the course of proving parentage. There are cases of chimerism that have been discovered during genetic testing for medical reasons other than chimerism such as for organ transplants.

SYMPTOMS OF CHIMERISM:

The symptoms of chimerism vary from person to person. Many with this condition show no signs or they may not recognize these signs as chimerism. Some symptoms include:

- Hyperpigmentation or hypopigmentation in small patches or across areas as large as half of the body
- Two different-colored eyes
- Two or more sets of DNA present in the body's red blood cell
- Possible autoimmune issues, such as those related to the skin and nervous system
- Twin chimeras may experience an increased rate of autoimmune disease
- Possible psychological effects such as stress and depression could arise from chimerism affecting the appearance of the skin or sexual organs

A CASE OF A HUMAN CHIMERA:

A small number of chimera stories have appeared in popular news headlines over the past few decades. Recently, a singer from California named Taylor Muhl was profiled as a chimera. She was reported to have twin chimerism as she had a fraternal twin that she absorbed in the womb during the stage of fetal development.

CONCLUSION:

There's no way to eliminate a person's chimerism. But getting a better understanding of this condition can help to improve the lives of those affected by it.

REFERENCE: Draper, Nicole.L. "Chimerism – A Clinical Guide".

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Why And How Do We Cry?

If the question is why do we cry, the most common answer would be due to sadness or pain, but it's too simple an answer. Those are not the only reasons and crying is actually accompanied by a complex process!

The act of crying:
Crying is primarily a form of nonverbal communication aimed at eliciting assistance, comfort and social support from others. Scientifically it is defined as 'A complex secretomotor phenomenon characterized by shedding of tears from the lacrimal apparatus without any irritation of ocular structures '. We generally cry in the settling of sadness and other negative emotions because it helps us to feel better by releasing the stress hormones through tears. Animals do cry as a part of its ocular functioning but emotional crying is a unique behavior of humans!

Types of crying and tears:
As known crying is generally due to pain or extreme emotions such as happiness, anxiety or grief and such tears are referred to as emotional tears. In addition, we secrete tears triggered by irritants like wind, smoke or onion, known as reflux tears and tears that are constantly secreted that keep the eyes moist. Crying can be classified into two types – spatial and temporal crying. Spatial crying occurs when a person wants to be somewhere or longing for something eg.: home. Temporal crying takes place when a person looks back into his/her past or future and elicits an emotion eg.: Childhood memories.

The mechanism behind shedding tears:
The physical act of crying is a combination of neural activity in the brain that is associated with emotions and its connection to the lacrimal system, the structure that produces and drains tears. Emotions originate from different structures of the brain that involves the amygdala, hippocampus, and hypothalamus which are collectively termed as the limbic system. This system regulates the endocrine and autonomic nervous systems that produce a response to emotional stimulation.

Cranial nerves originate from the brain and brain stem and innervate the eyeball and surrounding region. Specifically, oculomotor nerve, trigeminal nerve, and facial nerve innervate eyelid, lacrimal gland, and eye. A stimulus produces neural activity in the brain and the lacrimal gland is signaled via cranial nerves and tears are produced.

Benefits of crying:
Crying is found to be a self-soothing process to calm and regulate an individual's emotions. Emotional tears release oxytocin and endorphins. These chemicals make people feel good thus they are referred to as "feel-good chemicals". Crying helps to keep the eyes clean as it contains lysozyme. It is also found to improve vision as the basal tears lubricate and prevent the eyes from drying since dried eyes result in a blurry vision. Though crying aids in the psychological and emotional aspects, prolonged crying could be a sign of depression and should not be ignored.
Thus, we could conclude that crying is not always bad, and what may seem like salty tears, have a complex process that serves to keep the eyes healthy, and the mind, light!

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Happy Fruit Banana

Banana is a stimulating organic product as it contains three normal sugars - sucrose, fructose and glucose—and is high in fiber as well. So it is most loved by competitors. One medium banana conveys only 100 calories and is stacked with a specific sort of fiber called Resistant Starch (RS), which tops you off, yet in addition wards those harming desires off, supports your digestion, and keeps stoppage under control as well.

