

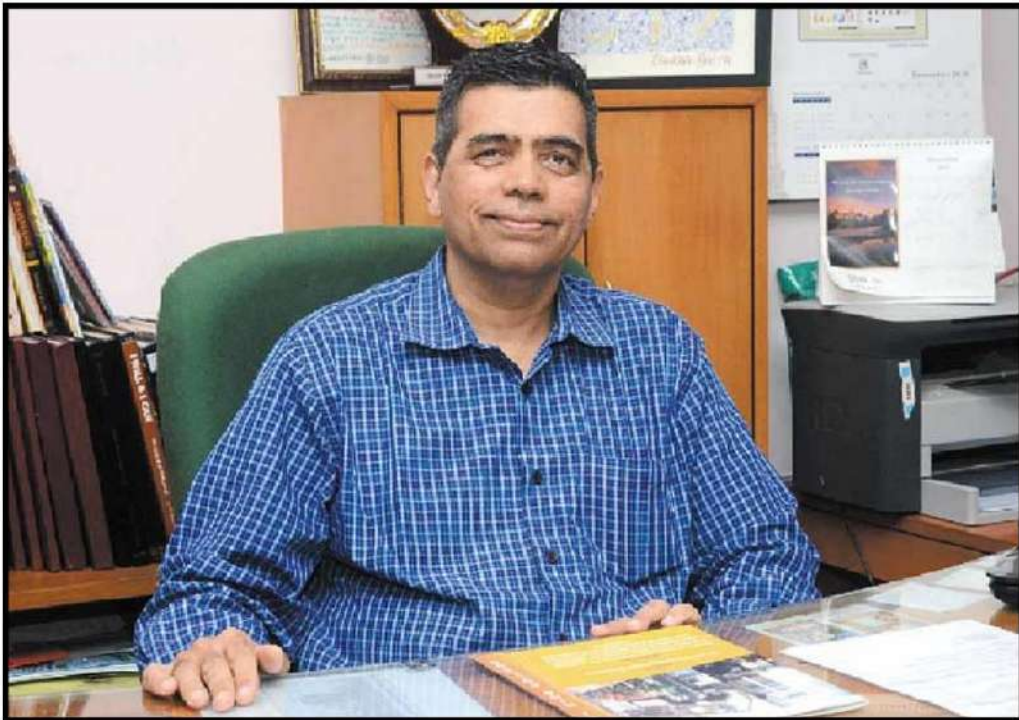


IRIS | DEPARTMENT OF LIFE SCIENCES | JAI HIND COLLEGE



THE CATALYST





Principal Dr. Ashok Wadia

***Our Mentor. Our Guide.
Our source of inspiration
Thank you Sir!!***

MESSAGE FROM THE TEACHERS

Welcome to our world; it's a wonderful place to be!!!

Life Sciences is an interdisciplinary subject that uses the principles of chemistry, physics, and mathematics, to help answer some important questions in biological sciences. As the study of "Life" itself, Life Sciences is a subject that draws the interest of almost everyone. Our understanding of the foundations of Life is constantly growing, becoming more nuanced and sophisticated every year. As a broad-based Biological Sciences department, we are a community dedicated to understanding the natural world from global ecosystems down to molecular interactions. We discover new knowledge and train budding scientists!!! From the very outset we had 100% results, with a majority of the students being placed A-grade and O-grade.

The Department has a vibrant and interactive faculty having varying specializations. The faculty perform cutting-edge research addressing questions of relevance to Life Sciences; Microbiology, Botany, Biotechnology, Environmental science, etc. Our Department couples this foundational understanding with opportunities to perform hands-on research alongside our expert faculty and to present your findings at University or national conferences. We also encourage participation in community outreach activities and student organizations, to ensure that you graduate well rounded and career ready.

The Catalyst...

We, as a Department, understand the need of future Scientists to not only be scientifically refined but also develop soft-skills that are essential for success. The idea of "The Catalyst" emerged from our belief that "Learning goes beyond books"... Under the aegis of the Department Society "IRIS" (Insight - Resilience - Innovation - Success), The Catalyst was incarnated to do exactly what a catalyst does; bring molecules together to enhance the rate of a process... It has brought together research and various other articles written by our own TY, SY and FY students and we hope that it eventually helps bring various Science departments of Jai Hind College together...

Our Vision - The vision behind the magazine is creation of knowledge network and collaborative research in Life Sciences

Our Mission - Scientific Research in modern times is a collaborative process with team-based outcomes.

Keeping this in mind, the mission of this magazine is to identify hidden talents, provide opportunities for students to realise their full potential and to inculcate scientific temper and, thereby, shape them into future leaders, entrepreneurs, collaborative team leaders and above all good human beings and responsible citizens. 'The Catalyst' is fundamentally a collaborative Tool for the scientific research of the students of Life Sciences The magazine content will help the readers look into the unexplored areas in the field of biology, a source of inspiration and creative ideas

We are eternally thankful to our ever-supportive and encouraging Principal Dr. Ashok Wadia, and our Student-Team who culminated our imagination into reality... We hope the readers enjoy reading the magazine as much as we enjoyed putting it together!!!!!!



— — — — —
TEAM CATALYST
— — — — —



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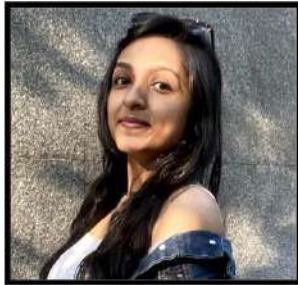
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ODELIA REBELLO



MEHER BHAGWAGAR



ZARHAAN KHAMBATTA

MESSAGE FROM THE STUDENTS

Life Sciences is an interdisciplinary field of science that includes all aspects concerned with the study of living organisms. We the students of Life Sciences of Jai Hind College (Autonomous), present to you the very first edition of our department magazine: The Catalyst.

With the help of our teachers, and inspired and encouraged by the motto of our college, "I Will and I Can", we have tried our best to make this magazine as informative and interesting as possible. The Catalyst is an amalgamation of our own research projects, some fun facts, and a few puzzles to ponder over and test your knowledge with. Even during these tough pandemic days, the will to learn and know must not fade. This magazine will be the perfect way to learn something new and divert the mind from the outside world for a while.

The word Catalyst in science means a substance that modifies and increases the rate of a reaction without being consumed in the process. But there is also another meaning of Catalyst - the metaphorical one. It means "a person or thing that causes a change". We hope that this magazine can help you all to have a better understanding of Life Sciences, bring a change towards your perception, encourage you to come up with creative research work and inventions, grow your understanding and love for the subject.



STUDENTS' ACHIEVEMENTS



Exams Qualified by Students

Competitive exams are the means for students to compete with others on a similar educational level. Such exams promote the learning of skills in various subjects. They inculcate a sense of healthy competition which is significant in an educational society to bring the best out of a student. Here are a few of our Life Sciences students who have achieved laurels in these exams.



Neha Vadagbalkar:
JGEEBILS 2021
IIT JAM (Biotech)-AIR 169



Kunal Jagetiya:
JGEEBILS 2021
IIT JAM (Biotech) -AIR 606
GATE (XL) - AIR 666



Publications

One of the main achievements for us scientists is to get our works published in a journal. Research articles and papers are our way of expressing our views and ideas, in the way of discovering new theories as well as corroborating or contradicting other existing literature. In this section, we proudly present to you the works of some of our students who managed to achieve that milestone this year as an undergraduate.

Compendium of Research Insights of Life Science Students (ISBN Number: 978-81-946500-0-3 (Volume - 1) By JPS Scientific Publications



1. Bioinformatics Approach on Evolution and Phylogeny Of SARS CoV-2 and Host ACE2 Protein Receptor

-Varisha Khan, Jaansi Bhansali

The recent outbreak of the novel coronavirus (SARS-Cov-2) has spread all over the world making it a global pandemic. In the case of the SARS CoV-2 virus the method of phylogenetic is used to determine the intermediate host of the virus. The host, ACE2 could be a species-specific barrier that interferes with bat-to-human coronavirus cross-species transmission. Phylogenetic studies have suggested that pangolin has become an opportune host to intermediate bat-to-human SARS-CoV-2 jump and entry.





2. Proteomics of Alzheimer's Disease

- Jaansi Bhansali

Alzheimer's disease is caused by the gradual death or degeneration of neurons. The disease is characterized by the formation of aggregations of amyloid β -plaques and neurofibrillary tangles. Phylogenetic tree comparison could be suggesting that during evolution there was a genetic mutation of the gene coding for the enzyme, that formed another type of enzyme resulting in the production of a different type of protein. 1.9 million people suffer from this age onset disease and it has been years since Alzheimer's remains as an unsolved puzzle.



3. Sleep Paralysis: Supernatural or Science



- Varisha Khan

Earlier, sleep paralysis was described as nightmares since it ranges from seconds to a few minutes involving episodes of vivid hallucinations and feelings of suffocation or chest pressure. It has been associated with various supernatural beliefs. Sleep paralysis represents a strong evidence of how a neurobiological phenomenon can be interpreted and shaped by different cultural contexts. The stigma that is associated with it prevents the sufferers from reporting at medical institutions. Therefore, it is of utmost importance that people are educated and sensitized on what sleep paralysis is and how it should be approached.

Compendium of Research Insights of Life Science Students (ISBN Number: 978-81-946500-0-3) (Volume - 2) By JPS Scientific Publications



1. Bioplastics: An Additional Pair of Hands to Save the Earth

-Jiban Gogoi



Biopolymers happen to be the boon of evolution of plastics with biodegradability within its grasp. Biodegradation of any compound or material is a chemical process during which microorganisms convert polymers into various natural compounds depending on the microbes present such that the products go back into the soil or the atmosphere. Bioplastics mainly save fossil resources using biomass which regenerates and provides the unique potential of carbon neutrality.

PARTICIPATION AND PRIZES WON IN XPLORE AND AVISHKAR

Presenting our work as a science exhibit has been a huge part of sharing the knowledge that we gained, with our peers and professors as a scientist in making. It helps us to apply our theoretical knowledge practically and get new perspectives about the same. In this column, we showcase the winners of various exhibitions that helped us grow and learn more about the science behind the world that we are living in.

1. Anushka Pai and Richa Mishra:

SY Xplore Biological Sciences: 2nd Prize
(Alternative Proteins)

2. Rushabh Chheda:

SY Xplore Chemistry: 1st Prize (Aerogel)

3. Akash Andhle and Megha Thakur:

FY Xplore Biological Sciences: 3rd Prize
(Human Body Ingredients)

4. Hibah Mulla (FYBSc, Avishkar)

Title: Eco Bliss: Biodegradable, Cost effective sanitary napkins
Guided by: Niloufer Kotwal

5. Navin Chawathe (TYBSc, Avishkar)

Title: Studying the effects of common food additives on the development of Zebrafish (*Danio rerio*) embryos.
Guided by: Ms. Sakina Garothwala

6. Kunal Jagetiya (TYBSc, Avishkar)

Title: To compare the effect of different available feeds on the growth and survival of *Poecilia sphenops* and understanding the mating behaviour in males.
Guided by: Sakina Garothwala

7. Neha Vadagbalkar (TYBSc, Avishkar)

Title: Effect of Pesticides on Earthworm '*Eisenia fetida*'
Guided by: Ms. Sakina Garothwala

8. Indeira Rohra (TYBSc, Avishkar)

Title: Effects of varying concentrations of Zinc and Magnesium on *Brassica juncea* seedling leaves
Guided by: Ms.K. Srilatha



9. Jaansi Bhansali, Varisha Khan (TYBSc, Avishkar)

Title: A Molecular Docking Study: Comprehensive drug analysis (anti-RdRp) for SARS-CoV-2

UGC STRIDE National Research paper presentation competition: 2nd place
Guided by: Ms. Niloufer Kotwal

10. Navin Chawathe & Tanvi Chhatwani- TY Xplore 2 place

11. Sakina Grothwala & Navin Chawathe- Selected for the final round of Aavsihkar

12. Avani Dave (SYBSc, Avishkar)

Title: A statistical analysis on Acid reflux and it's prevalence across the population.
Guided by: Ms. Sakina Garothwala

13. Roshni Keshwani (SYBSc):

UGC STRIDE National Research paper presentation competition: 2nd place
Title: A Comparative study of the link between Alzheimer's, Parkinson's and Huntington's disease using Bioinformatic tools.



INTERCOLLEGIATE COMPETITIONS

Intercollegiate competitions are held for students to compete with each other in a healthy and fun way having the best win. They are not only a great platform for student learning but also a great way to develop better communication skills and various other soft skills. The process involves gaining a lot of knowledge, experience and teamwork, it boosts one's self confidence and encourages a student to participate in more activities and give their best in future. Here are some of the achievements of our Life Sciences students at intercollegiate competitions.

Rushabh Chheda:
Alchemia Chemquest -
1st Prize Alchemia
Crossword -
2nd Prize

Roshni Keshwani:
Alchemia Quiz
Competition - 2nd
Prize

Sanika Naik:
Poetry of Physics -
3rd Prize (Poem on
Gravity)

CONTENTS

COVID-19 AND PATHOGENIC DISEASES

13 Mental Well-Being of People During the COVID-19 Lockdown

14 Study of the Superstition and Misconceptions of Home Remedies of COVID-19

15 Evolution of Human Immune Response

16 Wolbachia Endosymbionts and Human Disease Control

17 COVID-19 - Risk Perception, Prevention and Knowledge

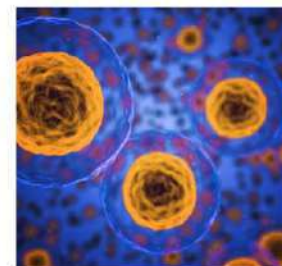
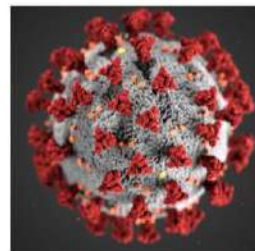
18 Evolution of Malarial Parasites

19 Relationship Between Mental Stress and Sleep Pattern Disturbance During Lockdown

20 Significance of Epidemiology

21 SARS CoV vs SARS CoV 2 - Comparison of Pathogenicity

22 Comparison of Spike protein in SARS CoV 2, MERS CoV and HCoV OC43



ASTROPHYSICS

23 The international thermonuclear experimental reactor

23 Dark energy, Dark matter

24 Astrobiology, life on venus

24 Kardeshev scale

25 DID YOU KNOW?



NEUROBIOLOGY

- 26 A Comparative In-Depth Study of the Link Between Alzheimer's, Parkinson's and Huntington's using Bioinformatic Tools
- 27 Evaluating Human Altruism and Correlation Between Genes and Genetic Relatedness with Altruism
- 28 The Difficulty to Differentiate Between Red and Green
- 29 Comparison of the Brain Sizes of Vertebrates
- 30 Evolution of the Human Brain
- 31 Study of the Evolution of Human Speech
- 32 Study of the Evolution of the Human Nervous System
- 33 Evolution of Human Intelligence

BIOTECHNOLOGY

- 34 The impact of stem cells in regenerative medicine
- 34 Is human immortality possible?
- 35 Scientific approach behind commercialization of cloning.
- 35 What if we created hybrid Human-Animals ?
- 36 Nanofood
- 36 The Science behind Chocolate

EVOLUTION

- 37 Evolution of Sharks and Dolphins
- 38 Evolution of Apes to Humans
- 39 Study of the Evolution of Vermiform Appendix in Humans
- 40 A Study of the Heights of Individuals Across Different Ethnic Groups and Races
- 41 Evolution in Archaeopteryx
- 42 Study of Vestigiality of Wisdom Teeth in Relation to Human Evolution
- 43 Sequence Alignment of mtDNA Genes of Homo sapiens, Homo neanderthalensis and Denisovans using Bioinformatic tools
- 44 Statistical Analysis- Acid Reflux and it's Prevalence Across the Population

GENETICS AND DIAGNOSTICS

- 45 Nature vs Nurture
- 46 Epigenetics-Gene silencing
- 46 Dark DNA
- 47 Preimplantation Genetic Diagnosis
- 47 The Body Before Birth
- 48 Cognitive bias in forensic science
- 48 *Massospora cicadina* - a fungus parasite
- 49 Prions
- 49 Hutchinson-Gilford Progeria Syndrome



PLANT GROWTH AND DEVELOPMENT

- 50 Music is the wine that fills the cup of silence
- 51 Effect of various acids on the growth of Fenugreek plant
- 52 A comparative study on the effect of Caffeine and Hemp seed powder on growth of plants.
- 53 Green Chemistry: a study on acid-base indicator property of various natural fruit- /flower- pigments
- 54 Effect of Fertilizers and Biofertilizers on *Trigonella foenum-graecum* for the plant growth
- 55 Effect of Human Vitamins and Dietary Supplements on Plant Growth
- 56 **DID YOU KNOW?**
- 57 Chemical vs Organic insecticides
- 58 Effect of detergent on growth of *Vigna radiata*
- 59 IAA or nutrients; the better plant growth factor?
- 60 Extraction of natural dye from plants
- 61 Effect of Microwaves and UV C light on Seed Germination (*Vigna radiata*).

EXPERIMENTS ON ANIMAL MODELS

- 62 Effects of chemical pesticides on earthworms *Eisenia fetida*.
- 63 To study the mating behaviours and preferences in male *Poecilia sphenops* (Molly) fish.
- 64 Bioplastics from Sea-Waste
- 65 Effect of Artificial Sweeteners on the embryological development of *Danio rerio*
- 66 Impact of deprivation of circadian rhythm on transpiration in plants
- 67 Food Additives or poison?

FACTS AND GAMES

- 68 QUIZ
- 70 PUZZLES
- 72 ANSWERS
- 73 MEMES
- 75 ARTWORK

Mental Well-Being of People during the COVID-19 Lockdown

One in three Covid survivors developed a neurological or psychiatric condition within six months of the infection

RESULTS AND CONCLUSION

The outcomes of this survey study show a significant psychological toll that this lockdown has brought upon most of us. Indicating deteriorating conditions of those already suffering from a mental illness and introduction of new ones in otherwise psychologically healthy individuals. Although much attention has been given only to the economical and the physical well-being aspect of this lockdown, this study shows that equal care and attention should be paid to even the mental well-being.



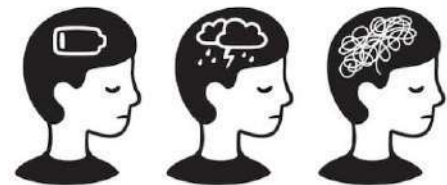
INTRODUCTION

The coronavirus (COVID-19) pandemic has profoundly affected all parts of society including mental health. The lockdown included aspects which could prove to be harmful and induce long term effects such as serious psychological disorders. Along with physical well-being, it is also important to protect the mental well-being for proper control of the outbreak and long-term positive health outcomes. The main objective of this study is to determine the plight of the population of India's mental well-being during the COVID-19 lockdown. Along with determining how the lockdown has impacted differently on various populations



MATERIALS AND METHODS

A survey was conducted using Google Forms. The responses were analyzed with statistical graphs as pictorial representations using Microsoft Excel/Google Sheets for pie charts and bar diagrams.

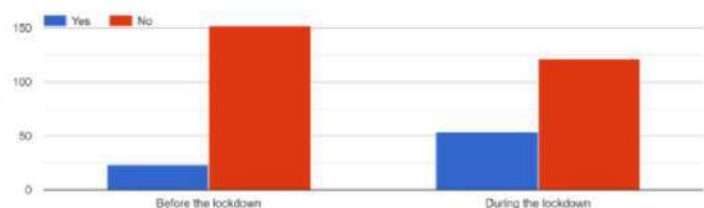


Depression is more common than AIDS, cancer, and diabetes combined.



In comparison to other literatures, similar results were obtained from various parts of the world too, stating how the degradation of mental well-being of the masses due to this lockdown is a global concern. Various factors were taken into consideration during the survey including pre-existing mental illnesses, changes in the sleeping patterns, social interaction, emotional trauma, effect of the media, etc.

Have you been struggling with a mental illness?



Irshikaa Sharma SYBSc

THE STUDY OF SUPERSTITIONS AND MISCONCEPTIONS OF COVID 19

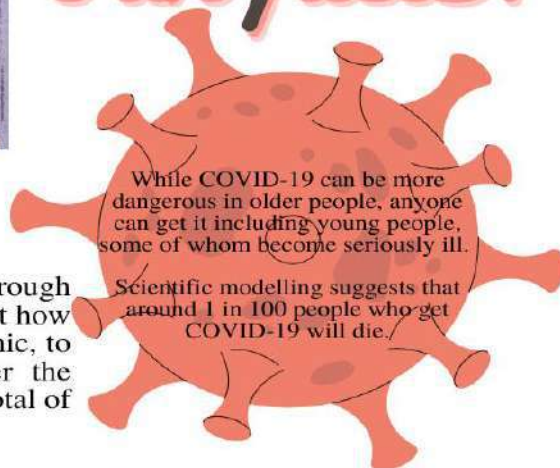
Introduction



The coronavirus pandemic has left the whole world at a staggering halt with its rapid transmission from person to person. This airborne virus has made its way through every nook of the world, leaving everyone paranoid. Due to the massive outbreak of covid cases in the world, the scare of this virus is wreaking havoc worldwide, making people so fearful of contracting the virus that they are willing to try just about any remedy they can find. Many false claims about measures against COVID-19 have circulated widely on social media or by the word of mouth, and are spreading even more because people are forwarding information without looking it up or checking the information's source.



Fun facts!



Methods and Materials



I have attempted to collect my data by the means of a survey carried out through Google forms. The main objective of the questionnaire survey was to find out how people inform themselves about everything related to the COVID-19 pandemic, to identify the main channels of communication they use and to discover the repercussions that misinformation can have. The survey was answered by a total of 72 people aged between 18-60, and was active for two weeks.



Results and Conclusion

The spread of fake news takes place because a large number of remedies have been suggested for the treatment of COVID-19 and there have been so many variations in the information issued by government bodies, that sometimes there are contradictory messages. The study conducted suggests that the pandemic has generated a situation of uncertainty in a society, leaving the public unsure of what action to take, making them scapegoats to false news, through the different information channels.



Jheel Popat, SYBsc

Evolution of Human Immune Response



Introduction

Evolution of the immune system is a co-evolutionary process. Tuberculosis and malaria have led to many mutations in immune related genes like in TYK2 (Tyrosine kinase 2). Migration inhibitory factor and emergence of several traits like sickle cell anemia etc. The study will help in dealing with deadly diseases like tuberculosis and malaria, and will help understanding the miracle of our immunity.

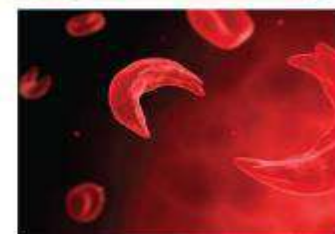
Materials and Methods

Gene sequence of normal TYK2 and of tuberculosis patient was taken and ran through BLAST alignment tool to identify the mutation. Similarly, for sickle cell hemoglobin mutation, the same process was repeated. Deep analysis of population study of MIF gene mutation and Duffy antigen was done.

Results and conclusion

Mutation in Tyk2 gene is 2935 G>A. African Population also showed mutation of MIF gene - CATT tetranucleotide microsatellite repeat. Beta chain haemoglobin gene mutation at 6th codon, replacing Adenine by Thymine. Absence of Duffy Null receptor in majority of African population.

The mutations in TYK2, MIF gene, beta chain hemoglobin are all due to natural selection led by pathogens. The mutations of TYK2 and MIF are negative mutations because these led to increased susceptibility towards tuberculosis. Mutation in beta chain hemoglobin led to the arrival of sickle cell trait which provides resistance against malaria in African population, also absence of Duffy antigen in African population provides resistance against malaria.



Tuberculosis caused the Mercy Brown Vampire Incident. Mercy Brown, who died of Tuberculosis, came to be known as World's first lady Vampire after her body stayed undecomposed and thought to be undead.

Fun facts

Bubble Boy disease is severe combined immunodeficiency, having deficient immunity occurs 1 in 100,000 births.

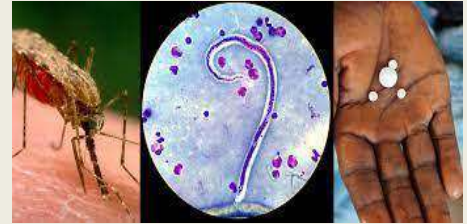


Wolbachia Endosymbionts and Human Disease Control

Human lymphatic filariasis (LF) is a debilitating disease caused by *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori* and are transmitted through mosquitoes. Most, but not all, filarial nematode species possess the mutualistic symbiont Wolbachia within their tissues, which is required for fertility, development, and survival, providing a novel range of targets for filariasis control. Wolbachia can induce conditional sterility, which can be used to control mosquito populations and other medically significant insects. Thus Wolbachia, a pandemic endosymbiont offers great potential for elimination of a wide variety of devastating human diseases.

METHODS

A systematic review was performed on peer reviewed original research extracted from PubMed reporting on the Wolbachia Endosymbionts and Human Disease Control and the data was collected.



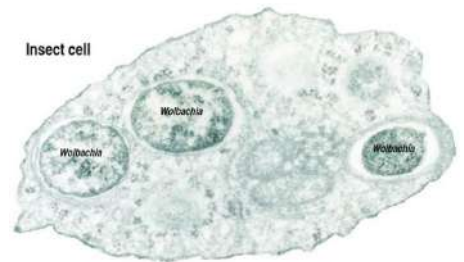
DID YOU KNOW?

Wolbachia are present in 60% insect species and act as parasites in them.

RESULT & CONCLUSION

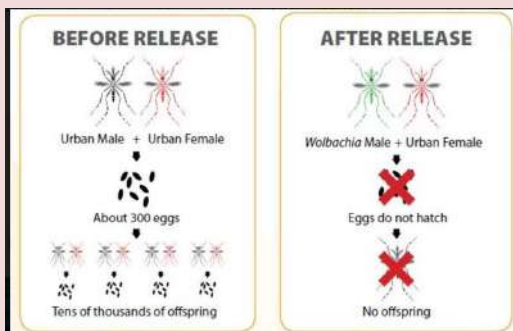
Four major approaches are being used to help identify potential Wolbachia genes/gene products for drug targeting: (1) The A-WOL project, an international collaboration formed to detect anti-Wolbachia compounds using a high-throughput tiered screening process, conducted high-throughput drug screening using Wolbachia viability as an initial endpoint. (2) The use of genomic knowledge to classify possible genes for targeting - an Anti-Wolbachia strategy, often used by A-WOL, is to identify potential targets that might be essential for Wolbachia viability via genomics. (3) Microarray and RNA Sequence approaches which identify stage specific Wolbachia gene expression. (4) Proteomics approaches for identification of stage-specific expressed genes.

Based upon analyses, RNAi and other confirmatory methods can then be used to further confirm the targets. Recent technical advances from the arthropod and filarial communities provide a set of approaches for control of parasitic diseases using Wolbachia.



FUN FACT

Dengue, which is transmitted by the mosquito *Aedes aegypti*, is not naturally infected with Wolbachia. Wolbachia strains have recently been introduced into *Aedes aegypti*. Here, Dengue virus replication is greatly reduced, lowering the viral risk to the human population.



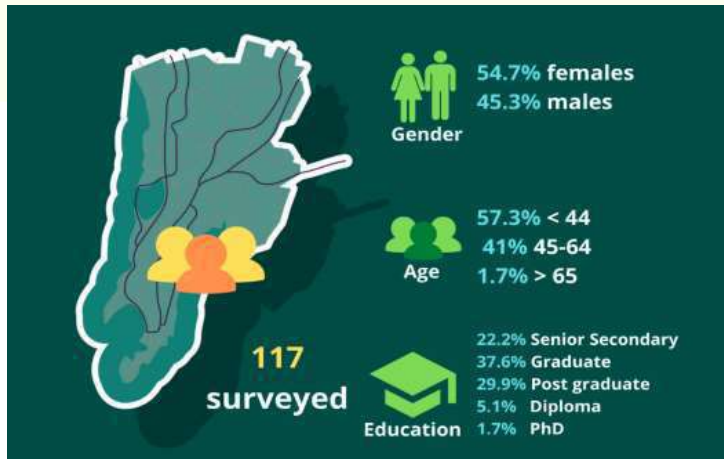
Mitali Sharma SYBSc



COVID - 19 - RISK PERCEPTIONS, PREVENTION AND KNOWLEDGE

The COVID-19 global pandemic has received unlimited media coverage since the first cases that were diagnosed in Wuhan city. Relevant disease knowledge, such as of SARS, has been linked to worry less about personal risk. Epidemiology refers to study of distribution of health-related events in a particular population and the study helps us to look after how improvements can be made for the well-being of the population and other policies and programs. In the current study, risk perception and their knowledge of the virus was measured and assessed. It was hypothesized that (a) better knowledge of the Novel Coronavirus would be linked to lower perceived risk of contracting the virus and that (b) the internet would be one of the major sources of information about the virus

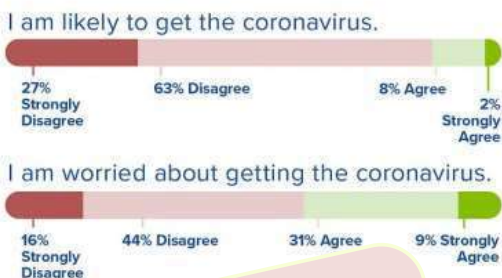
DID YOU KNOW?
 The Disneyland has had closed 6 times partially or fully in its history, due to JFK assassination in 1963, Anti-Vietnam War protests in 1970, Winter storm in 1987 and 1994 Northridge Earthquake, 9/11 and COVID-19 Pandemic



METHODS

Data were collected online using electronic questionnaire developed with reference to previous relevant studies. Data were analyzed using the Microsoft Excel and Statistical Software for Social Sciences (SPSS).

Results show the majority of people do not think they will get coronavirus.

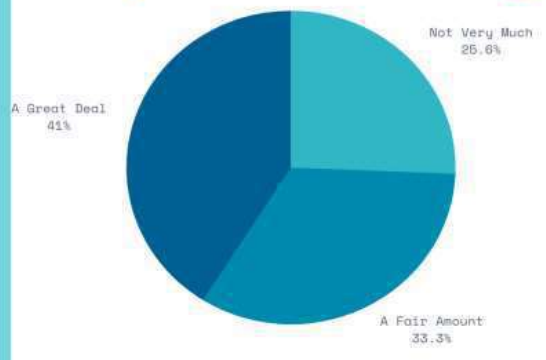


DID YOU KNOW?
 A strong correlation has been found between prevalence of Vitamin D deficiency and population mortality rate from COVID-19.

RESULT & CONCLUSION

Risk perception was not significantly associated with knowledge levels. Internet and Social Media were the primary sources for COVID-19 information. The findings suggested that the provision of health information about COVID-19 may be somewhat effective in informing the public about the risks and of preventive measures. Topics which need more clarity were Vaccine Awareness and available facilities. Policy makers may seek to further exploit the internet as a means of delivering information about the disease.

Summary of Level of Knowledge





EVOLUTION OF MALARIAL PARASITES

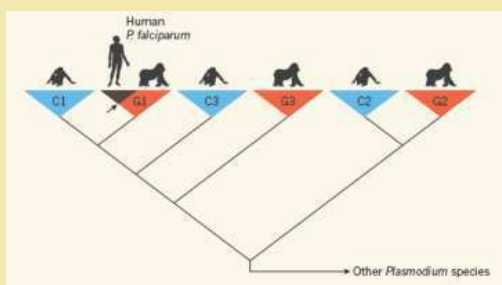
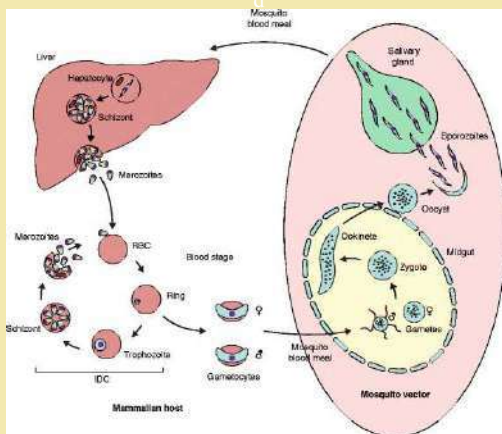
Methods and Material

Parasitic species used in this study:

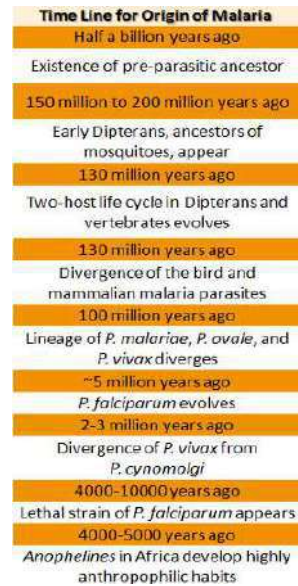
Species	Natural Host	Accession number
<i>Plasmodium falciparum</i>	Human	AY282930
<i>Plasmodium vivax</i>	Human	NC_007243

Gene sequences were taken from GenBank (<https://www.ncbi.nlm.nih.gov/>) in the FASTA format. The sequences were aligned using BLAST (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>).

Steps that were followed while aligning the sequences: 1) Open BLAST using the link (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>) 2) Go to Global Align option, a page will open with two search boxes. 3) Insert the sequences in the search box and then click on 'BLAST'. 4) Interpret the results.



Plasmodium falciparum and *Plasmodium vivax*, the two *Plasmodium* spp. known to commonly infect humans, cause the vast majority of malaria morbidity and mortality and are the primary targets of malaria prevention and eradication efforts. *P. falciparum* infection is relatively recent in humans, possibly resulting from the acquisition of a parasite from a gorilla within the last 10,000 years. Similarly, *P. vivax* did not emerge in Asia, but represents a bottlenecked lineage that escaped out of Africa before the spread of Duffy Negativity rendered African humans resistant to *P. vivax*.

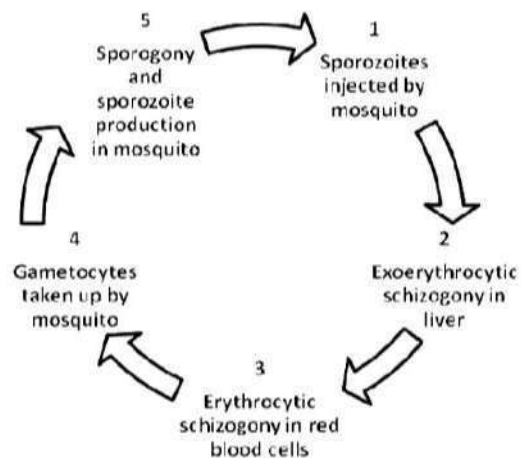


Results and Conclusion

The following results were obtained:

- a) *Plasmodium falciparum* Isolate 3D7 Mitochondrion, Complete genome
Sequence Id: AY282930. Length: 5949. No. of matches: 1
- b) *Plasmodium vivax* sal – 1 Mitochondrion, Complete genome
Sequence Id: NC_007243. Length: 5990. No. of matches: 1
- NW Score: 1503
- Identities: 4169/7253 (57%)
- Gaps: 2567/7253 (35%)

Knowledge gained from comparative population and genomic studies of ape parasites will provide new insight into the biology and pathogenesis of human *P. falciparum* and *P. vivax* and will inform malaria eradication efforts by identifying potential zoonotic threats.



FUN FACTS!

Among all communicable diseases, malaria is the third largest killer of children between the ages of one month and five years, following pneumonia and diarrhoea.

Malaria is a misnomer, it's a combination of two Italian words, "mal" and "aria", which mean bad air. Before it was discovered that mosquitoes transmitted the disease, people assumed that the source of the problem was polluted air near the marshes and swamps. That is why the disease was first known as Marsh Fever.

TO ASSESS THE RELATIONSHIP BETWEEN MENTAL-STRESS AND SLEEP PATTERN DISTURBANCE DURING LOCKDOWN.

In spite of being a prevalent problem, mental health was to assess and compare various factors related to during the lockdown for the COVID-19 cases with unknown causes were reported, provinces of China within a month. The coronavirus, SARS-CoV-2. Most countries pandemic.



is always overlooked and ignored. The aim of this study mental health, stress and sleep pattern disturbances pandemic. In Wuhan, China, a series of pneumonia after which the epidemic spread rapidly to all the 34 pneumonia was found to be caused by a novel enforced lockdowns as a containment strategy for the



1 in 5 young people (aged 13-18) have or will develop a mental illness in their lifetime.



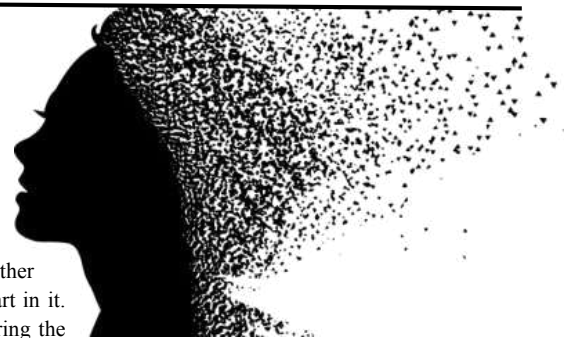
METHODS

An online survey was undertaken with an intention to study the effects and meet needs around mental health during the COVID-19 lockdown, from the viewpoints of people with experience of mental illness and also the general population.

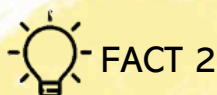


RESULTS & CONCLUSIONS

This study found that despite anxiety being prevalent, people were not too anxious. Depressive symptoms were seen among many participants, which was an evident concern. Participants were constantly struggling with low moods and feeling dispassionate throughout the lockdown. Participants did not feel a loss of appetite. It was found that participants' screen time increased drastically during lockdown. Online gambling and addiction, which was shown to be on a high rise in other studies, was not found to be that prevalent in this study. Most participants denied taking part in it. Participants responded that their sleep cycle had changed. Most people got more sleep during the lockdown and most said that their quality of sleep was good.



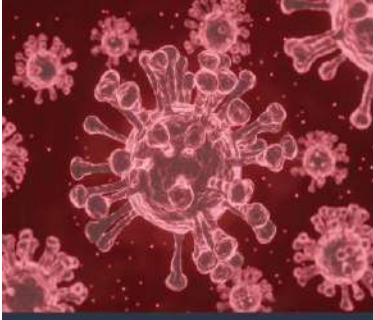
The study aimed to assess and compare various factors related to mental health, stress and sleep pattern disturbances during the lockdown. It is seen that the lockdown has had an effect on the mental health of people.



More than 1 in 4 adults living with serious mental illness struggle with substance abuse.



RIDDHESH AHIRE, SYBSC



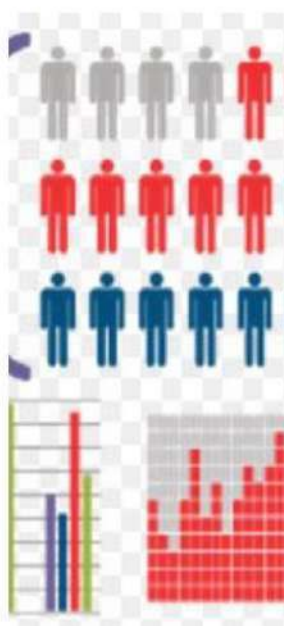
SIGNIFICANCE OF EPIDEMIOLOGY

ODELIA REBELLO, SYBSC

Our understanding of the causes of infectious diseases and their modes of transmission is bifurcated. On one hand, it was built through experience, practice, observation and analysis of the peculiar circumstances associated with disease occurrence. On the other hand, it was constructed through experimentation and observations made under particular conditions.

METHOD

A survey was conducted via Google forms which was filled by people from the age group 18–30 years. Their responses were analysed taking various factors into consideration like their lifestyle, environment, physical activity, diet, etc.



FUN FACTS

1. The American Pygmy Shrew is the smallest mammal, but it has the fastest heartbeat at 1,200 beats per minute.
2. It's possible to have a broken heart. It's called Broken Heart Syndrome and can have similar symptoms as a heart attack. The difference is that a heart attack is from heart disease and broken heart syndrome is caused by a rush of stress hormones from an emotional or physical stress event. Broken Heart Syndrome is extremely rare.

RESULTS & DISCUSSION

Based on the data analysis, we have come across risk factors like stress, obesity, alcohol consumption, consumption of excess junk food, pollution and lack of exercise that are predominant in the population. These if neglected can lead to cardiovascular diseases and lung cancer in the future. Some factors like smoking, hypertension, diabetes, insomnia, even though not predominant, are not excluded as potential risk factors. Thus we can conclude that risk factors are linked to disease frequency in a population and in order to prevent a disease it is important to study all its risk factors. In this way, we can lessen the disease frequency in a population.

SARS CoV vs SARS CoV 2 - COMPARISON OF PATHOGENECITY

RUSHABH CHHEDA, SYBSc


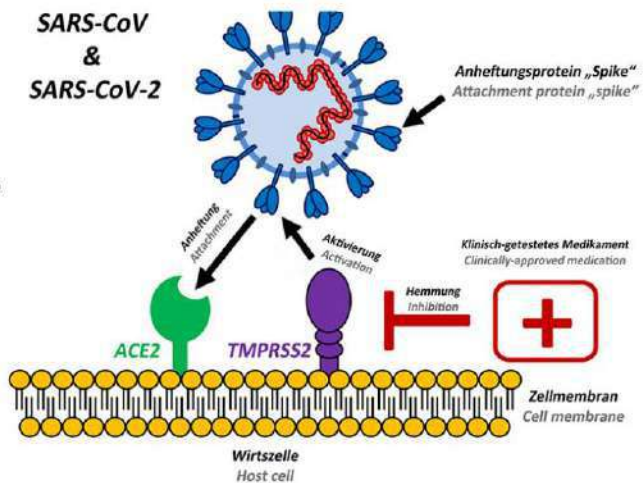
December of 2019 saw the rise of a new disease called COVID-19 caused by SARS Coronavirus 2. A similar pandemic was observed in 2003-04 that was caused by its predecessor, SARS CoV. Since we should learn from history, this study was done to compare their genomes to understand their pathogenicity.

FACT 1

The word coronavirus comes from the word "corona" meaning crown due to its crown like structure.

METHODS

Bioinformatics tools such as BLAST- N & P, ClustalW and Uniprot were used to compare the gene and protein sequences of the 2 viruses for analysis.

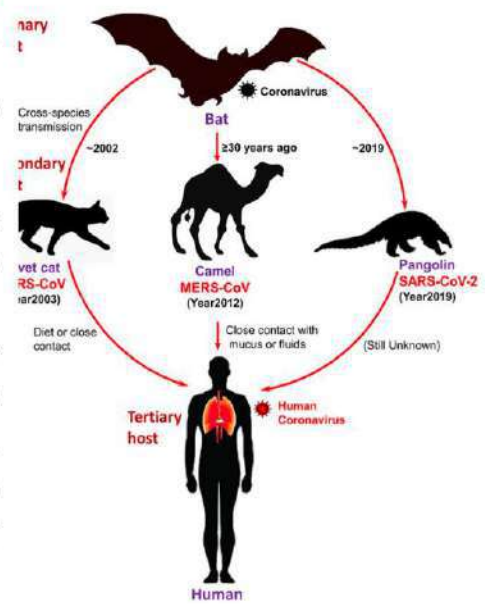
RESULTS AND CONCLUSION

The homology between SARS CoV-2 and SARS CoV is found to be 82-83%. The spike protein is responsible for host cell attachment and entry.

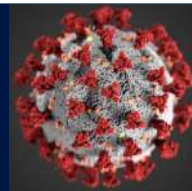
FACT 2

Coronaviruses have the largest RNA genomes (27 to 32 kb) among the RNA viruses.

On structural and sequence analysis of this protein it was found that the RBD of the S1 subunit differs in affinity for hACE2 as well as in its structure for the 2 viruses. Higher affinity was for SARS CoV2 which explains the higher R0 value.



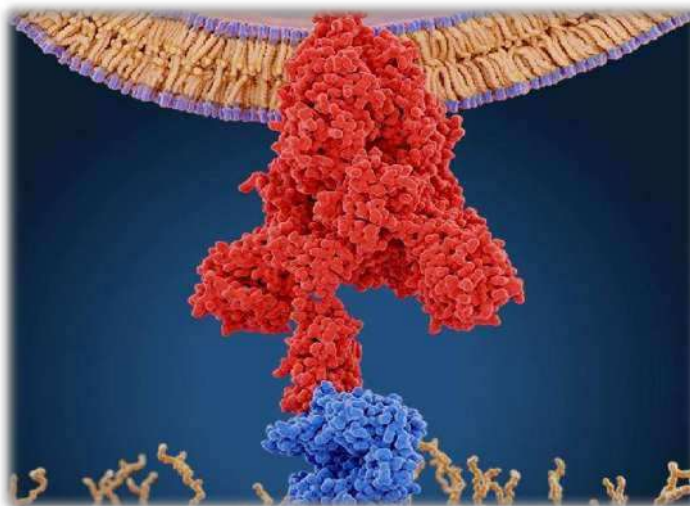
Spike protein in SARS-CoV-2, MERS-CoV AND HCoV-OC43



Coronaviruses (CoV) are a large family of viruses that cause a range of illnesses from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). Coronaviruses are zoonotic, meaning they are transmitted between other animals and humans.

Coronaviruses constitute the subfamily Orthocoronavirinae, in the family Coronaviridae, order Nidovirales, and realm Riboviria. They are enveloped viruses with a positive sense ssRNA genome and a nucleocapsid of helical symmetry. The genome size of coronaviruses ranges from approximately 26 to 32 kilobases, one of the largest among RNA viruses.