Bananas are stacked with potassium, a mineral that helps keep the circulatory strain down and the bones solid and sound. "Bananas are an upbeat natural product as they have tryptophan, which gets changed into serotonin in the body, known to cause you to unwind, improve your state of mind and make you feel more joyful," includes Pratima Mishra, clinical, Columbia Asia Hospital, Ahmedabad. Thus, you can avoid your terrible dispositions, Seasonal Affective Disorders and decrease PMS side effects by eating a banana. They even mitigate morning ailment during pregnancy. This joined with fiber, nutrient C and B6 content in bananas are generally perfect for sound heart wellbeing . Eating a banana can even lower the body's internal heat level on a hot day and cools during fever.

Regardless of whether you have diabetes or your glucose is somewhat high, you can devour bananas with some restraint. "This is on the grounds that the sugar in banana is regular and gets discharged gradually because of the nearness of fiber and gelatin in it. What's more, to reduce the sugar spike further, pair it with protein and solid fats, for example, nuts or seed spread or yogurt," says Mishra.

Is there anything that banana can't do? Unquestionably, this is an organic product which is certainly not only for monkeys.

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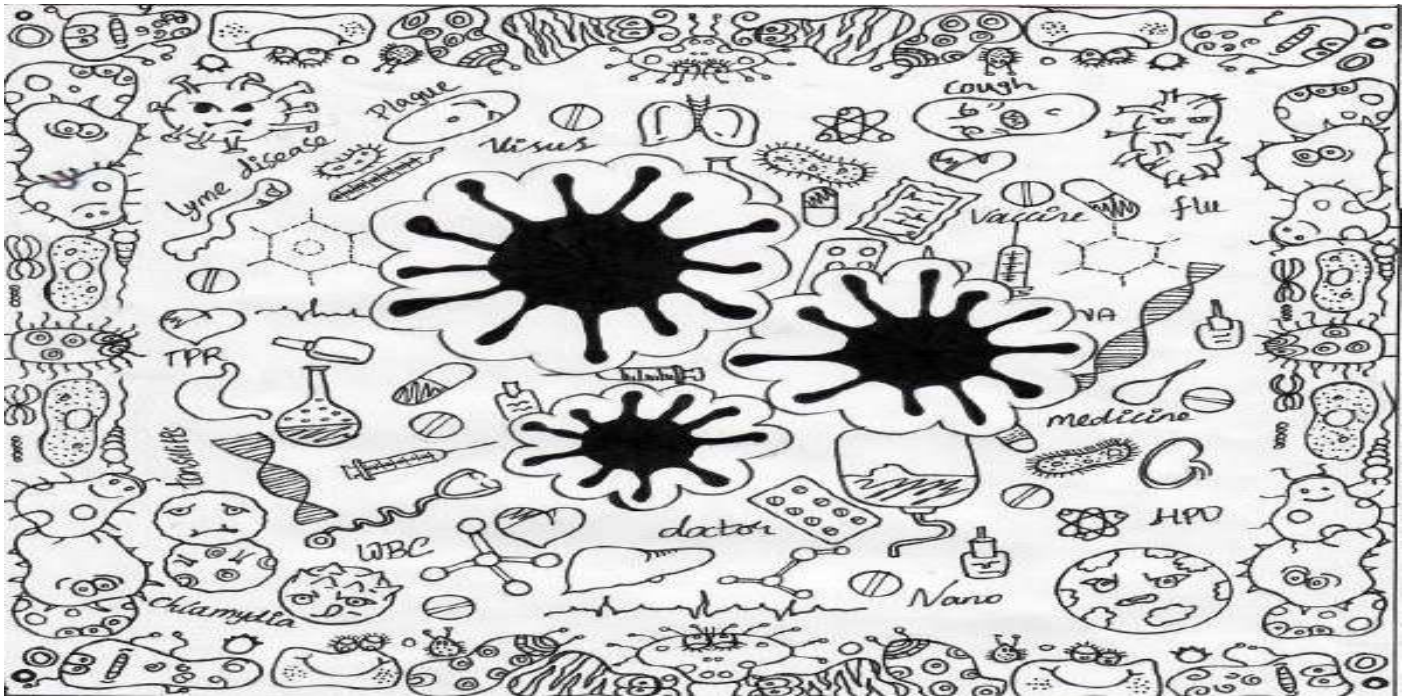

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