They have characteristic club-shaped spikes that project from their surface and help in attachment to the host cell.



FUN FACT
Spike protein of the novel coronavirus is more flexible than expected.

METHODS

Amino acid sequences of the S protein used in the analysis were obtained from NCBI GenBank.

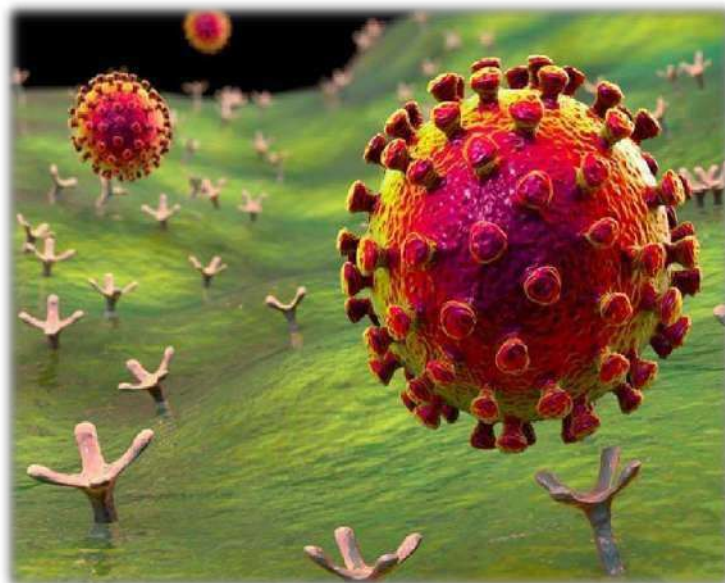
Sequence alignments were performed on coronavirus S protein sequences using CLUSTAL OMEGA. S protein structures and amino acid sequences were obtained from the RCSB Protein Data Bank.



RESULTS AND CONCLUSION

Spike proteins on the virus are important in serology testing. Spike proteins are responsible for the ability of the virus to bind to the protein. By this study, it can be concluded that the spike protein of SARS-CoV-2, MERS-CoV, and HCoV-OC43 differs structurally. Also, the lengths of each spike protein differ.

FUN FACT
Protein subunit vaccines include harmless pieces similar to spike protein of the virus instead of the entire germ.

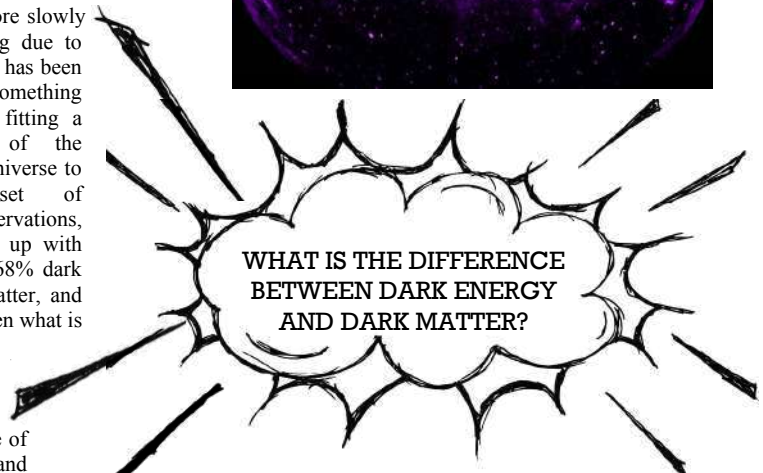
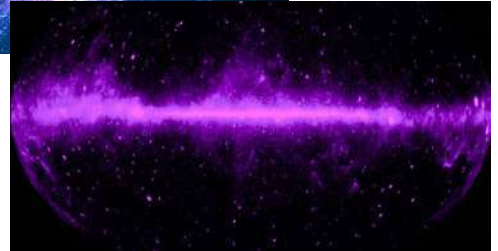
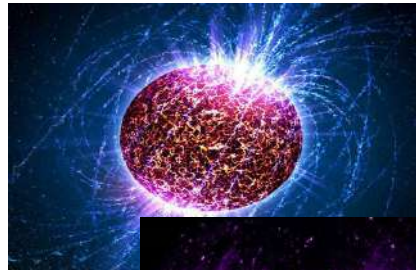


Avani Patil, SYBSc.

DARK ENERGY AND DARK MATTER

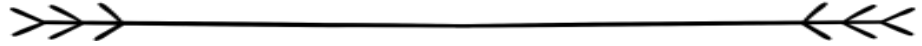
-Akash Sanga, FYBSC

In the early 1990s, one thing was fairly certain about the expansion of the universe. It might have enough energy density to stop its expansion and collapse; it might have so little energy density that it would never stop expanding, but gravity was certain to slow the expansion as time went on. Granted, the slowing had not been observed, but, theoretically, the universe had to slow. The universe is full of matter and the attractive force of gravity pulls all matter together. Then came 1998 and the Hubble Space Telescope (HST), observations of very distant supernovae that showed that, a long time ago, the universe was actually expanding more slowly than it is today. So, the expansion of the universe has not been slowing due to gravity, as thought, it has been accelerating, and something was causing it. By fitting a theoretical model of the composition of the universe to the combined set of cosmological observations, scientists have come up with the composition as: 68% dark energy, 27% dark matter, and 5% normal matter, then what is dark matter?



We are much more certain about what dark matter is not than we are of what it is. First, it is dark, meaning that it is not in the form of stars and planets that we see. Observations show that there is far too little visible matter in the universe to make up the 27% required by the observations. Second, it is not in the form of dark clouds of normal matter, it's made up of particles called baryons. We know this because we would be able to detect baryonic clouds by their absorption of radiation passing through them. Third, dark matter is not antimatter, because we do not see the unique gamma rays that are produced when antimatter annihilates with matter.

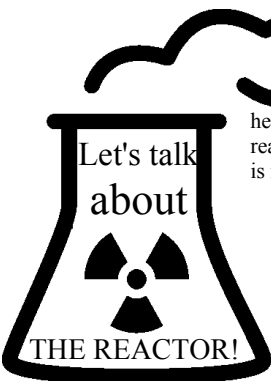
'More is unknown than is known'. We know how much dark energy there is because we know how it affects the universe's expansion. Other than that, it is a crucial and complete mystery. It turns out that roughly 68% of the universe is dark energy. Dark matter makes up about 27%. The rest – everything on Earth, everything ever observed with all of our instruments, all normal matter – adds up to less than 5% of the universe.



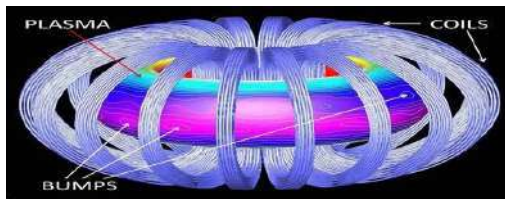
INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR

-Rohit Patil, FYBSC

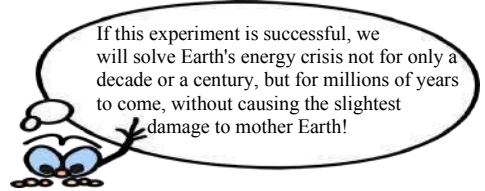
In this article, we will look at humanity's most important experiment ever performed, involving major cooperation between countries around the world. We are talking about ITER (International Thermonuclear Experimental Reactor). It is a unique reactor which will use fusion as a reaction instead of fission, a fundamental reaction of the universe. It is based in France and costs around a staggering \$65 billion! India is an active and founder member of this program.



The goal is that if this experiment is successful, we are going to replace fuel from hydrogen to sea water! Ever heard of creating energy from water? A proud moment for us is that the reactor, which needs to be cooled down, has a cryostat installed which is made in India. It was built by L&T Pvt. Ltd.



Which is, at this stage, the presence of plasma is hard to confirm. So, the world's most powerful magnets will be used, which are also referred to as super magnets or electromagnets (10,000 tonnes of magnet!) to confirm the presence of plasma. In this way energy will be extracted from that plasma.



The reactor is named as the "Tokamak reactor" after 4 Russian scientists who created it in 1960. This reactor will be fueled by isotopes of hydrogen which are deuterium and tritium. Tritium is radioactive, so care is required. The basic principle is that these isotopes will heat up to a massive temperature of 150 million degrees Celsius. To convey the gravity of this statement, the temperature of the sun's core is around 15 million degrees Celsius. This exceeds the highest temperature limit known to us. At such a high temperature, these elements will fuse to give plasma, which is a state of hydrogen at high temperature. But there's a twist.

KARDASHEV SCALE

- Nachiket Joshi, FYBSc



The Kardashev Scale was originally designed by Nikolai Kardashev through the cosmic signals in space. He devised the scale to differentiate and categorize the level of technological advancement of a civilization, based on its energy harnessing capacity. The scale is categorized into different types of civilizations, which can be differentiated as follows:

TYPE 1 CIVILIZATION: -

A civilization is designated as a type 1 civilization when given to species who have been able to harness all the energy that is available from a neighboring star, gathering and storing it to meet the energy demands of a growing population.

TYPE 2 CIVILIZATION: -

A type 2 civilization can harness the power of their entire star but not control the star. Several methods for this have been proposed. The most popular of which is the hypothetical 'Dyson Sphere.'

TYPE 3 CIVILIZATION: -

A civilization can be called a type 3 civilization when it's in possession of energy at the scale of its own galaxy. These may be cyborgs with the descendants of regular humans being a sub-species among the now highly advanced society. Human race is not even on this scale yet, since we still sustain our energy needs from dead plants and animals. Here on Earth, we are a lowly type 0 civilization with a long way to go before being promoted to a type 1 civilization. Theories tend to believe that, all things taken into consideration, we will reach type 1 in 100 – 200 years' time.



LIFE ON VENUS

- Tanushree Patil, FYBSc



THE HUNT FOR LIFE BEYOND EARTH: -

Ever since early humans initially looked skyward and imagined the celestial bodies as distant campfires, humanity has been puzzled if we are alone in the Universe. Within the 21st century, the new field of biological science harnesses the specified technological and scientific capability to noticeably address the ancient and basic question of the existence of life on the far side of the world. Astrobiology is the study of life within the universe.

The rummage around for life on the far side of the planet needs an understanding of life, which is produced by space biology by combining information and techniques from several fields.

Have you ever pondered that something weird is happening on the planet next door? Venus, the neighboring planet, has long been thought to be earth's twin. It's of similar size as our planet, with similar gravity and composition. For hundreds of years, humans thought its surface could be lined in oceans, vegetation, and abundant ecosystems, providing a second refuge for living within the system. Early science observations of the world divulged that it's a menace of a world that would kill earthlings.

That its surface will reach a burning 9000F - over 90 times what is felt on Earth's surface. Also, the planet's atmosphere is primarily suffocative. As we know, on rocky planets like Venus and Earth, phosphine will solely be created by life, whether humans or microorganisms. However, if phosphine is truly floating through the Venusian cloud deck, its presence suggests that either the alien life forms are dexterously linking along phosphorus and hydrogen atoms, or some utterly unexpected chemistry is crafting phosphine within the absence of life.



DID YOU KNOW?



Destructive Desert Locust

Schistocerca gregaria, desert locusts, are short-horned grasshopper-like insects. They can be found in Africa, West Asia and in some parts of West Asia. The desert locust shows periodic changes in its body form and can change from solitary non-migratory forms to gregarious migratory ones. During dry spells, solitary locusts are forced together in the patchy areas of land with remaining vegetation. This sudden crowding release serotonin in their central nervous systems that make locusts more sociable and promotes rapid movements and more varied appetite. Locusts can become gregarious at any point in their lifecycle. Guaiacol is produced in the gut of desert locusts by the breakdown of plant material. This process is undertaken by the gut bacterium *Pantoea (Enterobacter) agglomerans*. Guaiacol is one of the main components of the pheromones that cause locust swarming. Desert locust upsurges and infestation were seen in 1915 Ottoman Syria, 2003-2005 West Africa, and 2019-2020 East Africa and Asia. Their swarms may contain 40-80 million insects and each locust can eat its weight in plants each day.



KUNAL JAGETIYA, TYBSc

The only hibernating bird

Hibernating animals aren't actually sleeping, they become merely inactive to save energy. Their heart rate and breathing slow down, body temperature drops, and they do not eat or drink during hibernation. We have heard about hibernating bats, squirrels, bears, frogs, and others. But have you ever heard of a hibernating bird? *Phalaenoptilus nuttallii*, Common Poorwill, is the only bird known to hibernate. It is a nocturnal bird and can be found along British Columbia and Alberta states of US and northern Mexico. They are known as Hopi in common language, which means the 'sleeping one'. As the winter cold deepens, these petite members of the nightjar family can enter a hibernation-like state and stay like that for hours or even weeks! The poorwills that stay through the cold come out of their hibernation as the temperature rises, the days lengthen, insects become abundant again, and the breeding season nears... and that is something to sing about.



A Seed that can kill

Ricin is extracted from Castor (*Ricinus communis*) seeds. It is a highly potent toxin. 1 mg/kg can kill a human in seconds. LD₅₀ of ricin is 22 mg/kg of body weight! But how will Ricin kill you? The quaternary structure of ricin is made up of A and B chains named RTA and RTB respectively. 10⁶-10⁸ ricin molecules bind to eukaryotic cell surface with help of RTB. After cellular uptake, enzyme protein disulphide isomerase (PDI) cleaves RTA and activates the cytotoxicity of ricin. RTA has rRNA N-glycosylase activity cleaving glycosidic bonds within 60S subunit of ribosomes. Ribosomes are eventually inactivated by the process of depurination. A single RTA molecule can depurinate 1500 ribosomes per minute. The protein machinery of the cell collapses and the cell is murdered. If exposed to Ricin, remove your clothes and take a bath as soon as possible. The symptoms you may develop are inflammation, nausea, dysphagia, hematemesis, organ-failure, and others...





A Comparative study of the link between Alzheimer's, Parkinson's and Huntington's disease using Bioinformatic tools

- Huntington's disease is an autosomal dominant neurodegenerative disease characterized by movement disorders and cognitive impairment.
- Clinical manifestations of Parkinson's disease include motor disorders such as a resting tremor, rigidity, and bradykinesia.
- Alzheimer's disease is a progressive brain disease. It is characterized by changes in the brain including amyloid plaques and neurofibrillary, or tau, tangles that result in loss of neurons and their connections.

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GAGGAGCTGCTCAGCTCCCAGGTCACCCAGGAA
ATGAGGCTTATGAAATGCCTTCTGAGGAAGGGT
AGTGAGGTGGTCAGATCCCTTCTAGT----GGT
      * * * * * * * * *
--GGGCGTGATGGACGAGACCATGAAGGAGTT
-----GACT
GTTTGAGCTGATGTATGTGACGCTGACAGAACT
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Your DNA could stretch from the earth to the sun and back ~600 times

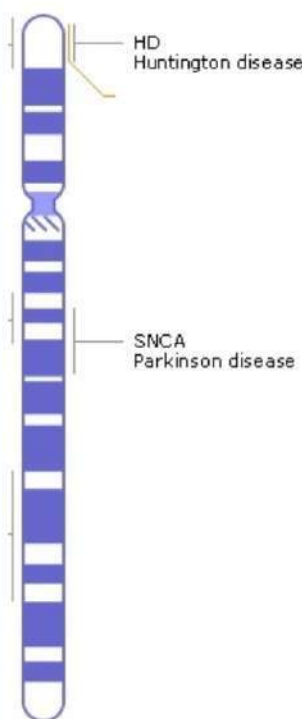
Materials: BLAST, CLUSTAL Omega, GenBank, NCBI, SWISS-MODEL and Uniprot.

Methods: Multiple and Pairwise alignment using BLAST and Clustal Omega is performed with 3 protein and 3 gene sequences respectively. The Amyloid beta precursor protein and the APOE gene for Alzheimer's, the Leucine-rich repeat serine/threonine-protein kinase 2 and the SNCA gene for Parkinson's and the HTT gene and the huntingtin protein for Huntington's.

Experimental structures/models using SWISS-MODEL will be configured and the depiction of the cytogenic location of each gene on the chromosomes will be analyzed.

Model #01	File	Built with	Oligo-State	Ligands	GMQE	QMEAN
	PDB	ProMod3 3.2.0	monomer	None	0.34	-3.99

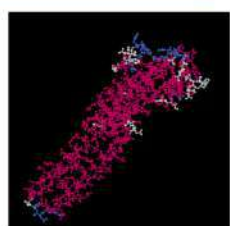
Template	Seq Identity	Oligo-state	QSQE	Found by	Method	Resolution	Seq Similarity	Range	Coverage	Description
Ex9o.1.A	99.87	monomer	0.00	Hi-bits	EM	-	0.61	95 - 3136	1.00	Huntingtin



The outcome of this study shows that the Aβ and the huntingtin protein show a considerable number of similarities when it comes to the protein sequence but they are not exactly related since they hold a difference of 19.86%. On the other hand, the SNCA gene and the HTT gene show a higher grade of similarity as compared to the protein distribution, the HTT gene along with the SNCA gene show a 90.94% percent identity between the gene sequences along with a very high E value of 1e-114 indicating that it is of good quality moreover, both the genes lie on chromosome 4.

Your nervous system can be hacked! - the cells can be programmed to react to light through genetic altering.

Furthermore, these results from the alignment propose that during the translation process, the HTT gene and SNCA gene undergoes some mutations in the base pairing. Seeing that after the synthesis of the proteins through the mRNA template, the degree of similarities decreases between the two genes since the pairwise alignment of the Aβ protein and the LRRK2 protein appeared to have a higher similarity percentage. Therefore, the association of Aβ, huntingtin and LRRK2 protein in their respective diseases do coexist yet represent three independent disease states.



Roshni Keshwani SYBSC

Evaluating Human Altruism and its Correlation Between Genes and Genetic Relatedness

Altruism is the unselfish concern for other people: doing things simply out of a desire to help. One such instance is known as reciprocal altruism. It involves taking actions to help others with the expectation that they offer help in return. Another one known as genetic altruism is a type of altruism that involves engaging in altruistic acts that benefit close family members. New research published shows that by looking at how different brain regions interact, it is possible to predict whether an altruistic act is motivated by empathy or by reciprocity—a “you scratched my back, now I’ll scratch yours” situation.

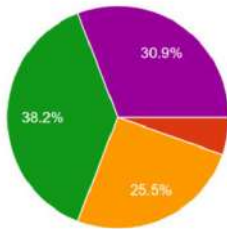


METHODS



Using google forms, I had conducted a survey that had a total of 24 questions pertaining to not only people’s ideas of altruism but also their real-life experiences. The data was interpreted via SPSS software.

If yes which motives did you have ?
55 responses



- I had personal connection to where the money was going.
- Out of situation not because of conscience or something.
- Out of compassion.
- It made me feel better somehow.
- Not to feel better but to help.



FACT 1

“Rotten Kid Theorem” is thought of as a theory of how the family can act as an altruism amplification device. The theorem states that all members of a family will behave efficiently, even if they are completely selfish provided that the head of the family is sufficiently altruistic to make an operative transfer.



RESULTS & CONCLUSIONS



I wanted to know whether or not the humans’ altruistic behavior is associated with genetic relatedness and thus I performed Carl Pearson Correlation. Correlation analysis is used to describe the strength and direction of the linear relationship between two variables and after interpreting the output which indicates that the relation is significant. This basically states that parents’ and related genes influence prosocial behavior. Thus, I could conclude that Altruism is influenced by Genetic Relatedness



FACT 2

Altruism is often present as a motivating factor in the economic realm.



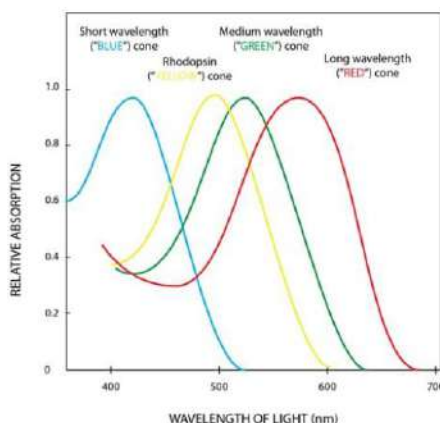
Richa Mishra SYBSc

The Difficulty to Differentiate Between Red and Green

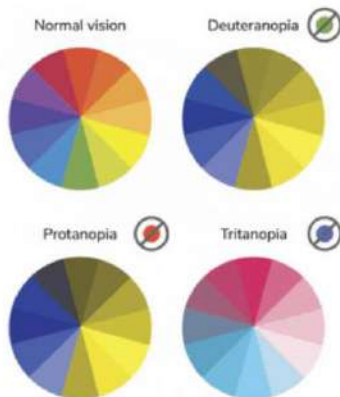


Colour blindness occurs when a person is unable to detect/see the colours in a normal way. This disorder is also known as colour deficiency. It is also called Daltonism as John Dalton was the first one to describe this condition. It usually happens when a person cannot distinguish between specific colours. The colours that cannot be distinguished are generally green and red but sometimes blue too. The rod cells and cone cells in the retina of the eye are the two types of cells that detect light.

Red-green colour-blindness, with X-linked inheritance, is the most common, but other types are also considered. Colour blindness can occur due to any of the following reasons in the cones cells: a) The cone cells are absent. b) The cone cells aren't functioning properly. c) The cone cells detect a different colour than normal.



They have taken tests further in the form which can to some extent confirm the same. The symbolic use of figures in the signal light (white human figures) is for colour-blind people to help them differentiate between red and green. Mild/major colour blindness is thought to affect the 2.6 percent of the population who can't tell the difference between red, green, and blue colours. Different tests in the survey were taken to support our discussion.



Using the quantitative data of the 76 Indian respondents, we hope to determine if any person has colour blindness or is a susceptible carrier. According to a referred research paper, the colour vision deficiency is mostly self-diagnosable with the help of a few tests. Treatment in such cases may help but this deficiency is not completely curable. 95% of the total colour-blind population are men. The percentage of people who find it moderately difficult to distinguish between red and green signal lights can be mildly colour blind.

A cat's vision is similar to that of a human with red-green colour-blindness.

According to statistics, colour blindness tests are not compulsory in India and as a result majority of the cases go undetected for a long time. It is only when a person recognises his/her inability to differentiate between colours that he or she may recognize their colour vision deficiency.

Methods: A survey was conducted in a selected population (of 50 people) by using Google forms as a method of survey. A total of 15 questions were asked (excluding the age and gender) and the responses were recorded.

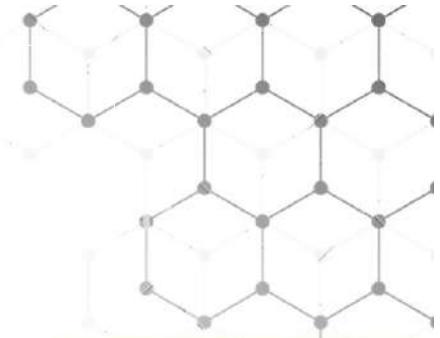
DID YOU KNOW?

It's possible to be colour blind in one eye and have normal colour vision in the other. This is called unilateral dichromacy and it's a very rare condition.



Mahek Sangoi SYBSc

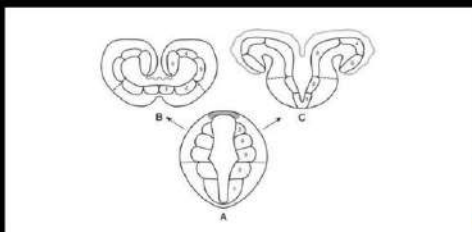
Comparison of the Brain Sizes of Vertebrates



The brain can't feel pain. It interprets pain signals sent to it, but it does not feel pain.

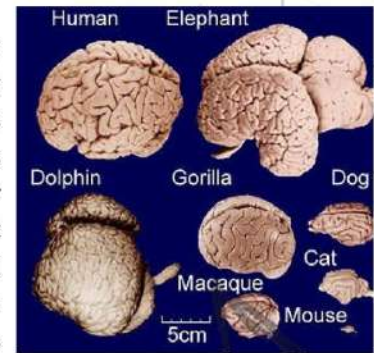
RESULTS AND CONCLUSION-

Intelligence has evolved many times independently among vertebrates. Primates, elephants and cetaceans are assumed to be more intelligent than 'lower' mammals. Brain properties assumed to be relevant for intelligence are the (absolute or relative) size of the brain, cortex, prefrontal cortex and degree of encephalization. However, factors that correlate better with intelligence are the number of cortical neurons and conduction velocity, as the basis for information-processing capacity. Brain size has increased during evolution in a variety of different lineages. In many cases, these increases are increases in the range of the size distribution rather than involving replacement of smaller brains by larger ones.



INTRODUCTION-

In vertebrates, brain size variability relates to two main parameters: body size and ecological factors. It is considered that brain growth is significantly associated with higher processing capacity only when it occurs associated with ecological circumstances - active growth. When the brain scales on body size, there is little change in processing capacity - passive growth. The structure vertebrate brains is basically the same. During the course of evolution, the vertebrate brain has undergone changes, and become more effective. Three major conclusions regarding brain evolution in vertebrates:



1) All vertebrates, with the exception of the agnathans, which appear to lack a cerebellum, have the same number of brain divisions 2) Brain size has increased independently in some members

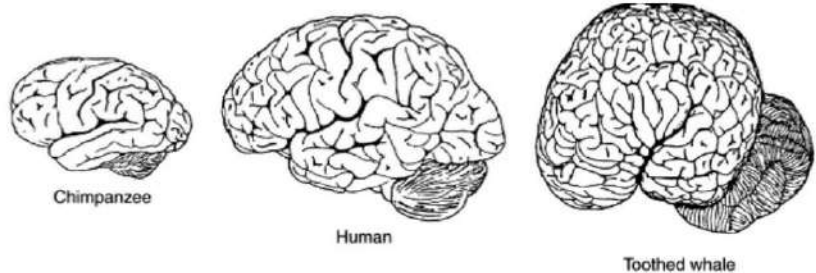


3) Increase in brain size have frequently resulted in increase in the number of neural centers, neuronal cell is and analysis of previous research to the extent that it leads to new and creative outcomes classes within a center, and probably, increases in behavioral complexity.

Larger brains don't necessarily make a smarter mammal.

METHODS-

In the case of brain evolution, there are four major questions: 1) What changes in brain organization and function have occurred over time? 2) When did these changes occur? 3) How did these changes occur? and 4) Why did these changes occur?

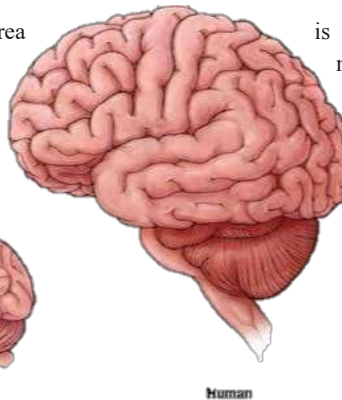


Jafrin Sayad SYBSc

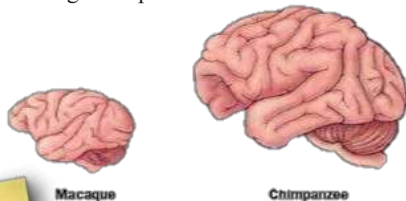
EVOLUTION OF HUMAN BRAIN



Broca's area is found in the left inferior frontal gyrus and Wernicke's area superior temporal gyrus. Non-human primates (both apes and that are in similar locations and have similar cytoarchitecture as in humans, and are probably homologous to them. The putative Broca's area, known as area 44 or area F5, shares functional Broca's area. In both species, the region represents non-movements.



is found in the left posterior monkeys) possess cortical areas Wernicke's and Broca's areas macaque homologue of properties with human linguistic hand and mouth



Macaque

Chimpanzee

Human

FUN FACT
 Research studies begin with a question in mind. A paper that describes a particular study clearly states the question, methodology, findings, and other relevant information.

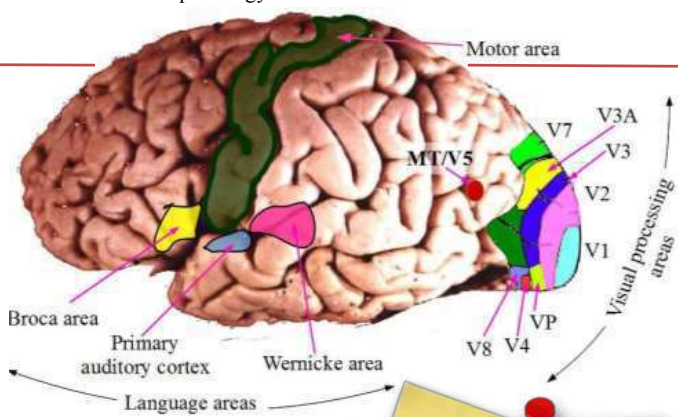
METHODS

The sample comprised 20 complete series of histologically processed brains of individuals from five hominoid species. It included both hemispheres of eleven humans, three chimpanzees, two bonobos, two gorillas, and one orangutan, with an additional right hemisphere of another orangutan specimen. All specimens were fixed in either 4% buffered formalin (pH 7.4) or a Bodian mixture (formalin, glacial acetic acid, and ethanol) within 24 hours after the natural death of the subject and were then processed and stained in a consistent manner. All brains were paraffin-embedded and serially sectioned in the coronal plane into 20µm thick sections (except for one chimpanzee, YN89, which was cut in the axial plane into 15µm thick sections) producing complete series through the entirety of each brain. Every 10th to 13th section was mounted on a glass slide and stained with a modification of the Gallyas silver stain for neuronal perikaryon. One specimen (gorilla A375) was stained with cresyl violet. In no case was a neural pathology the cause of death

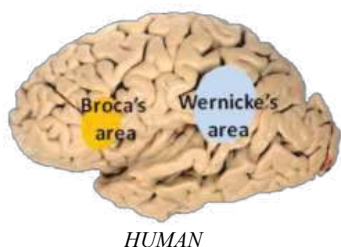
RESULTS AND CONCLUSION

Detailed quantitative data on the size of these areas have been reported only for humans and chimpanzees so far. One study found that area 44 in the left hemisphere is 6.6 times larger and area 45 in the right hemisphere is 4.1 times larger in humans compared to chimpanzees, while Brodmann area 45 was 6.0 times larger on the left and 5.0 times larger on the right. On comparing, the overall brain size was 3.6 times larger for this sample, implying that there have been disproportionate increases in Broca's area, particularly in the left hemisphere during human evolution. Quantitative comparisons of Wernicke's area have not been reported.

The increase in overall brain size paved the way for language by promoting localized cortical specialization as well as making increasingly complex social interactions possible, which provided the core utility for language, driving its evolution. Specific brain areas relevant to language increased disproportionately



FUN FACT
 Men have 6.5 times more gray matter in the brain than women; however, women have about 10 times more white matter than men.



HUMAN



CHIMPANZEE

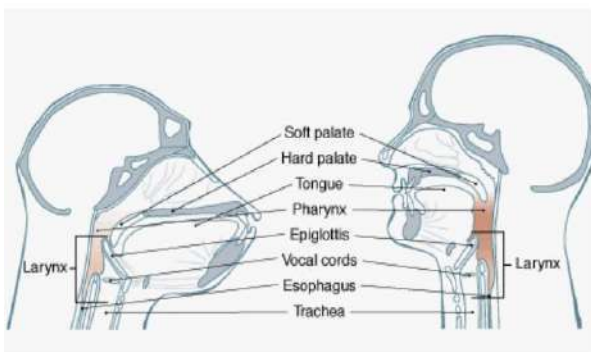


THE EVOLUTION OF SPEECH IN HUMANS

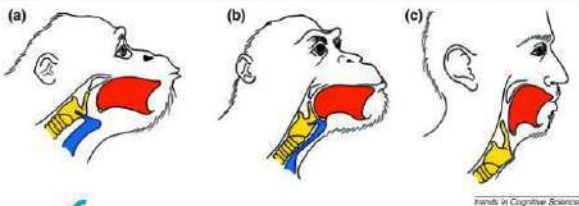
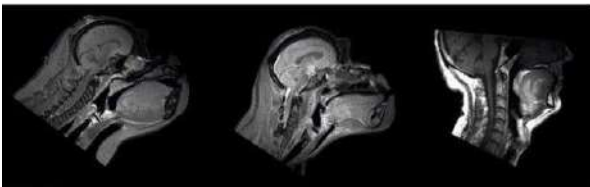
Mariam Dadani, SYBSC



Speech is the physical signal used to convey language. Due to its nature, speech is easier to compare among species and to study in fossil records. It was first seen in *Homo erectus*, according to a new theory. Humans may often choke while eating, but can produce controlled vocalizations better. Parker and Smith (1990) observed that optimization for a function often indicates selective pressure related to that function. It is likely that humans underwent selective pressure related to speech. Speech is the default modality for language across cultures. Humans' first recourse is to encode thoughts in a sound method, which depends on capacities for controlling the lips, tongue and other components of the vocal apparatus.



Analysis of the evolutionary evidences of speech origin was done from various research papers. Analysis included comparison of speech evolution in Neanderthals and *Homo sapiens*, the point of change in vocal organs, speech-related problems and expression of feelings without speech. It also included time taken for the adaptations to occur and the extent to which speech and language evolved independently.



FUN FACTS

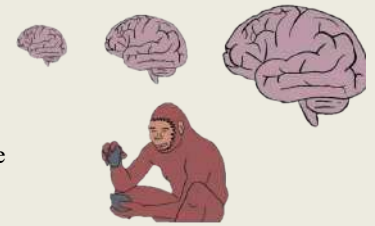
1. Humans can execute about 14 movements per second, whereas speech apparatus like lips and jaws cannot execute more than 2 movements per second.
2. The first symbolic language emerged 2.5 million years ago when *Homo habilis* fabricated the first stone tools.

Based on comparative analysis of related species (specifically other great apes) and the theoretical results, this article argues that speech adaptations have evolved gradually. It is likely that speech motor control is a key aspect that underwent observable selection as all the necessary precursors are present in closely related species. This implies that finding empirical evidence is possible for evolution of speech motor control. Such research is currently in its infancy. Convergent evidence for adaptations to complex vocalizations in Neanderthals and *Homo heidelbergensis* indicates that these adaptations were present 400,000 years ago. In combination with what is known about the prelinguistic abilities of other apes, it seems likely that some form of language was present too. It was proposed that later during in human evolution, hands got such a demand for making and using tools that the competing demands of gesturing became a hindrance. The transition to spoken language supposedly occurred at that point. Since humans have utilised tools throughout evolution, researchers propose that language began as gestures, then gradually or suddenly switched to vocal modality, leaving gesture as a residue.

There has been substantial progress in describing human speech evolution recently. But we are far from understanding how the evolution of some hallmark changes is rooted in genetic, molecular and cellular processes. Consistent with this, the structural and functional properties of the larynx have been observed in humans.

THE EVOLUTION AND DEVELOPMENT OF THE HUMAN NERVOUS SYSTEM

The study of the nervous system, particularly, the brain and its cognitive abilities are humans' most distinctive and impressive attributes. Although humans share most of their genetic, molecular, and cellular features with non-human primates (NHPs), there are compelling differences in cognitive and behavioral capacities. It is implied that human mental abilities have gradually evolved from ancestral forms and functions, with culture in addition to genomic information playing a critical role in the emergence and transmission of complex behavioral skills.



METHODS

Figures and graphical data of the million years were and estimated. Developmental mechanisms and underlying genetic and molecular changes that generate these structural and functional differences were studied.

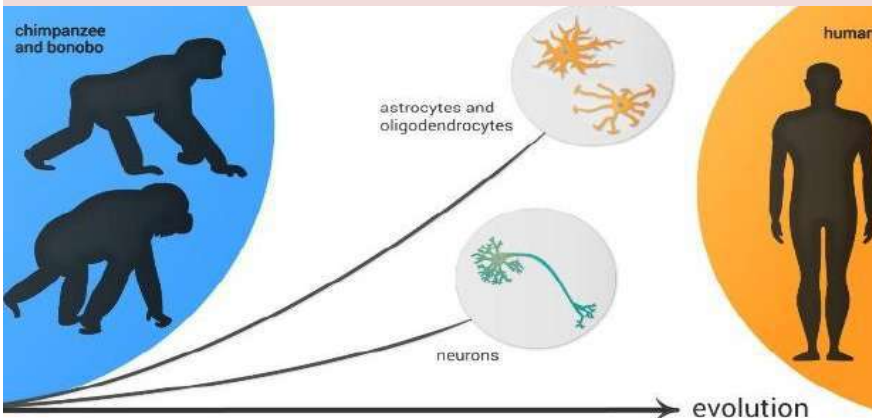


RESULT & CONCLUSION

The overall size of the CNS has been correlated with general intelligence and other indicators of cognitive capacities. The human CNS is about three times larger than that of chimpanzees.

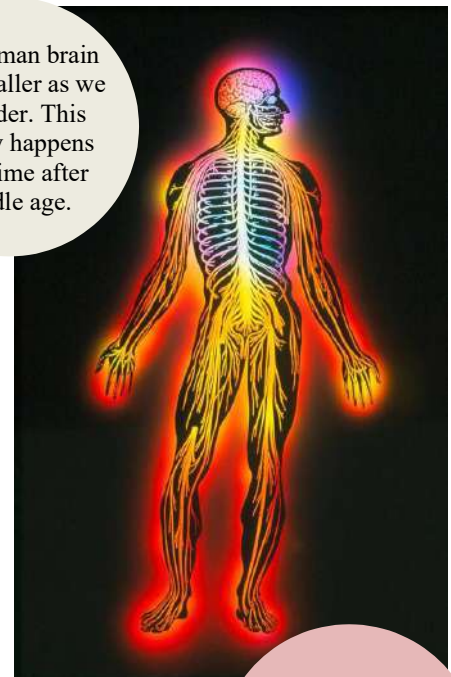
- One possibility is that larger animals have bigger brains simply as a consequence of isometric scaling.
- Second possibility is that the relative sizes of discrete territories in the brain differ across species.

There has been substantial progress in describing human brain evolution in recent years. Nevertheless, we are still far from understanding how the evolution of some hallmark changes is rooted in genetic, molecular, and cellular processes.



FACTS

The human brain gets smaller as we get older. This usually happens sometime after middle age.



There are more nerve cells in the human brain than there are stars in the Milky Way.

EVOLUTION OF HUMAN INTELLIGENCE

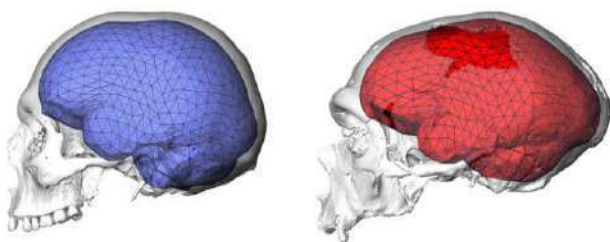
-DANIA PATNI, SYB_{sc}

Human brain has evolved from structures to its size, and therefore the amount of data it can store and process is huge. The more information a system (brain) receives, the faster it can process the information and adequately aid in evolution by being able to better respond to the environmental challenges, increasing its chances of survival. The objective is to present current perspectives on primate brain evolution, especially in humans, hence considering the comparative studies of the human brain with ancestors and leading its path towards how the development of cognitive thinking has evolved over the years.

METHODS AND MATERIALS:

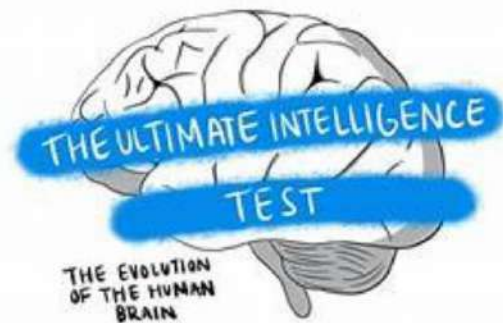
To study the evolution of the human brain by comparing the size and shape of the human brain along with other various factors responsible; from millions of years with the help of statistical data and gene comparison. The following points were considered:

- How did a structure as complex as our own brain ever evolve?
- Evolutionary changes in the size and the number of neurons in the human brain with respect to other primates, as well as the cellular and molecular reorganization of its neural circuits.
- Cognitive aspect related to the gene FOXP2, a gene that is important for normal development of speech and language which is a distinctive human feature.



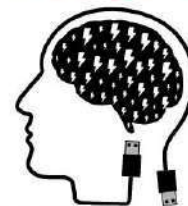
RESULTS AND CONCLUSION:

Structural and functional differences associated with scaling the brain, including neuronal populations at the root of functional connectivity, may therefore be among the substrates susceptible to evolutionary and developmental variation and consequently associated with the emergence of human cognition. Consistent with this, changes in the numbers, as well as the structural and functional properties, of both neurons and neuroglia have been observed in humans. Hence, these observations, as well as the study of brain size and organization in extinct primates suggests that many independent changes rather than one single defining event have occurred across the nervous system in the human lineage. It is also likely that these changes have affected various, if not all, brain structures and levels of organization.

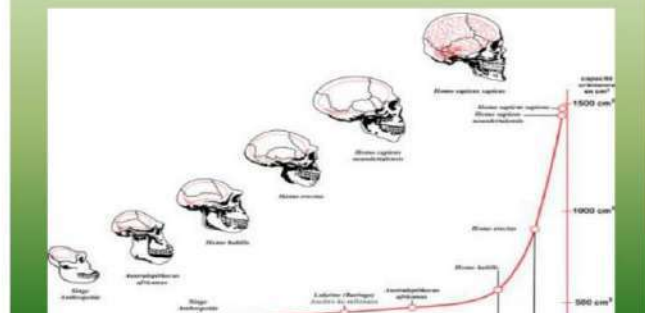


1. The human brain contains about 100 billion neurons, more than 100,000 km of interconnections, and has an approximate storage capacity of 1.25×10^{12} bytes.
2. Mutations in the FOXP2 gene interfere with the part of the brain responsible for language development.

FUN FACTS



The evolution of human brain:-



Prerana Kamat FYBSc

The impact of stem cells in regenerative medicine

One of the most evolving and modern branches of Science, Regenerative Medicine is coming into the limelight. When the body tends to reject its natural ability of regenerative responses, stem cells come into play. Currently, donated tissues and organs do not satisfy the transplantation prerequisites of aged and diseased populations. The uncertain self-renewal and strength to divide into various kinds of cells showcase stem cells as the flag bearer of Regenerative Medicine. A few categories of stem cells go parallel with regenerative applications



Umbilical Cord Stem cells (USC's) – Parents around the world are shedding their pockets to preserve cord blood of their newborns. This provides them with an additional level of insurance for their children in case a

chronic disease knocks at their doorstep. Human Embryonic Stem Cells (HESC's) – Their immortality and determinable potential promises an unlimited supply of cell types. The transplantation of HESC's do miracles in the treatment of diseases like Parkinson's disease to leukemia. They are, therefore, known as biological 'catalysts' that encourage tissue repair. Hematopoietic Stem cells (HSC's) – The origin of HSC's is from the bone marrow or peripheral blood. Establishment of Stem cell research in cell therapy has proved to be the alternative for treating diseases which could not be dealt by conventional medical means. A ray of hope for improvement among individuals brought this treatment in the frontline. In the foreseeable future, stem cell therapy in regenerative medicine could be studied for contemplating the pathophysiology of various diseases. Now that Regenerative medicine is an emerging, multidisciplinary field, is it possible to cure every disease on Earth? Would the most critical medical cases be dissolved back to normal? Well, the life and death clock of the human body has been a mystery. However damaged tissues, cells, organs, consequently a undermined system can be up and running as good as before or maybe better because of such remarkable discoveries in cell therapy. Despite ongoing research, the sole purpose of stem cells in regenerative medicine will always be to restore, maintain and enhance.



Immortality in living beings reminds one of Jellyfish because they are biologically immortal. The average human lifespan about a hundred years ago was around 40, but it has increased dramatically over the last 100 years and today it is about 80 years. This has been achieved by advancements in technology, science, and medicine. But could we ever achieve immortality? There are several theories and technology that can make human immortal or can increase their lifespan to a large extent. One such theory is of a pill that triggers the anti-aging enzyme Sirtuin-1. It is estimated to extend the human lifespan by as much as 15%. It is thought to slow down the aging process. Another one is gene therapy that can induce cells to express telomerase. One experiment in 2012 was carried out on mice that showed an increased longevity in 1/4th of the mice tested. It was a great success. If it works on humans, then it will be a big step towards an increased lifespan. Scientists believe that if in the future we will able to save and upload copies of ourselves. This is called as cybernetic immortality. Then these copies could be installed into robotic bodies or avatars and that would enable us to live forever. Induced hypothermia can also be an option. In this process, body's metabolism slows down to such a level that it can put the body 'on pause'. 3D printing and cloning is the another technology that is developing incredibly fast and could soon be used to print body parts, like the human heart or grow body parts like ears, bones, skin as well as complex organs can be formed. So, in conclusion, technology is improving at a very fast rate and with that, the simplicity and ease of living is also increasing. There are a lot of theories and possibilities which can make humans live very long. But these are still under development and in future having a long lifespan may become possible. But, to be immortal, it's still a long way to go in terms of technology.

Is human immortality possible?

Pankaj Maurya FYBSc

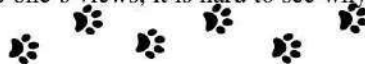


SCIENTIFIC APPROACH BEHIND COMMERCIALISATION OF CLONING

PRANALI DONGRE, FYBSc



So, imagine growing up with a family dog. Eating, sleeping, playing basically going through life together, entering your teen years, he entered one of his lasts. The worst thing is not being able to do anything about it, but what if you could? The solution is Cloning. Pet cloning is one of the many examples of commercial animal cloning. It is the process of using genes from one pet to generate a second, genetically identical replica of the first pet. This cloning is carried out as somatic cell nuclear transfer (SCNT). Enucleation (removal of nucleus) of an oocyte, which is taken from a surrogate mother, is done. Somatic cells are then taken from the animal that is being cloned, and fused with the oocyte using an electric current in order to provide genetic material. The oocyte is then activated and re-inserted into the surrogate mother. The end result being an animal that is almost genetically identical to the animal the somatic cells were taken from. In this way, we can't really save the said pet but have the satisfaction of having a part of them around. Now there are numerous questions raised about the ethicality of this technology and similarly different countries have different laws regarding the same. There is a chance that the cloned pregnancy doesn't take hold in the uterus or die shortly after birth. We can't really come to a conclusion about this as of now because if we look into the history, a lot of discoveries which have become a part of normal working were considered unethical and were looked down upon. As far as we know, this could one of those discoveries, couldn't it? As Sir Peter Medawar once said "All experimentation is criticism. If an experiment doesn't hold out the possibility of causing one to revise one's views, it is hard to see why it should be done at all."



WHAT IF WE CREATED HYBRID HUMAN- ANIMALS?

SANIKA MORE, FYBSc



What species would you prefer if you could merge your genes with those of any animal on the planet? Will you prefer the wolf's power, the cat's agility, or the bird's wings? Since this technology is just around the corner, we need to make up our minds soon. Human-animal hybrids, in the scientific world, are referred to as 'chimeras', organisms having genetic material from two or three different origins. Humans have attempted to implant human cells into a variety of animals, including rodents, rabbits, and pigs, with differing degrees of effectiveness. The Japanese government licensed a biologist named 'Hiromitsu na Kochi' to develop human cells in animal embryos in 2019. The intended goal is to create a modern approach to human organ transplantation that eliminates the need to rely on humans. Currently, the aim is to create an animal embryo that lacks the gene needed to make a particular organ, then inject human stem cells into the animal embryo to create a human-compatible replacement organ that can then be harvested and transplanted, which in-turn will be a huge help to those in search of organ transplants. So maybe we should avoid getting too far down this path. Perhaps we will learn to produce an unlimited supply of organs in the lab rather than in animals, allowing us to perform full-body transplants, but that's a story for another what if.

NANOFOOD

Sanika Naik, FYBSc

Nanofood- the term seems like a leading-edge one. But at present, there exists certain eatables which have a trace amount of nanomaterials in them. The pioneer of Nanofood is Richard Feynman. Thousands of nanoparticles could fill up the space of a single red blood cell.

Nanotechnology has been used for a long-time wherein certain fruits and vegetables are coated with fine wax-like nanocoating, which improves their shelf life. One might not be aware that certain candies such as M&M's and Skittles as well as bottles for toddlers involve the integration of nanotechnology. This whole idea of food nanotechnology is not accepted truly all over the world and it is also considered an alarming technology, but precisely our body deals with nanosized food particles regularly.

We all know the trouble to scrap out that last bit of Nutella from the jar. This trouble is also in the process of being solved. Certain researchers are developing a fine lining of 20-25 nanometres that will probably prevent food from adhering to the container. Nanotechnology could be used to lower the fat content in certain eatables such as Mayonnaise which has a creamy texture due to the presence of numerous fat droplets. Lately, nanotechnology is being used to develop nanometre-sized salt particles which are apparently ten thousand times smaller than our usual table salt which will help to lower the extra sodium consumption with the same taste. This might be a relief for people with high blood pressure. Might be in the future a single capsule will serve as a three-course meal itself. Certain big brands such as Nestle and Heinz are monitoring this field of food nanotechnology for further use.

Incorporating nanotechnology into food has a whole new side of benefits for both the food industry as well as for consumers. The prominent benefits include reduction of fat, salt, and sugar in eatables unaccompanied by any slight change in its flavour and other benefit counts for the producer wherein nanotechnology helps manufacture foods with longer shelf life. It has been estimated that by 2040, every aspect around us will have a trace amount of nanotechnology in it.



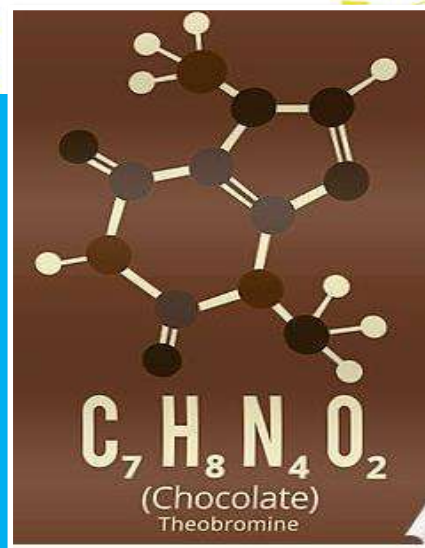
THE SCIENCE BEHIND CHOCOLATE

Mudita Adaniya, FYBSc

"Strength is the ability to break a chocolate bar into four pieces with your bare hands and then eat just one of those pieces." -Judith Viorst.

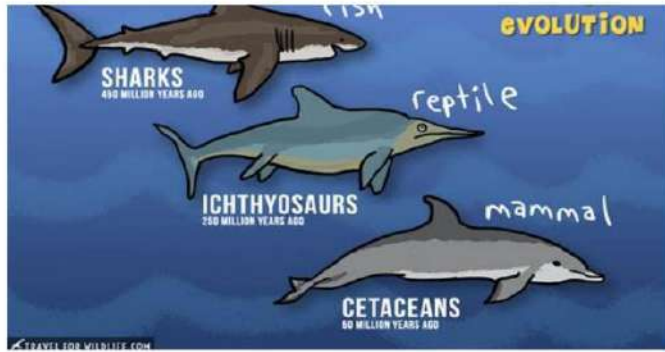
Chocolate is derived from the beans of the tropical *Theobroma cacao* tree. They are then pressurized to form two ingredients known as chocolate liquor and cocoa butter. Chocolate has many stimulants, the most important being theobromine (CHNO). Chocolate is a delicacy that many of us cannot resist. But have you ever wondered why? Indulging in chocolate hits the spot when you're feeling tired, stressed, or in a bad mood. This is because chocolate's caffeine content boosts the Central Nervous System, especially Dark chocolate. Additionally, chocolate affects the brain in several ways such as improving blood flow to the brain, increased attention span, memory, reaction time, and problem-solving skills. Chocolate contains quite a few mood-boosting ingredients, like Tryptophan, which stimulates the mood-boosting hormone serotonin, and a compound called anandamide, providing a sense of well-being as it binds to the dopamine receptors in the brain. Anandamide is a lipid in our brain that is normally broken down quickly. But the anandamide present in chocolate prolongs the existence of natural anandamide in our brain, giving us a "chocolate high". Being a good source of magnesium, chocolate also helps reduce stress by suppressing the release of the stress hormone cortisol. Chocolate also contains high levels of antioxidant chemicals called phenolics (found in red wine and tea), which make it into the bloodstream and protect lipoproteins against oxidative damage. Thus it raises HDL and protects LDL from Oxidation. Thereby, preventing cholesterol formation. Dark chocolate can also reduce insulin resistance, which is another common risk factor for many diseases like heart disease and diabetes.

It's common hearsay that "Don't eat too much chocolate! It will rot your teeth". But pure cocoa itself is harmless to your teeth. In fact, it has an antibacterial effect. The problem comes from the sugar in cocoa products. It makes plaque, which feeds the bacteria that causes tooth decay and gum disease. Studies have also shown that small quantities of chocolate help reduce anxiety in the short term and depression in the long term. Although excess chocolate can also be bad for your brain as it can induce hyperactivity due to Theobromine. While chocolate is not a cure-all, it has its benefits. Now go treat yourself to some!



THE EVOLUTION OF SHARKS AND DOLPHINS

-MEHER BHAGWAGAR, SYBSc



Evolutionary biology in a way helps scientists to understand the past living creatures based on the diversity amongst the species that exist today. Like for instance, the experiment conducted by Oparin and Haldane in 19th-20th C proposed that the first form of life could have come from pre-existing nonliving organic molecules and that the formation of life was preceded by chemical evolution. The result which they obtained was a big bang in the field of evolutionary biology. Likewise, as per some of the physicists and mathematicians, life is said to come from space. To deepen the understanding about life and its existence, scientists work on a species or a group of species of their choice and with the help of gene sequencing, analyzing the conserved region in the gene and building up a phylogenetic tree, they build phylogenetic relationships between species and their ancestors.

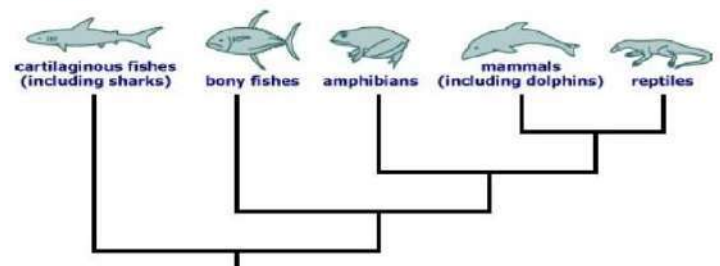
METHODS AND MATERIALS:

For this experiment, two methods were used. In one of the methods, certain softwares were used (like NCBI, GenBank, BLAST, CLUSTALW, MEGA X) to build a phylogenetic tree and to find out evolutionary relationship of the species which were taken under study (i.e., sharks and dolphins). The other method was based on the comparison between the fossil records, morphological structures (like fins, tail, and head), anatomical structures (i.e., the internal organization), their survival strategies, and certain adaptations (like physical, behavioral, and ecological). The purpose behind following the second method was - (a) to find whether sharks and dolphins are analogous or homologous species and (b) to understand the similarities and differences between these two species, covering up almost all the aspects which were necessary.

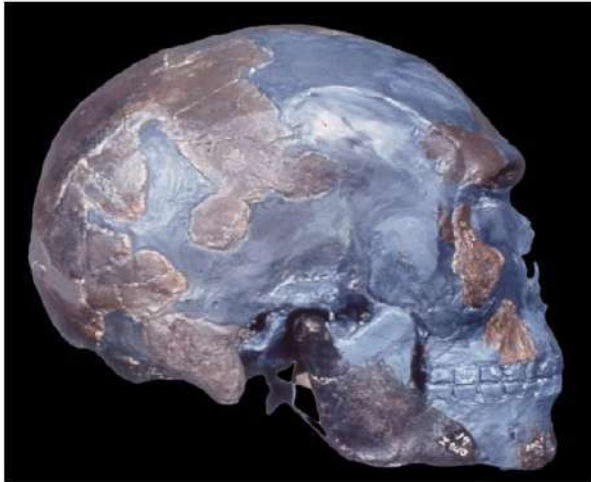
FUN FACTS

1. Bottlenose dolphins and Killer whales share an ancestral relationship with tiger shark, bull shark, great white shark, nurse shark, shortfin mako shark, and whale shark.
2. Sharks were reptiles whilst dolphins were mammals in the past.

RESULTS AND CONCLUSION:



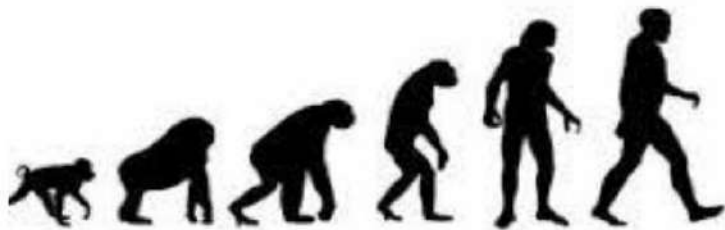
Sharks and dolphins do share an ancestral relationship. Although they have diverged from two different ancestors (i.e., convergence), they share some relative similarities. They have analogous structures with sharp teeth, a dorsal fin at the back, a pectoral fin at the side, a triangular tail, a streamlined and torpedo-shaped body. They are carnivorous species. Dolphins are found to be very social whilst sharks are silent killers and do not like to be as social. Sharks are found only in the depths of the waters, but dolphins come over the surface of water to breathe. Dolphins have bones whereas sharks have cartilage. Thus, in this experiment, with the help of various aspects, relative similarities were made which ultimately highlighted the ancestral relationship between sharks and dolphins



THE EVOLUTION OF APES TO HUMANS

-SEJAL PATIL, SYBsc

From the past to the present there have been many changes in humans' eating habits, living, adaptation to the environment, anatomical features and communication. Evolution is the process by which there is a change in the heritable characteristics of biological populations over successive generations. Evolution is a gradual process. Humans originated from ancient apes. Humans evolved from apes with different characteristics and its fossils have been discovered from many places. These are highly diverse creatures that are linked by having various hominin-like traits (mostly dentition and locomotion). Fossil bones of Human ancestors have been discovered from Africa, France, Germany, China, Java, and other parts of Asia. There are four main stages in the origin of Humans namely Ape stage, Ape-men stage, Primitive men (prehistoric man), and Modern man. Some important human ancestors reconstructed from the available fossil records are: Propliopithecus, Dryopithecus, Ramapithecus, Australopithecus, Homo habilis, Homo erectus, Neanderthal man (Homo neanderthalensis), Cro-Magnon man (homo sapiens), Modern man (homo sapiens sapiens).



METHODS AND MATERIALS:

This study has been conducted by referring to websites like Pubmed containing various articles which have information about the studies done on human evolution. Through this research, we studied how human beings have evolved from apes gradually over several years concerning their anatomical features, living and adaptations, etc. We studied the fossils which were found at different places all over the world.

RESULTS AND CONCLUSION:

Based on this research we conclude that modern man has been evolved from apes. Paleontological evidence shows that the major changes in human evolution were regarding the skull, dentition, vertebral column, pectoral girdle, pelvic girdle, forelimbs, etc. Also, the essential features in human evolution include the increase in the size of the brain, bipedalism, the use of tools and fire, the transition from hunting, gathering to agriculture and cultural evolution which includes the development of funeral and burial rites, paintings, carvings and sculptures.

FUN FACTS

1. Blond hair in humans developed only 11,000 years ago as an evolutionary response to the lack of sunlight in Northern Europe to enable more Vitamin D synthesis
2. Around 550 million years ago, homo sapiens had a common ancestor with a rod-like sea animal called lancelet!

Study of the Evolution of Vermiform Appendix in Humans

A type of antibody called Immunoglobulin A (IgA) is produced in the appendix.

Vestigial organ is a biological evidence in the present day that has evolved from the simple form of the past. Vestigial organs are functionless organs. One such example is that of vermiform appendix. The term vermiform comes from Latin word "worm shaped" by Vido Vidui, 1530. They are useless to us today, however, they were well developed and functional in our ancestors, indicating their evolutionary significance. It was not until the 19th century that a surgical procedure was devised for treating the serious inflammatory disease caused due to an infected vermiform appendix.



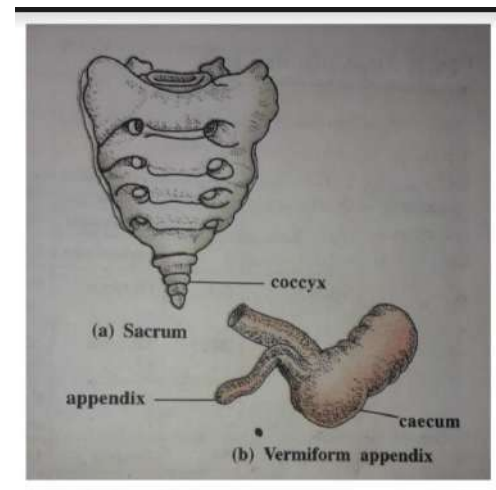
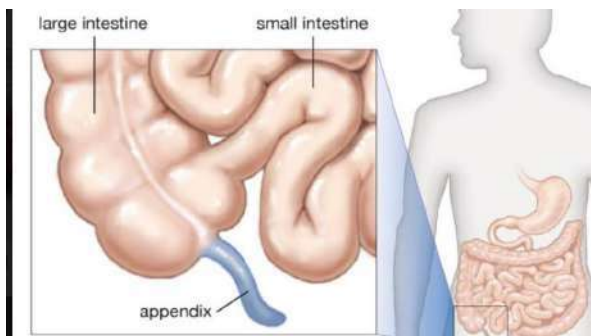
METHODS-

To do the comparative study of vermiform appendix in hominoids and in humans using secondary data from various research papers and journal and study:

- The important aspects of the vermiform appendix.
- The function and the role of vermiform appendix in humans.
- How evolution of the appendix came into existence.

RESULTS AND CONCLUSION

From all the literature studied, it is evident that in most hominoids such as apes and primates, the appendix is present and is functional due to the different size of the caecum. Although appendix is considered as vestigial, it still has an important function in humans somewhere and it is the only organ to have considerably evolved. The appendix has evolved more times than it has been lost. Today the appendix has evolved in boosting the immunity across mammals and it may be providing a fresh population of the gut bacteria that keeps your digestion on track.



Although the appendix is lost by numerous species, it also has been maintained for more than 80 million years in at least one clade, supporting the idea that the structure has a vital biological role. The mammalian appendix involves in immune-mediated maintenance of the normal gut flora, such function is enhanced by the narrow lumen of the appendix and it also helps in some degree of protection from the contaminants in the fecal stream. The flexibility is remarkable and it is one of the few organs that shifts in function and it is now a backup for surgical techniques. Appendix has high concentration of immune cells within its wall that help the direct movement of lymphocytes to various other locations in your body. The present analysis strongly supports the idea that the appendix is frequently lost during evolution.



The Appendix has evolved in mammals at least 29 times.

Akanksha Singh SYBSc

A STUDY OF THE HEIGHTS OF INDIVIDUALS ACROSS DIFFERENT ETHNIC GROUPS AND RACES



Genetics plays an important role in heights individual's height. Nowadays, nutrition have better access to good nutrition. adolescence, allowing them to reach their role in heights of individuals. Genetic factors nutrition plays a major role too. Since the Industrial nutrition. This has helped them grow more during their their maximal growth potential.

of individuals. Genetic factors account for 80% of an plays a major role too. Since the Industrial Revolution, people This has helped them grow more during their childhood and maximal growth potential. Genetics plays an important account for 80% of an individual's height. Nowadays, Revolution, people have better access to good childhood and adolescence, allowing them to reach

METHODS

Correlation and standard deviation were calculated among the groups. These values were compared with the height and diet of these groups. An explanation was given on the results for the same.



RESULT & CONCLUSION

Between the race groups, strong correlation in heights was seen, more so in males. In the Indian groups, some correlations were strongly positive while some were negative. Diets of the four races affirm their heights. People with high dairy/protein consumption are taller. Diets of the Indian groups can't explain why some groups are taller/shorter on average. Some groups with lower protein/dairy consumption show greater average heights and vice versa. As a result, the degree to which nutrition and genetics play a role in various groups is still unknown.



FACTS

Animal proteins have a 95 percent digestibility, which increases to nearly 100 percent when meat is boiled and consumed.



180 loci on the human genome affect individual height.



STUTI SRIVASTAVA, SYBSc

EVOLUTION IN ARCHAEOPTERYX



Paleontologists consider *Archaeopteryx lithographica* as a transmutation fossil between dinosaurs and modern birds. With its blend of vertebrate and reptilian features, it has long been viewed as the earlier well-known bird. Discovered in 1860 in Germany, it's generally cited as *Urvogel*, the German word for "original bird" or "first bird." *Archaeopteryx* is a combination of two ancient Greek words: *archaios*, meaning "ancient" and *pteryx*, meaning "feather" or "wing". There are two species of *Archaeopteryx*: *A. lithographica* and *A. siemensii*. Despite their little size, broad wings and inferred ability to fly or glide, *Archaeopteryx lithographica* had a lot in common with alternative little Mesozoic era dinosaurs than with modern birds. They particularly shared the following features with the dromaeosaurids and troodontids: jaws with sharp teeth, 3 fingers with claws, a protracted bony tail, hyperextensible second toes ("killing claw"), feathers (which additionally recommend warm-bloodedness) and numerous features of the skeleton.



METHOD AND MATERIALS

I studied data from different research papers and then analyzed it. I used several reputed sites to collect my articles such as Pubmed and Researchgate for reference. I used at least 10 articles for my study, so that I have a wide variety of articles to refer to. I will use carbon dating tools to analyse the age of the fossil of *Archaeopteryx* and what features it possesses. I will use CALIBomb software to calibrate modern, pre and post-bomb radiocarbon ages.



THE CONCLUSION

From the articles that I have read, I can say that *Archaeopteryx* is the link between avians and reptiles. *Archaeopteryx* has a beak like that of modern day birds and tail like that of reptiles. Survival of the fittest could have been the reason for this. As evolution took place species migrated from one place to another to survive. *Archaeopteryx* might have developed this trait to survive. While a general agreement of the position of *archeopteryx* within the evolution of contemporary birds is troublesome to search out, it's clear that it contained several passing characteristics of both dinosaurs and modern birds. Though possibly not a transmutation species itself, the characteristics that it did possess recommend that the transition from archosaurian reptile to modern bird did occur.



DID YOU KNOW?

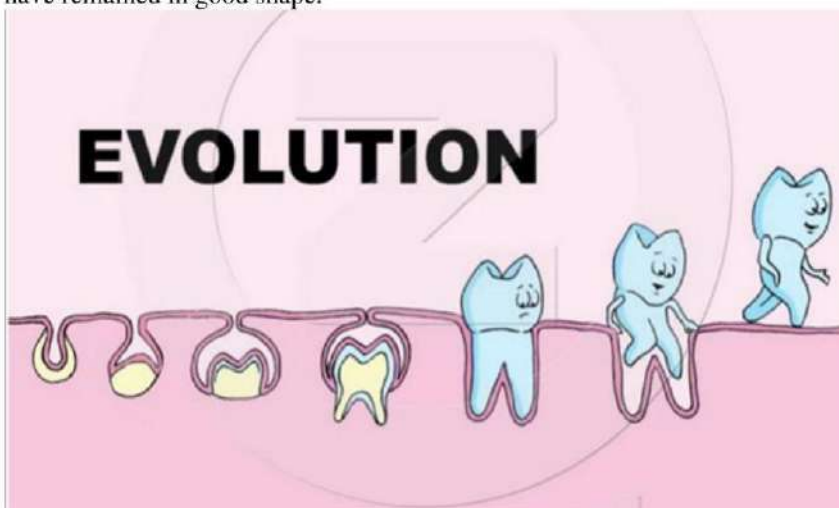
- 1) One scientist wanted to rename *Archaeopteryx* after the mythical Griffin.
- 2) It was the first feathered dinosaur known to science.



VESTIGIALITY OF WISDOM TEETH IN RELATION TO HUMAN EVOLUTION AND LIFESTYLE MODIFICATION.

IZZA MAPARI, SYBSc

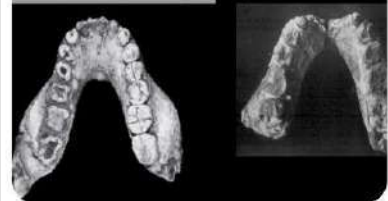
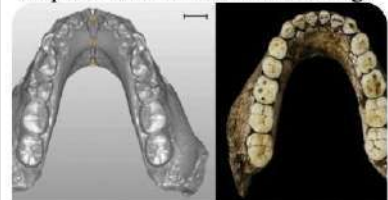
“Vestigial” refers to a rudimentary, atrophied or non-functioning structure, which is the remnant of an organ or structure that was fully developed and functioning in a preceding generation or earlier stage of development. Wisdom teeth, also known as third molars, are some of the last teeth to develop in the human body. Third Molars begin to erupt at 18 to 23 years of age. However, they begin to develop at 5-6 years of age. There was a time when our jaws could comfortably accommodate all 32 teeth including the molars, like in the prehistoric version of man that lived 100 million years ago. Wisdom teeth are no longer useful as our diet has changed a lot. Ancient man had a diet consisting of raw plants and hunted animal flesh. This required lots of chewing to grind plant material and raw meat, which wore down teeth extensively. By the time wisdom teeth erupted between ages 17 and 25, the other molars and teeth were worn down, giving room for wisdom teeth to erupt. Since the food of modern man has become softer due to the introduction of cooking, the teeth have remained in good shape.



On compilation and analysis of the entire questionnaire, two broad categorizations were made. The first one was based on food habits, frequency of eating vegetarian/non-vegetarian foods and junk food. The second one was based on teeth arrangement, crowding of teeth, eruption of wisdom teeth and preference of using wisdom teeth for chewing.

Skulls excavated as fossils of ancient humans had relatively larger jaws with more teeth which served to chew raw plants to compensate for the inability to digest cellulose and even to grind hard meat. Since human diets changed, smaller jaws with overcrowded teeth evolved, causing dental problems. For the third molar to develop and erupt, the smaller jaw is not able to accommodate it as most of the teeth have already erupted. They are the last to erupt in a limited area. This results in eruption getting impacted, which leads to minimization of their usage. Thus this project suggests that wisdom teeth have become vestigial due to reduced use.

Vestigiality of wisdom teeth was analysed by observing all the wisdom teeth samples given in various research papers. Analysis was done keeping in mind the lifestyle of people, their food preference (including raw fruits and vegetables), wisdom tooth eruption and teeth overcrowding.



FUN FACTS

- Wisdom teeth are the only teeth that don't form in the womb.
- Wisdom teeth produce stem cells that can be stored and potentially used later in life to help with a number of health-related problems.

Homo Sapiens: Mom's Neanderthal and Dad's Denisovans

Comparative study of modern human genomes and paleo genomes lead to the hypothesis that Neanderthals contributed to the modern human genome's composition. Green et al. hypothesized that Neanderthals contributed to the modern makeup of the human genome, through comparative study of modern human genomes and paleo genomes (Green et al., 2010; Ko, 2016; Prüfer et al., 2014; Simonti et al., 2016). The researchers investigated regions of the genome where Neanderthal and Denisovan



genetics differed. Denisovan's DNA fragments were identical to the genomes of the two ancient hominins. More than 40% of the time, one of the DNA fragments matched the Neanderthal genome, while the other matched the Denisovan genome. This implied that one pair of chromosomes was inherited from a Neanderthal and the other from a Denisovan. Denisovan was clearly the immediate descendant of two separate humans, according to Pääbo.



METHODS



FACT 1

Neanderthals lived in nuclear families. Discoveries of old and deformed Neanderthal skeletons suggest that they took care of their sick and those who could not care for themselves.



Sequences were downloaded from GenBank and were assembled using the Basic Local Alignment Search Tool (BLAST). To maintain the reference numbering, sequences were aligned with Clustal Omega (GenBank under accession number: NC_012920.1, NC_011137.1 and NC_013993.1).



RESULTS & CONCLUSIONS

The sequenced product was composed of 3 species of sequences which showed similarities among them. The patterns of C to T and G to A substitutions along ancient DNA molecules strongly suggest that the overwhelming majority of misincorporations in ancient DNA are due to deamination of cytosine residues. The modified study suggests that guanine residues which produce G to A substitutions are a rare phenomenon. If there is a mutation in the NDUFA1 gene, it will lead to neurodegenerative disease.



FACT 2

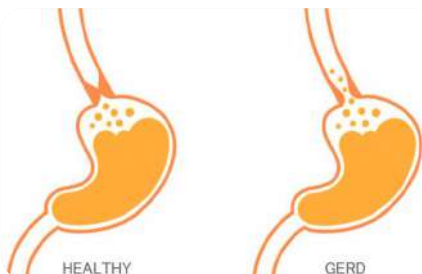
A study published in the "Science" magazine determined that Neanderthal DNA is 99.7 percent identical to modern human DNA (a chimp's is 99.8 percent identical).



Pranali Mani, SYBSc.

STATISTICAL ANALYSIS: ACID REFLUX AND IT'S PREVALENCE ACROSS THE POPULATION

Acid reflux is a condition that develops when there is a retrograde flow of stomach contents back into the esophagus. Even though we have been battling with acid reflux for years, recently the number of incidents has risen, making it a common stomach complaint across the globe.



This study was aimed to understand the prevalence of overlapping factors that lead to the development of unavoidable symptoms as well as to highlight the preferred mode of treatment amongst the selected population.

FACT 1

Humans are not the only ones who experience acid reflux, we have many from the animal kingdom who join us on this journey!

-  Burning sensation in the chest
-  Bitter, acid taste in the mouth
-  Discomfort when lying in certain positions
-  Pain when consuming certain foods

METHODS



A randomly selected population of sample size of 100 was selected for the study; as they answered a self-reporting survey revolving around Acid reflux, conducted to facilitate the identification and assessment of symptom severity.



RESULTS & CONCLUSIONS

The results showed that 42.0% of respondents experienced acid reflux more than twice a month and 18.0% of respondents show a potential development of Gastroesophageal Reflux Disease (GERD).

FACT 2

Less than 20% of Acid reflux cases happen during the day- the vast majority of people report feeling symptoms at night.

As far as the awareness regarding GERD amongst the population of the current study is concerned, around 40% were aware, most of which belonged to science background. Hence, more awareness is needed to fight this silent killer. The personalized treatment needs to be incorporated due to the array of causative agents and to reduce the negative effects on life.

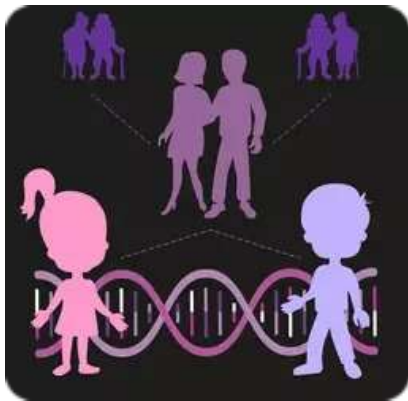


Nature or Nurture - What makes us the way we are?

-Shruti Anand, SYBSc.

Just like eusocial insects, human beings are social species who spend most of their time with other human beings exchanging verbal and non-verbal signals with each other. Under the umbrella of behavioural genetics, we have something known as human behaviour genetics which is involved in studying the role of genetic and environmental influences on human behaviour. Typically, human behavioural studies started off with studying about the inheritance of behavioural traits but now it has ventured into addressing more complex aspects, for instance, the correlation between genes and environmental factors; the importance of genetics and/or environmental factors on varying human behavioural traits; the extent at which both these factors can impact on the overlap between the human behavioural traits and so on.

Methods - A survey using Google Form to a population of people having siblings was conducted, taking into consideration the following factors - Gender, Inheritance, Peer and Lifestyle. The data was represented and analysed using bar graphs.



Result & Conclusion - In conclusion, the study is backing up other literature in the same field which states that genes and environment are correlated with each other when it comes to their effect on an individual's social behaviour. Gender proved to fall under the umbrella of the aforementioned factors instead of being a sole factor that contributes to human social behaviour. Although the environment is a major contributing factor, it is not the sole factor responsible for an individual's social behaviour. Much light has been thrown on the genetic aspects only recently, this study aims to give an insight on the same.

Fun Fact!

Older siblings have a slightly higher IQ and linguistic advantage!



Fun Fact!

On average, the amount of DNA you share with a sibling is approximately 50 percent. Half-siblings share about 25 percent. It is due to DNA swapping resulting in different gene combinations in the 23 chromosomes passed down from each parent.



Dark DNA

When the world was trying to unravel the mysteries of dark energy and dark matter, biologists made an advancement. 'Dark DNA', therefore became the center of attraction not only for biologists but also for physicists.

Dark DNA refers to the missing genes of DNA but to our astonishment, the proteins encoded by them are found in the body tissues of the organism. Thus, it's analogous to the dark matter which comprises 25% of the universe but still remain undetected.

This is supported by a case study on sand rats i.e., *Psammomys obesus*. Scientists were looking for a gene 'pdx1' which is responsible for insulin production to understand its susceptibility to type 2 diabetes. But they didn't find the gene. Other than that, 87 surrounding genes were missing.

Later, they found out that these genes are not missing but hidden somewhere. They are not able to detect it as they have high Guanine and Cytosine content which poses a problem to DNA sequencing technologies. Thus, they remain undetected and not completely missing.

Dark DNA was also found in bird species. A study published in *Genome Biology* stated that researchers found 274 genes missing and it was GC rich.

Adam Hargreaves and his colleagues were a part of the sand rat case study. He named the places where genes appear to be missing as 'Hotspots'. A later conclusion was drawn that it may have undergone a fast evolutionary change which created this hotspot.

It may also change our perspective towards evolution. Evolution happens in two stages – mutation and natural selection. Mutation changes the sequences in DNA and natural selection decides whether it should be inherited or not by the future generations.

But the hotspots of higher mutation have increased chances of mutating which can change the direction of evolution. Do we also have Dark DNA? Or it's a mere exception that's found in these birds and rats.

Another research paper "*A Black Hole at the Centre of Earth Plays the Role of the Biggest System of Telecommunication for Connecting DNAs, Dark DNAs and Molecules of Water on 4+N- Dimensional Manifold*" on PubMed draws a connection between Dark DNA and water molecules exchanging information which helps water to store information and have memory. It also proposed Dark DNA having gender as normal DNAs.

It may sound a farfetched theory but being open to possibilities is an integral part of science.

-Manali Chakraborty, FYBSc

Epigenetics-Gene Silencing

Gene Silencing is switching off of the expression of a gene, for example by the introduction of an antisense RNA that blocks translation of the messenger RNA. A mechanism by which cells shut down large sections of chromosomal DNA

Gene silencing can occur during either transcription or translation and is often used in research. In particular, methods used to silence genes are being increasingly used to produce therapeutics to combat cancer and other diseases, such as infectious diseases and neurodegenerative disorders. Currently, there are several routes of GS identified in plants, such as: post-transcriptional gene silencing or RNA interference, transcriptional gene silencing, microRNA silencing, and virus-induced gene silencing. All these pathways play an important role at the cellular level, affecting differentiation, gene regulation, and protection against viruses.

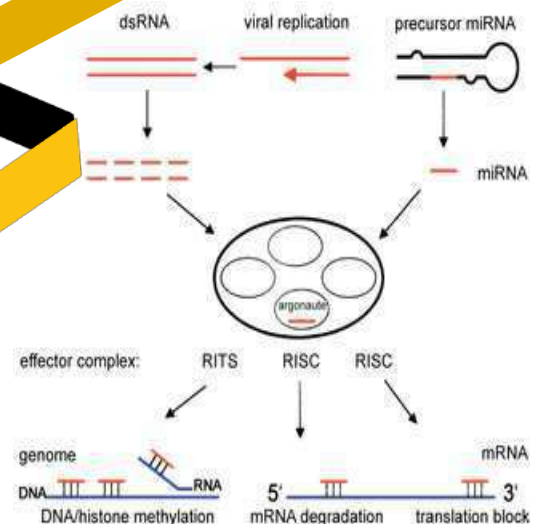
Most of the GS phenomena are related to RNA activity within the cell. Therefore, the term RNA silencing is often used to describe GS and comprises all mechanisms by which RNA sequences regulate gene expression, except those sequences characterized as mRNAs, tRNAs, or ribosomal RNAs. Moreover, the biological pathways underlying dsRNA-induced GS exist in many, if not most, eukaryotic organisms. The study of similar phenomena in different organisms (*Caenorhabditis elegans*, *Neurospora crassa*, *Drosophila melanogaster*,) allowed the proposal of models for different but interacting forms of silencing.

GS is a powerful tool in an attempt to better understand the various biochemical pathways and gene functions. Transgenesis is an important alternative for engineering traits into forest trees and developing basic research in gene function. In this scenario, genetic transformation comes into context and, consequently, the application of GS technology.

RNAi stability in plants is a very important feature to be accessed in the near future as well as the development of tissue specific and inducible promoters. Control of metabolic pathways will also represent a major challenge when trying to obtain plants with altered levels of specific metabolites. The use of artificial miRNA to engineer viral resistant plants also shows great potential.

GS techniques represent great opportunities for plant breeding. Several practical applications in economically important crops are possible as well as research on gene function and expression. There is still much to investigate such as the molecular structures of the proteins involved, the nature of the systemic signal and the stability of these pathways in a given time frame.

- Megha Thakur, FYBSc



Body Before Birth

-VINAY CHANDEKAR FYBSc

Childbirth, labor, delivery, birth, parturition is the culmination of a pregnancy period with the birth of one or more infants from a woman's uterus. The process of normal childbirth is categorized into three stages of labor: the shortening and dilation of the cervix, descent and birth of the infant, and expulsion of the placenta. There are several phases during labor and delivery of the child. First, the upper part of the mother's uterus muscles start contracting and the cervix thins up and dilates because of the pressure on the blood vessels of the cervix.



In the beginning, the contractions take place every five minutes, but once the cervix is dilated, the contractions resurface at three minute interval period. Finally, the cervix dilates to its capacity, and the frequency of contraction increases every two minutes. Crowning is seen at the end of labor.

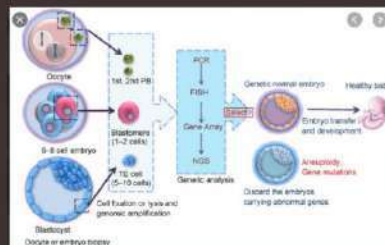
A question may occur to you, that "Why does the head of the fetus grows faster than other body parts?"

This is because the nervous system doesn't continue to develop throughout the life of the organism. It has an initial period of growth during adolescence and then there is no more creation of new brain cells. Even though the head size of adults is larger than kids, their brain size is almost equal.

Pre-implantation genetic diagnosis

-HIBAH MULLA FYBSc

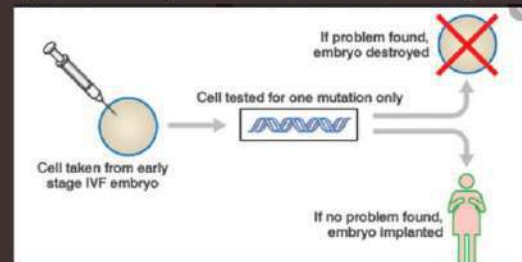
Prenatal genetic tests are providing more and more knowledge about the health of potential children to today's couples. Couples may use this knowledge in a variety of ways thanks to new reproductive technologies. In vitro fertilization is one of these technologies. Hormones are used to cause ovulation in this process. The ovulated eggs are surgically removed from the ovary's surface and placed in a laboratory dish, where they are fertilized with sperm. After that, the embryo is inserted into the uterus. Thousands of babies have been born as a result of in vitro fertilization. In vitro fertilization can be used in conjunction with genetic testing to enable the implantation of embryos that are free of a



particular genetic defect. This procedure, known as preimplantation genetic diagnosis (PGD), helps people who have a genetic defect to prevent having a child with the condition. Lets take an example, When a woman is a carrier of an X-linked recessive disorder, for example, half of her sons are likely to develop the disease as well. It is possible to choose an embryo free of the condition for implantation in

her uterus using in vitro fertilization and preimplantation testing. The treatment starts with in vitro fertilization, which produces multiple single-celled embryos. The ability to perform a genetic test on a single cell is needed for preimplantation genetic diagnosis. The polymerase chain reaction, which allows small amounts of DNA to be multiplied easily, can be used for such research. The DNA sequence is analyzed after the cell's DNA has been replicated. Preimplantation diagnosis is also experimental, with only a few research centers offering it. Since it allows for active selection for or against specific genetic characteristics, its use poses a range of ethical questions.

Nowadays people opt for this technology because they want a genetically modified child, be it for saving the life of the other child or for not wanting certain traits. However the question remains, Is this ethically correct?



The role of cognitive bias in Forensics

-Labdhi Jain, FYBSc.

Cognitive Bias is systematic errors in thinking that occur when people process and interpret information in the world around them which affects the decisions and judgments that they make. It's the alteration of how a person may perceive situations, it's a unique pair of invisible glasses that make people view the world differently. Forensic scientists rely on this ability to interpret patterns, observe the evidence and predict the trail of events that turn a room into a crime scene. These people are the backbones of an incredibly crucial field. Their final judgements are believed to be accurate predictions which further aid in investigations, so imagine if someone so important, based their decisions from a biased perspective? How reliable can it be then?



People don't possess the ability to be completely unbiased. We are the puppets of our biases, these biases come into play when we least expect it and we don't even realise. A forensic scientist's childhood and upbringing affect their ability to do their job greatly. The specifics of a crime scene are only viewed by the way their mind views it, for instance, if a forensic analyst who has had an easy upbringing with little to no challenges will approach a crime scene of murder may question how someone could do something so horrible, but on the other hand, if an analyst has had a rough childhood or grew up in a challenging environment, they may be unaffected or indifferent towards the heinous crime. This is how their bias comes into play. An analyst however does undergo training in order to minimise the effect of their personal bias onto their final interpretation of the specifics of their job.

It's truly fascinating to believe how the same piece of evidence may be viewed differently by two people who have received the same training, making us question their credibility. This has been a rising issue in the forensic science field and is a controversial matter too. Their training makes them capable of helping investigations but their bias may make matters worse instead of better. Even though this is true for all career fields, it's imperative to minimise bias in forensics because the final verdict of labelling someone a criminal hangs in the balance. The detective on the case may piece the puzzle of crime but a forensic analyst finds those pieces and determines how it fits.

Massospora cicadina - a fungal parasite.

-Shubham Gautam, FYBSc.

Imagine a world where zombies live. Yes, this is possible and it has started with the insect Cicada because of a specialized fungal parasite *Massospora cicadina*. It not only attacks the insect but also hijacks the sexual signals of Periodical Cicadas. Male Periodical Cicadas, which are infected with the conidiospore infections of entomopathogenic fungus *Massospora cicadina*, show wing jerk signaling which is only normally seen in sexually receptive female cicadas. This often attracts copulation attempts from conidiospore specific males and spreads the infective conidiospores. Males with stage II infections make spores that are only activated in the next cicada generation. These individuals do not produce any female-specific signals (like the wing jerk signal). The changes in other fungi system shows an extended phenotype that attacks the cicadas converting them into carrier for the fungus transmission at their own interest. Parasites and their host reside within the same body but have different interests in how to make use of it. Parasites alter the host to make structures or behaviors that may be thought of as wider phenotypes serving the parasite's, and not the host's, reproductive interests. Stage I infected cicadas produces haploid conidiospores proficient in infecting other adult cicadas. And stage II-infected cicadas, affected by conidiospores, manufacture diploid spores that fall to the soil and help the fungus to complete its life cycle by infecting the next generation of the insect nymphs which are due to emerge 13 or 17 years later.

Mycosis follows a predictable phenology. Studies have suggested higher infection rates in female than males but the infections are more prevalent in males. Also, it has been found that there is no difference in stage I and stage II infection in both males and females.

Massospora infected insect shows normal sexual behaviors but physical damage caused by the fungus. These cicadas are also called as 'zombie cicadas'. The body of the cicadas remain intact but possibly the body is eaten from inside. The parasitic fungus eats up the insect and creates a large mass of fungus. The fungus eats the internal organs of the insect but the brain remains intact. The male cicadas infected with this fungus become undercover zombies which act as active carriers and infect other cicadas. Even after the body of the host gets eaten up by the fungus it still locomotes because of the fungus which instructs the brain to command the leg muscles. So beware, the zombies are coming!

PROGERIA SYNDROME

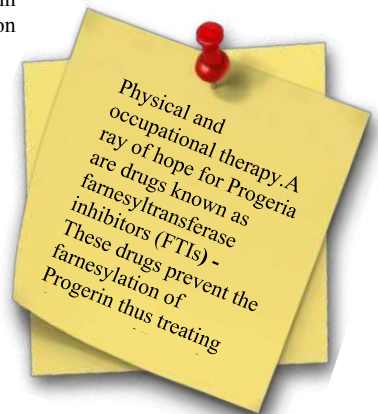


Hutchinson–Gilford progeria syndrome (HGPS) is an extremely rare, genetic, uniformly fatal, segmental “premature ageing” disease in which children exhibit phenotypes that give us insights into the ageing process. The word Progeria comes from the Greek “rogeros” meaning prematurely old. It was first described by Dr Jonathan Hutchinson in 1886, and Dr Hastings Gilford in 1897. The prevalence of this syndrome is one in 8 million births. Progeria shows no predilection, and is considered erratic. It is listed as a “rare disease” by the Office of Rare Diseases (ORD) of the NIH.

The average age of survival is 13.5 years. However, life expectancy is about 8 - 21 years. Interestingly, a woman in Ohio named Tiffany Wedekind, is the oldest survivor of progeria at 43 years old. Some common symptoms of Progeria include a small face, atypical jaw size, shrill voice, irregular dentition, pinched nose, wide-open eyes, dystrophic clavicles, absence of sexual maturation, short stature and cardiovascular diseases. Eyelashes are gradually lost and hair starts falling off, leading to complete baldness (alopecia). The skin becomes diaphanous. The notable thing in HGPS is that the cognitive abilities remain unaffected. Genetic Basis - Mutations in the *LMNA* gene cause HGPS. *LMNA* gene is located on chromosome 22. T transition in exon 11 results in increased usage of an internal cryptic splice site resulting in deletion of 150 nucleotides and 50 amino acids from the lamin

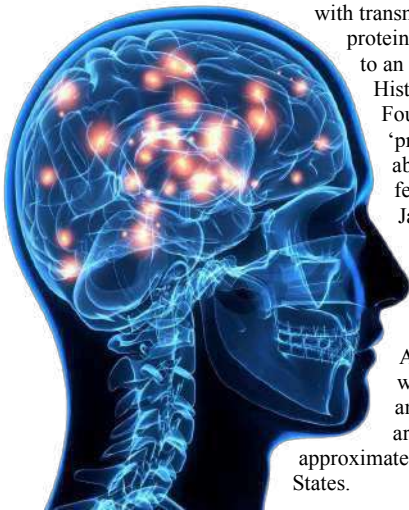
A protein. Lamin A is a key protein component of nuclear scaffolding that holds the nucleus together. This mutated Lamin A protein is called progerin. Molecular Basis - A key disease in HGPS is the farnesylation of progerin; it exerts more damage to cells as they age. The inability to release progerin results in structural stress on the nucleus. The pursuit for finding an effective treatment for HGPS is an on-going process. Some of the forms of treatment that have been implemented are as follows: Some children undergo coronary artery bypass surgery or dilation of cardiac arteries (angioplasty). Low-dose aspirin- prevents heart attacks and stroke. The use of growth hormone increases height and weight. Physical and occupational therapy. A ray of hope for Progeria are drugs known as farnesyltransferase inhibitors (FTIs) - These drugs prevent the farnesylation of Progerin thus treating the cause of Progeria to a certain extent. These drugs were actually developed for treating cancer.

KAINAT KHAN, FYBSc



PRIONS

What are prions? Are they protein molecules or viruses? Prions are infectious micro agents which are prone to infect humans and animals with transmissible spongiform encephalopathies, which is nothing but a neurological disorder. These are protein-based complexes that induce a host-encoded prion protein's template conformational changes to an insoluble self-like conformation.

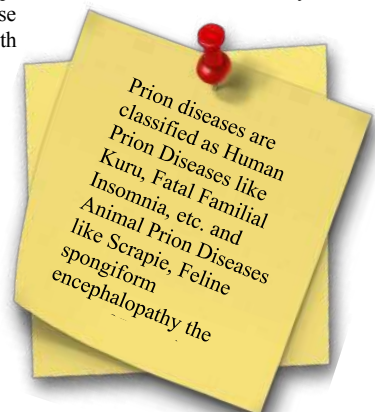


History of Prions. Prions were first recognised in the early 18th century by a French chemist Antoine Fourcroy. At first prions were termed as proteins, after the Greek word ‘prota’ which means ‘primary importance’. Around the early 18th century the shepherds in Spain observed a distinct abnormal behaviour in their Merino sheep, which made them pathologically scrape against fences. The disease was named Scrapie. In the late 19th century, pathologists Creutzfeldt and Jakob defined a neurodegenerative disease which later was included with Scrapie in a separate group of diseases known as Transmissible Spongiform Encephalopathies (TSEs). Later Griffith published his theory which included the discovery of a pathogenic protein which was capable of enciphering its own replication blueprint in the absence of a genetic code. Stanley Prusiner coined the term ‘prions’.

All about the Prion Disease: The prion hypothesis suggests that prions are infectious agents without any nucleic code, and only consists of a protein sequence. The diseases are caused by an abnormal protein and not by any bacterium or virus. These are very rare, often progressive, and fatal diseases with approximately 350 new cases are reported every year in the United States.

Major symptoms include long incubation periods, characteristic spongiform changes associated with neuronal loss, and failure to induce inflammatory response. Prions cause a few specific normal cellular proteins, most likely of the brain, to fold in an abnormal manner which ultimately leads to severe damage to the brain. The normal function of these proteins is currently not known. It begins by affecting nerve cells and then causes holes in the brain tissues, giving it the appearance of a sponge, hence the term spongiform encephalopathies. Prion diseases can be developed through - a) Acquired: Unplanned exposure to abnormal PrP from an outside source via contaminated food or water. b) Inherited: Mutations in the gene that codes for PrP produces misfolded PrP. c) Sporadic: Misfolded PrP can develop without any known cause. Prion diseases are classified as Human Prion Diseases like Kuru, Fatal Familial Insomnia, etc. and Animal Prion Diseases like Scrapie, Feline spongiform encephalopathy, etc.

RIYA MEHTA, FYBSc



*Music is the wine
that fills the cup of
silence*

FUNFACTS

Plants don't like being exposed to music for more than 1 to 3 hours.

Plants can wilt away if exposed to high frequency of music.

The present study was conducted to examine the effect of music on the growth of Periwinkle plants i.e., *Catharanthus roseus* from the family Apocynaceae. Just like humans, plants react to the attitude that they are exposed to. They are also sensitive to heat, cold, light and noise, just like humans. As for humans, the sound waves of music travel through the air at varying frequencies and finally reach our eardrums, i.e., when we recognise it as music. When plants are exposed to the same music, they also receive the same sound wave and could in fact be receiving some form of stimuli that we are yet to understand. Sound is ubiquitous in nature. Recent evidence supports the notion that naturally occurring and artificially generated sound waves contribute to plant robustness. New information is emerging about the responses of plants to sound and associated downstream signalling pathways. It is believed that sound wave treatment is a new trigger to help protect plants against unfavourable conditions and to maintain plant fitness.

METHODS

Hence, for the following research I have taken 4 Periwinkle plants and have subjected each to a different genre of music for 2 hours every day. The genres being jazz, classical, opera and rock, which have been compared to a standard control plant that is not subjected to any music. It is better to use a larger sample size but due to restricted access to required material, I have used one sample for each music type.



RESULT AND CONCLUSIONS

Believe it or not studies indicate that plants also seemed to have a specific taste in music! Some genres of music promote growth, whereas others can be damaging. For most plants playing classical or jazz music caused increase in growth, while harsher, metal music induced stress. This may be because the vibrations of Rock music or metal music are too intense for plants and cause excessive stimulation of cells.

The increased rate of growth in terms of more flowers, buds and shoot length suggests that a particular frequency including music can benefit the agricultural sector by increasing productivity. This might reduce the requirement of toxic chemical fertilizers and pesticides, thus reducing environmental pollution and facilitating the well-being of plants and animals and humans. There is a wide scope to carry out research in this domain; physicists, biologists and agricultural engineers can work together to devise a scheme which might accelerate this greenway of agriculture.

Comparative study on the effect of different acids on the growth of *Trigonella foenum-graecum* under saline conditions.



Owing to its high antioxidant properties and to the presence of an effective system for redox regeneration, in plants, Ascorbic acid (AA) plays a significant role in the defence against oxidative stress. The role of acetic as a bio-stimulant in alleviating salt stress is not known yet and needs to be examined.



Method

Around 330 Fenugreek seeds were sterilized with 5% sodium hypochlorite solution for 10 minutes followed by washing three times with distilled water and were then allowed to germinate by placing equal number of seeds into 11 separate bowls after giving them the treatments: - Control, 100mM NaCl, SA and AA at 300mg/L, 500mg/L and Acetic acid at 3%, 5% and 8% concentrations. The seeds were covered between two tissue papers and placed in bowls and allowed to incubate at room temperature. After about 72 hours, the germination percentage was calculated. The seeds were then transferred into 11 plastic pots and after 22 days, seed vigour index, soil pH, leaf colour, shoot; root and leaf length was calculated. The statistical analysis was done with the help of ANOVA.

Salinity is a major abiotic stress affecting various physiological and biochemical processes and crop production all over the world. With expansion in the anthropogenic activities in the environment, plants get presented to abiotic stresses like heat, salinity, heavy metals, etc. Fenugreek, a plant of the family Leguminosae, is extensively cultivated due to its high nutritional value and high-value elements in its leaves along with having antibacterial, anti-diabetic and anticancer properties. Salicylic acid (SA) is a synthetic plant hormone that has an important role in biochemical and physiological reflex to abiotic stress and its exogenous applications mitigates overall growth of plant under both salinity and non-salinity conditions by adjusting antioxidants scavenging system.



Results and Conclusion

In conclusion, the plants pre-treated with Ascorbic acid were able to reduce the effects to a large degree at all three concentrations across all parameters. SA produced substantial positive results at 500mg/L whereas acetic acid had no significant impact on plant growth when compared to control (saline) plants at any concentration.



1. The only mammals that can't synthesize their own vitamin C are primates, guinea pigs, fruit bats and humans. Somehow, during evolution, we lost one of four vital enzymes needed to produce it and have to get vitamin C from elsewhere.
2. Fenugreek was used for embalming in ancient Egypt. Stashes of fenugreek were found in tombs of many pharaohs, including Tutankhamun.



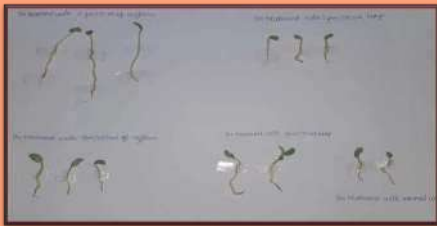
Effects of Caffeine and Hemp Seed Powder on Growth of Plants.

Caffeine is an odorless white powder having a bitter taste. Recently this drug has been gaining a lot of popularity as a safe chemical for the pests' management. Hemp seeds of Cannabis sativa show antibacterial activity in cases of Gram positive bacteria due to the presence of sesquiterpenes and cannabidiol. Vigna radiata L. and Trigonella foenum-graecum were used as they are fast growing plants. The shoot length and root length of the same were taken in measured periods and documented.



METHODOLOGY

60 seeds of Mung bean and Fenugreek were taken and sown in 5 pots each. One pot acted as a control while 8 of the others had 1gm/100ml, 2g/100ml concentrations of caffeine and 1gm/100ml and 5gm/100ml concentrations of hemp seed powder added to the soil respectively.



RESULT AND CONCLUSION

In all after performing the study we could see that, introduction to high amounts of caffeine was not beneficial for the growth of the plant. Additions of high concentrations of hemp caused stunted height in the plant, but it also showed significant increase in the girth of the plant shoot. Hemp did not have much of an effect on the leaf width of the plant at lower concentrations but it sure showed an increase in leaf width at high concentrations. Hence, to conclude the study, we can say that use of caffeine and hemp at lower concentrations can prove to be beneficial in the plants whilst too much concentration of either would lead to plant senescence. So, both the chemicals are good for use in plants at lower concentrations.



FUN FACTS

- Hemp seeds are exceptionally nutritional; they consist of omega-fatty acids and are a great source of plant protein.
- Caffeine does have a darker side to it and we are not talking espresso. It causes sleeplessness and if taken in high dosage it might cause psychosis, convulsions and sometimes even death.

Green chemistry: a study on acid-base indicator property of various natural fruits/flowers pigments.

Indicators are dyes or pigments that can be isolated from a variety of flowers. It is a water-soluble pigment that may appear red, purple, or blue according to pH. For example, flowers that are red, blue, or purple in color contain a class of organic pigments called anthocyanin.



METHODS

cut flower petals or chop them in a blender. Add enough water to cover the plant material. Simmer until the colour is removed from the from the plant. Filter the liquid into another container. Discard the remaining plant matter. Saturate clean filter paper with the solution. Check for the colour range, for acids and bases will depend on the particular plant.



DID YOU KNOW?

The most striking property of both acids and bases is their ability to change the colour of certain vegetable materials.

FUN FACT

Acids taste sour and turn litmus paper red; bases taste bitter, feel slippery, and turn litmus paper blue: amphoteric substances can act as both acids and bases!!



RESULT & CONCLUSION

The endpoints were obtained using traditional indicators. A colour range was observed in the pH range 10.80-11.20, which is the working pH range of beetroot. Turmeric gives brownish red colour in basic medium and yellow in acidic medium. The acid-base titre with the extract of pomegranate presented a rapid change of colour in the range of pH 4.00-6.00 due to the present instability of the anthocyanins. Bougainvillea juice imparts pink colour to the solutions at 1-7 pH, brown to the solutions at 8 pH and yellow to those at 10 pH.

Anthocyanins

Anthocyanins can act as pH indicators.

red at low pH (<4)
Cyanidin has less conjugation at low pH; green light is absorbed and red light transmitted

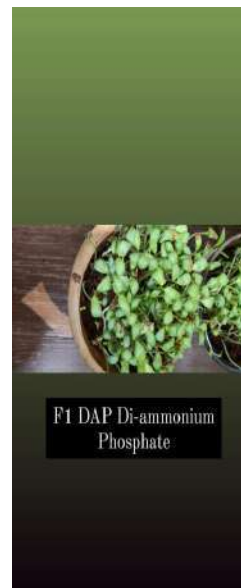
violet at pH 6-7

blue at higher pH 7-8
Cyanidin has more conjugation at high pH; orange light is absorbed and blue light transmitted

Effect of Fertilizers and Biofertilizers on *Trigonella foenum-graecum* for the plant growth.

INTRODUCTION

A comparative study on the effect of fertilizers and bio-fertilizers was done on growth and biochemical parameters of fenugreek. The experiment was with percentage replicates. The treatment was done by 0.06 M (Fertilizer - (F1) - Di-ammonium Phosphate), 0.06 (F2) - Nitrogen, phosphorus and potassium Biofertilizers -(B1) - egg shells + buttermilk, (B2) - garlic cloves and butter milk banana and onion peel, green and brown leaves, cloves of garlic soaked in water and control. The material consisted of fenugreek seeds of one species, pots, soil, and nutrient medium. The results indicated that there was a significant difference between the application of bio-fertilizer and chemical fertilizer for yield and yield component traits. Comparative study was conducted by recording the root, shoot and leaf length of the plant saplings among all the samples.

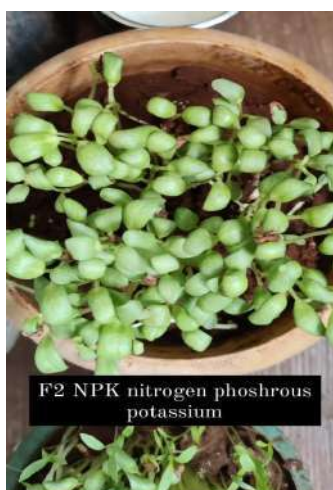


MATERIALS AND METHODS

The 5 potted plants were treated with diluted nutrient medium. The parameters used to measure the yield were root length, shoot length, leaf length and foliage by ANOVA for 14 days continuously.

RESULTS AND CONCLUSION

This study indicated that a combination treatment of bio-fertilizer and chemical fertilizer had significant effect and increased the yield and growth traits of fenugreek sapling. The F critical and calculated values were compared and accordingly the null hypothesis was accepted or rejected. The results of ANOVA single factor regression analysis by stepwise method for plant yield in fenugreek indicated that there was a significant difference in the plant yield variation.



FUN FACTS!



- Biofertilizers are thought to be very costly, but that's not the case. They can also be made at home using stuff which we generally discard i.e., banana and onion peel. Biofertilizers utilise certain microorganisms whereby, Nitrogen (N): enhances leaf growth; Phosphorus (P): enhances development of roots, flowers, seeds, fruit; Potassium (K): enhances strong stem growth, movement of water in plants, promotion of flowering and fruiting.
- Seaweeds are rich in various types of minerals; hence they are extensively used as a bio-fertilizer. It helps in breaking down clays. Fucus is used by Irish people as manure on a large scale. In tropical countries, bottom mud of dried-up ponds which contain abundant blue green algae, is regularly used as manure in fields. The mixture of seaweeds and blue green algae may serve as an ideal fertilizer.

EFFECT OF HUMAN VITAMINS AND DIETARY SUPPLEMENTS ON PLANT GROWTH



Introduction

Vitamins are organic compounds that people require in small quantities. Vitamin C, also called ascorbic acid is proved to be essential for the plant growth. It appears to increase a plant's smog tolerance, improve photosynthesis and make fruits more nutritious and that vitamin C supplementation acts as protection against ozone, decreasing brown spots, avoiding stunted growth and raising crop yield. Without proper nourishment from calcium, garden plants experience yellowing and curling of the leaves, blackened shoots and stunted growth. Calcium is an important nutrient for cell division and absorption of other nutrients in the soil. Iron plays a significant role in various physiological and biochemical pathways in plants. It is involved in the synthesis of chlorophyll and maintenance of chloroplast structure and function. The supplements can be used to fasten the plant growth and if they show positive results then this can be used to improve the plant quality and quantity in an easy way even at home.

Materials

Coriandrum sativum seeds were soaked overnight. Next day the seeds were sown in four pots, 20 per pot. The first pot was "Calcium pot", watered everyday with calcium supplemented water. Similarly, the Vitamin C pot and the Iron pot were also watered along with the supplements. The fourth pot was the Control group, watered with normal water every day. Each plant was watered regularly with 100 ml of water. The quantities of the vitamins/dietary supplements were as follows: 500 mg tablets of calcium, 150 mg tablets of iron and 500 mg tablets of vitamin C.



Results and conclusion

The results indicated that seeds in the Iron pot showed lesser growth and not very positive results. They were shorter in height compared to the water plants, majority of them were yellow and weak. Similar result was seen in the Vitamin C plants, but here the plants were healthier than the iron plants and even strong. Both the pots showed slower and lesser plant germination compared to the control group. The Calcium pot on the other hand showed positive germination results with almost all seeds germinating and also taller plants. The plants were even healthy and strong.

FUN FACTS

- Coriander word comes from a Greek word *koris*, which is the word for stink bug.
- After potassium, calcium is typically the most abundant element in plants.

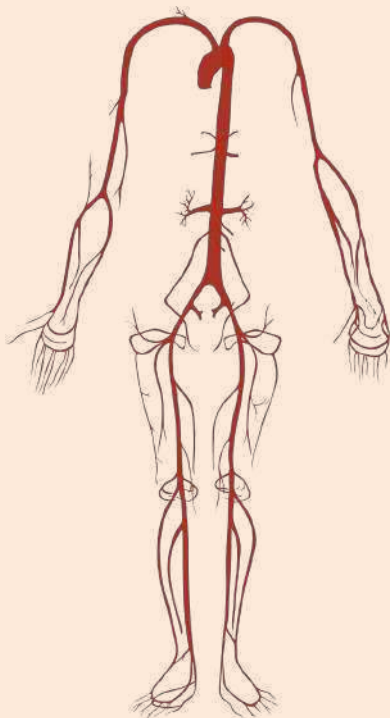


DID YOU KNOW?



A Pound of Fat and Extra Miles of Circulation

For every pound of fat gained, the body makes 7 miles of new blood vessels around it. Whenever any new tissue is formed in the body, it needs blood supply. This requires the body to make new blood vessels to supply blood to this tissue. These blood vessels are mostly capillaries, but can be small arteries and veins too. These extra blood vessels put greater load on the heart to pump blood for longer distances. This explains why obesity and heart disease go hand in hand. But this also works in reverse. If you lose the pound of fat, the body breaks down and reabsorbs these blood vessels, which lessens the burden on the heart.



Zarhaan Khambatta, SYBSc



Infrared: Invisibility Haven for Polar Bears

The primary source of infrared radiation is heat. Thermal cameras use infrared rays to detect heat loss from an object and form an image of the object. Polar bears are experts at conserving body heat due to their thick fur and vast storage of blubber. Even with surrounding temperatures reaching as low as -40°C , polar bears keep their internal body temperature at 37°C . The guard hairs on the fur of a polar bear have the ability to reabsorb heat emitted by the body as infrared radiation, instead of the heat being lost to the cold surroundings. Hence polar bears appear to be almost invisible under infrared vision, as the outer layer of their body has a temperature nearly identical to that of the surroundings.

Looking Familiar, Yet Unknown

Prosopagnosia (face blindness) is a cognitive disorder due to which people have trouble recognizing familiar faces, sometimes including their own face. Prosopagnosia is caused due to abnormalities or impairment of a fold in the brain called the right fusiform gyrus. This part of the brain coordinates neural systems that affect facial memory and perception. As many as 1 in 50 people suffer from this disorder up to some degree, many of which do not even realize it. Prosopagnosia is diagnosed by the Benton Facial Recognition Test (BFRT) or the Warrington Recognition Memory of Faces (RMF) test. There is no cure currently available for prosopagnosia. People with face blindness make use of secondary features like height, clothing, hair color and voice to identify people



Chemical vs Organic Insecticides

Lambda cyhalothrin is not only used as an insecticide but also a plant growth regulator.



Due to the potential harmful effects of the chemically synthesized pesticides, there is an emergence of organic pesticides in the market. A comparative study of the effect of chemical and organic pesticides was performed in this experiment. Chemical pesticides like Lambda cyhalothrin and Keetnashak were compared with organic pesticides like AgroPlus and Neem oil. Seed germination (% seed germination) tests have been used as simple, rapid, reliable and reproducible techniques to evaluate the damage caused by toxic pesticides. The aim of the present study was to evaluate the toxicity of chemical and organic pesticides on germination and root/shoot elongation of moong seeds.

METHODS-

The seeds of *Vigna radiata*, commonly known as moong, were used in this study. Moong seeds are easily available and can grow in compact spaces. Five different sets of seeds were made consisting of 20 seeds per set. The sets were namely- control, Lambda cyhalothrin, Keetnashak, AgroPlus and Neem oil. The concentrations of the pesticides used in the study were taken as suggested by their respective companies.

RESULTS AND CONCLUSION

The results of the present study show that the germination percentage and germination index along with other parameters like relative shoot and root growth percentage were higher in the seed treated with Lambda cyhalothrin and Keetnashak (chemical pesticides) as compared to AgroPlus and Neem oil (organic pesticides). Seed germination was not efficient in the seeds treated by the organic pesticides as compared to the chemical pesticides.



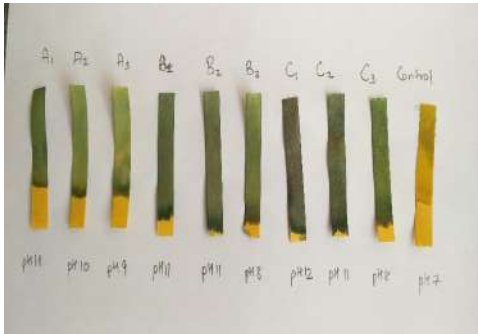
No significant phytotoxic effect was observed in the seeds treated by Lambda cyhalothrin, Keetnashak and AgroPlus. The use of pesticides is believed to be one of the major reasons behind the increase in agricultural production. The concentration of the pesticide sprayed on the plants plays a significant role. Toxicity of pesticides varies with the type of exposure whether dermal, oral or respiratory. However, in each case, the threat typically increases as concentration and duration of exposure increases.

Varisha Khan, TYBSc.



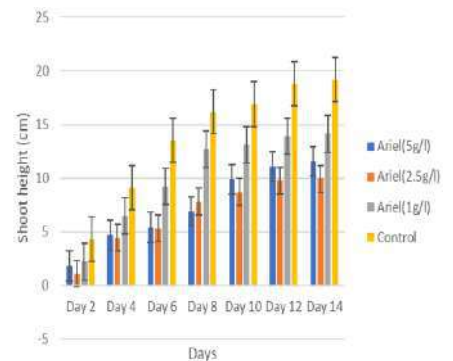
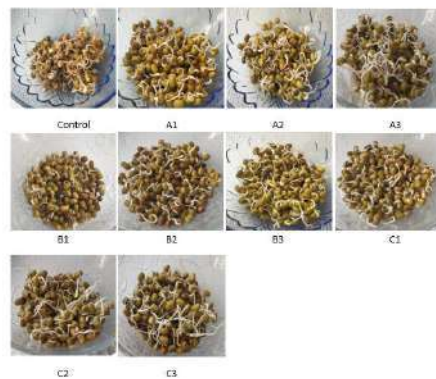
Moong beans are believed to have anti-inflammatory properties that help protect against heat stroke, high body temperatures, thirst and more.

Effect of Detergent on Growth Parameters of *Vigna radiata*



Water scarcity is becoming very rampant nowadays. Due to the scarcity of clean water, people have resorted to greywater reuse. Greywater includes all domestic water uses. Since the increasing use of detergents, the domestic water and sewage get contaminated which are the main sources of irrigation for kitchen gardens and farmlands around the cities. These detergents in higher concentrations destroy the plant growth and drastically affect the germination process. The surfactants (Alkyl benzene sulfonate- ABS) and other additives in this waste water may affect crops and soil. This may ultimately cause nutritional imbalance, various disorders and toxic effects on growth, metabolism and product composition. Hence this study was undertaken to investigate the effect of different detergents on seed germination and growth of *Vigna radiata*.

The surfactants (Alkyl benzene sulfonate- ABS) and other additives in this waste water may affect crops and soil. This may ultimately cause nutritional imbalance, various disorders and toxic effects on growth, metabolism and product composition. Hence this study was undertaken to investigate the effect of different detergents on seed germination and growth of *Vigna radiata*. Hence this study was undertaken to investigate the effect of different detergents on seed

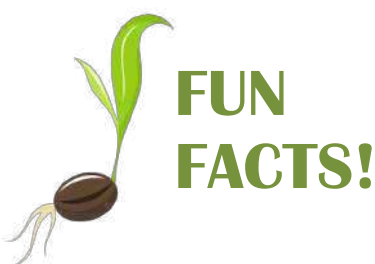


Method

Ariel, Mr. White and Patanjali detergent powders were used to prepare the irrigation solutions with three different concentrations each of 1.0g/l, 2.5g/l and 5.0g/l, while tap water served as the control. The seeds were germinated in 10 separate bowls and were planted in pots filled with soil.

Results and Conclusion

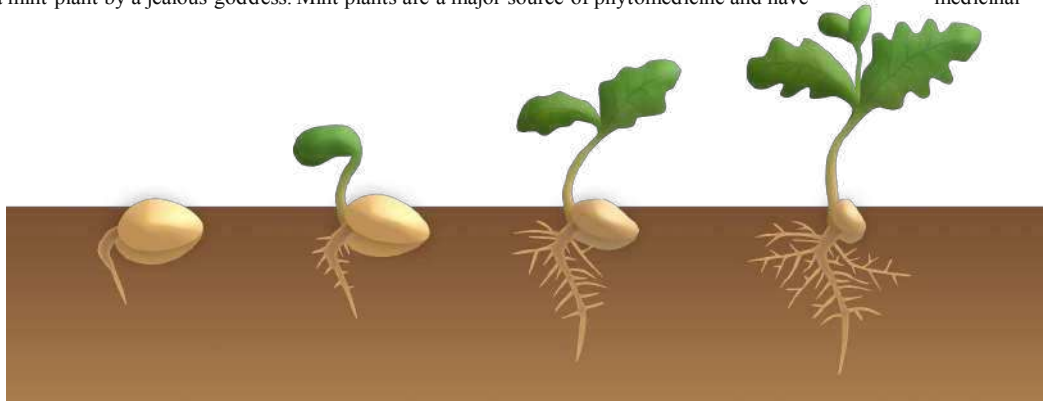
The results revealed that there was a decline in germination (%) and radicle length as detergent concentration in watering solutions increased. It was found that the growth of both, the shoot and the root decreased as the concentration of detergents was increased. Thus, the study showed that high detergent concentrations are unhealthy for plant growth. The results demonstrated that irrigation by the sewage contaminated by household cleaning products at high concentrations should be avoided.



- 1 Detergents will cause the plants to wither and possibly die since the detergents will hinder the plant's ability to make food for itself and absorb nutrients. This was justified by the fact that the plants treated with 5g/L detergent concentrations had a shorter life span compared to others used in this study and they eventually died after 2 weeks.
- 2 Plants treated with detergents showed a reduction in biomass as the detergents damaged their cell membranes and cell walls. As a result, the plant cells emptied their contents into the surrounding water making the plant lighter

IAA or nutrients; the better plant growth factor?

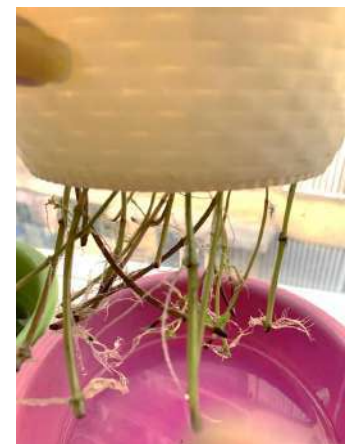
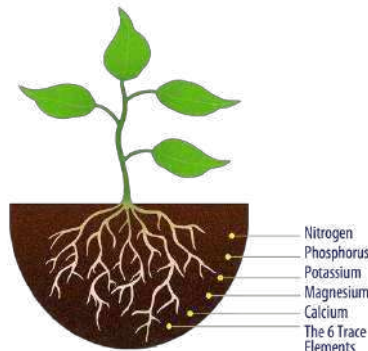
This research is conducted on *Mentha arvensis*, so let us look at a brief history of this plant. *Mentha arvensis* is a 0.5-m-tall perennial herb, phenotypically there are some peculiar features of this plant, one of them being that it has prominent square stems, hairy textured leaves that have a strong aroma when crushed. Its genus name *Mentha* is derived from the Greek nymph Minthe, who was changed into a mint plant by a jealous goddess. Mint plants are a major source of phytomedicine and have medicinal benefits.



METHODS



15 cuttings of *Mentha arvensis* were planted in 6 plastic containers with holes and were immersed in a tub containing water, such that the developing roots were under water. Two concentrations of Indole acetic acid (IAA) and Nutrient compost were prepared, 5000mg/l and 1000mg/l. (i.e 5g IAA and 5g of ready made compost in one litre of water respectively) Parameters observed were number of roots, root length, number of nodes and number of leaves.



RESULTS & CONCLUSIONS

The results depict a mixed set of observations, one of them being that cuttings with no leaves and buds did not germinate. Out of all the groups studied, it is seen that the control group that was grown in filtered water shows the least growth in terms of roots, nodes and number of leaves. The readings for root and stem length were measured in centimeters on the 30th day after planting the cuttings. Mint cuttings dipped in 5000mg/l solution showed the highest mean for root length which is 6.96 and there is a close completion with the reading of cuttings dipped in 5000 mg/l of nutrient solution, which reads 6.56. The single factor ANOVA statistics, also overlaps with the mean results. F value is greater than F crit for three parameters i.e., root length, number of leaves and number of nodes, suggesting that IAA and NS have a significant effect on all the three parameters.



EXTRACTION OF NATURAL DYE FROM PLANTS



Natural dyes have wide applications. However, the major issues for naturally dyed textiles are reproducibility of shade, non-availability of well-defined standard procedure for application and poor lasting performance of shade under water and light.

Methods

The floral parts of *Tagata erecta L*, *Rosa rubiginosa* and *Lawsonia inermis* were collected from the local market. The samples were boiled in a hot water bath for 2 hours. The colour was extracted and the solution was filtered. Cooking salt was used as a mordant. The textile material used was washed with water first. The textile was then transferred to 6.25% salt solution and boiled for one hour and then transferred to a dye bath for one hour.

The hair samples were collected from a local hair salon and bleached for a neutral colour base. The dyes were mixed with a conditioner and applied to the hair samples and kept for 2 hours. The dyes were mixed with paint and checked against different types of papers such as handmade paper and chart paper. The dye was mixed with a natural lip balm and was checked for its colour as well as side effects like rashes on skin.

Results

Natural dyes are fairly reproducible in textiles in which Marigold flowers dye have the best properties for fastness and washness. Research into this field is important as marigold can be used as a textile dye. The lip balm is natural and cheap. All the ingredients for the natural balm cost around Rs 150. Rose flowers that cost Rs. 10 produced almost 500ml of dye and could produce 2 batches of lip balm which is all natural. Rose cannot be used as paint. The colours produced by the other two plants were also very faint. Henna could produce colour with conditioner as a carrier and therefore can be used naturally.



Conclusion

More research in this field of natural dye will help us shift to more natural ways of living and eradicate synthetic dyes completely.



fun facts

1. 1.97% of the global textile industry uses non-sustainable techniques.
2. Purple colour was extracted from sea snails and was the hardest to extract.

Saniya Ballikar, TYBSc

Effect Of Microwaves and UVC Radiations On Seed Germination.

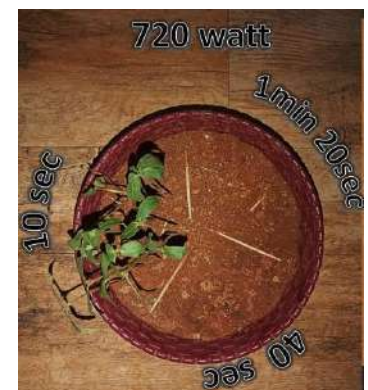
Bees can actually see Ultraviolet light, as they use it to direct themselves to pollen when the UV radiation is reflected off of flower petals.

Microwaves are a source of non-ionizing radiations ranging from 1mm-1m and UV are a source of ionizing radiations ranging from 100-400nm in the electromagnetic spectrum. Effects of both these types of waves on the seed germination of *Vigna radiata* was tested. UVC radiations are used in the experiment as they are the strongest among the three types of UV radiations i.e. UVA, UVB and UVC. UVA, UVB, microwaves and UVC radiation although show similar effects on seed germination, have practical applications that are completely different. Microwaves can be proved beneficial in agriculture, but on the other hand, UVC rays emitted from the sun are destructive for the agricultural sector. This fact has been exactly proved by this experiment and data collected shows similar effects but different uses.



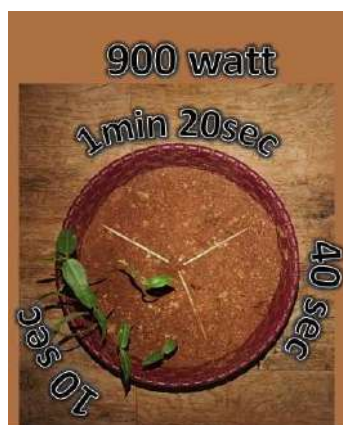
METHODS-

Six planting pots were taken and each was divided into 3 different sections, using toothpicks inserted in soil. The sections corresponded to 3 different time - periods of exposure of seeds to microwaves (i.e. 10secs, 40secs and 1min20sec). One pot was used as a control pot. 12 batches of 20 seeds were then exposed to 180W, 360W, 540W, 720W and 900W power of microwave radiations for all 3 different time intervals each. Another seven planting pots were taken (except 1 used for control). Each batch containing 30 seeds was exposed to UVC in a confined black box (to avoid other light ray interference) for 1min, 5mins, 20mins, 30mins, 45mins and 1hour. These seeds were then planted in their respective pots.



RESULTS AND CONCLUSION

When seeds were sowed after treating with both microwaves and UVC light, the plants did not grow after a particular power of microwave radiation & time and after a particular exposure time in case of UVC exposed seeds. The decrease in seed germination is observed in case of the wave-exposed seeds and the decrease was gradual, though the properties of both the radiations are completely different.



The effect of Microwaves and UVC on seed germination of *Vigna radiata* (moong seeds) was studied and observed to have almost similar effect on seed germination i.e. there was a gradual decrease in seed germination as the exposure time was increased but the amount of change in seed germination differed with respect to exposure time to both the radiations.



Test-tube studies have found that antioxidants from mung beans can neutralize free radical damage linked to cancer growth in lung and stomach cells.

-Gauri Barve, TYBSc.

Effects of chemical pesticides on earthworm *Eisenia fetida*



Chemical pesticides are widely used in agriculture to eliminate pests, thereby increasing the yield and supplying for the ever-rising demand for food. However, pesticides also adversely affect the motility, growth and development of non-target organisms like earthworms. The main aim of studies like the one undertaken here is to study the effects of pesticides on non-target organisms and provide data for ecological risk assessment in soil ecosystems.



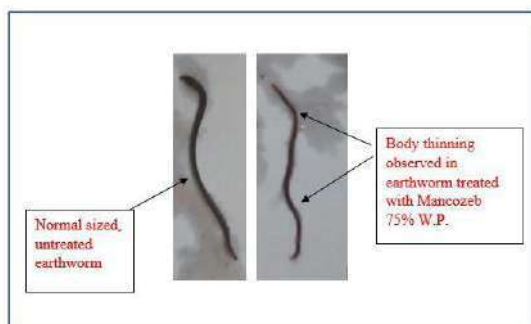
FUN FACT

E. fetida secrete a foul smelling fluid - their coelomic fluid - when roughly handled. The foul smell also gives the species its name - fetida, meaning foul smelling.

METHODS

The earthworms were kept in cardboard boxes containing soil and nutrients, and were exposed to three different concentrations of each of the two pesticides. Observations were made 7 and 14 days after initial exposure to the chemicals.

The earthworms were checked for changes in motility, and observations like body coiling, body thinning and decrease in motility were made.



RESULTS AND CONCLUSION

The highest concentration of Cypermethrin was found to be lethal for 7 of the 10 earthworms on which it was tested. Lower concentrations led to body coiling and thinning in the earthworms. Mortality was also observed at these concentrations. Body coiling is a result of inability of the earthworms to move or feed themselves. Body thinning is the loss of biomass.

Mancozeb showed very little observable effects on the motility of the earthworms. Although a few showed body thinning and coiling, a majority of them remained unaffected and mortality was zero. Other studies have shown that Mancozeb affects reproduction in earthworms - an aspect not included in this study.

Thus, Cypermethrin was found to be more toxic to the earthworms than Mancozeb. This may be because it is a neurotoxin that disrupts the sodium ion channels in the organism's nervous system.

A more thorough study needs to be undertaken to completely understand the effects of Mancozeb on earthworms.

FUN FACT
Cypermethrin also has molluscicidal properties. Molluscicides kill snails and slugs by extracting moisture from the living tissue of these water-dependent organisms.

Study of the Mating Behaviours and Preferences in Male *Poecilia sphenops* - Molly Fishes



FUN FACTS

Audience effect-This effect is shown by a large number of organisms including humans. It shows how in the presence of an audience we are intimidated and may change our behaviour. Although here the males try to mislead their competitor by showing the audience effect.

Molly fishes show **Ovoviviparous** mode of reproduction. It is also known as **Aplacental viviparity**. Babies develop in eggs inside the mother's body and just before birth, they hatch while still inside.

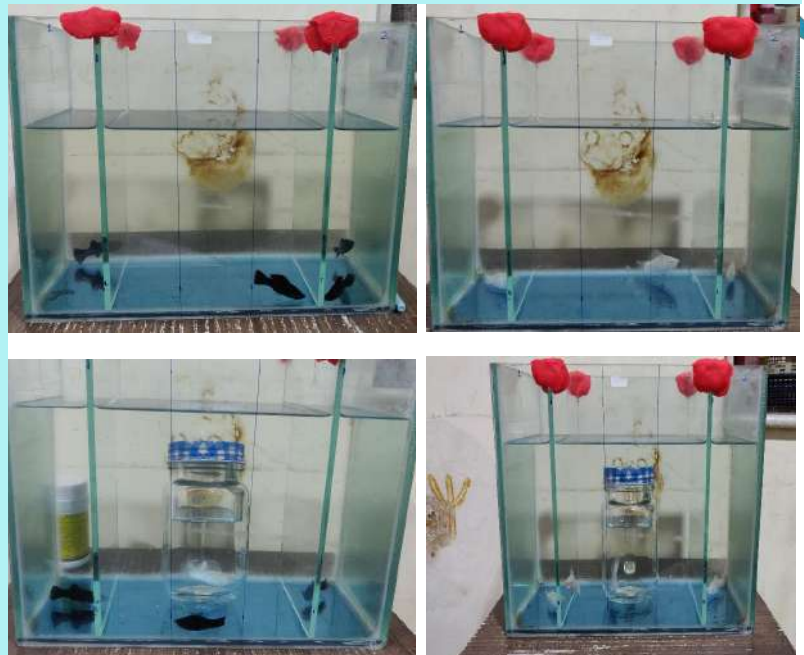
Males are usually known to show aggressive mating behaviour. The mating behaviours observed in molly fishes are- independent mate selection, non-independent mate selection and audience effect. Independent mate selection is showing mating preference for a particular female among others. Non-independent mate selection is copying matings of other females, this is usually shown by younger and less experienced males. Audience effect is choosing another female in presence of competitive males, this behaviour is to mislead the competitor and increase chances of mating with the preferred female.

Methods

Fishes above the age of 12 months are selected for the experiment. To observe mate preference behaviour, an experimental setup was made such that a tank was divided into five equal halves. The two peripheral sections were partitioned with glass, each section contained a single female. A male was placed in the central section and the preference was selected based on the time spent near each female. For observing mate-copying behaviour, the experimental setup was the same as above but an additional male was added in the section of the female which was not the preference of the male in the previous set-up. For observing audience effect, an audience male was presented in a glass chamber and was placed with the central male.

Result and conclusion

The male section of the tank was divided into central, neutral and either side preference zones. After recording the timing of the male spending time in each of the three zones, it was observed that all the males showed mate preference behaviour, mate-copying behaviour was less common in males and audience effect was more common in males.



BIOPLASTICS: An Additional Pair of Hands to Save the Earth

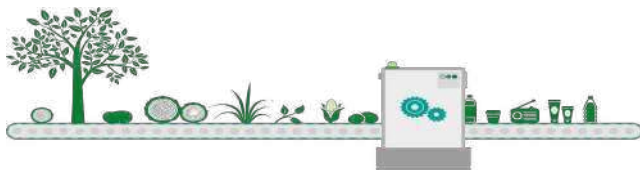


Introduction

Biopolymers happen to be the boon of evolution of plastics with biodegradability within its grasp. Biodegradation of any compound or material is a chemical process during which microorganisms convert polymers into various natural compounds depending on the microbes present such that the products go back into the soil or the atmosphere. Bioplastics mainly save fossil resources using biomass which regenerates and provides the unique potential of carbon neutrality. These are mostly derived from renewable biomass sources, such as starch, oils, sea waste like scales and shells etc. Some of the applications of bioplastics are in packaging materials, insulation, disposable cups and utensils.

Materials

In order to obtain the biofilms, the initial components were treated with vinegar and glycerol as a plasticizer to obtain the final biofilm product. However, in case of obtaining the raw materials from the scales and shells, these were treated with sodium hydroxide (NaOH) and hydrogen chloride (HCl) solutions to cause demineralization & deproteination. The production methods were time consuming and somewhat tedious.



FUN FACT

One of the significant advances in the production of bioplastic from sea waste was displayed by the UK based startup Marina Tex that has been founded by Lucy Hughes, who bagged the famous James Dyson award for her revolutionary idea.

To tackle the problem of pollution from conventional plastics, the bacterium *Ideonella sakaiensis* is a good solution as this species of bacteria is known for consuming plastics like any other food.

Results and conclusion

The films obtained from the four raw constituents of starch, gelatin, freshwater fish scales and shrimp shells, were quite high in terms of tensile strength and were dissolved faster in water compared to the commercial plastics. As expected, when exposed to environmental factors, the films got biodegraded without any external or applied factors. This highly speaks of its requirement in everyday use in the present times to replace the conventional plastics already in the market today.



Effect of artificial sweeteners on Embryological development of *Danio Rerio*

Artificial sweeteners are sweeter than regular sugar but they do not increase glucose level in blood.

Zebrafish (*Danio rerio*) is a valuable model. Sucralose, aspartame, and saccharin are some of the commonly used artificial sweeteners, which may persist in the environment after human consumption. The aim of this study was to study the effect of these sweeteners on development and survival of zebrafish embryos and to correlate these with human embryos. A total of five parameters such as hatching, mortality, scoliosis, pigmentation and developmental defects have been examined.



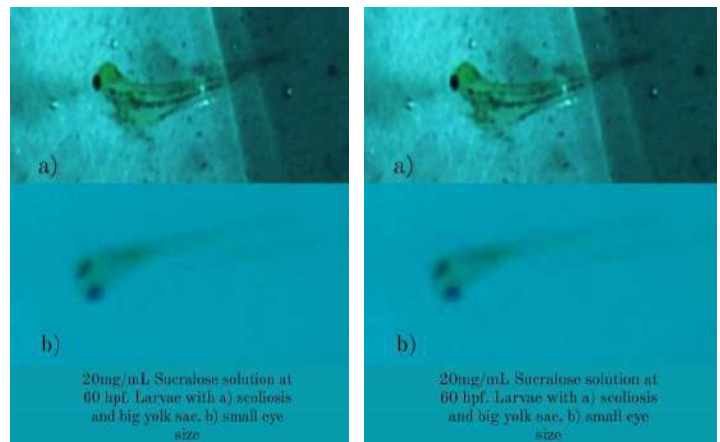
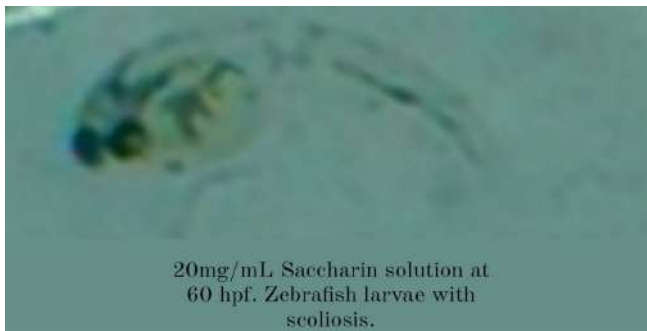
Experimental set up

METHODS-

How evolution of the appendix came into existence. Zebrafish embryos were obtained from breeders in Bandra. 0.5, 1.0 and 1.5 grams of sucralose was weighed and dissolved in five liters of dechlorinated water to get 20mg/mL, 100mg/mL and 300mg/mL of sucralose solution. Twenty-five zebrafish eggs were placed in each bowl respectively after 5 hours post fertilization (hpf). Steps were repeated with aspartame and saccharin to get these dilutions of nine treatment groups and one control group. Dead and unfertilized eggs were discarded in a discard tray. All the bowls were labelled. All the groups from 24 hpf to 96 hpf were observed.

RESULTS AND CONCLUSION

It was observed that hatching rate was high in the zebrafish embryos treated with sucralose, aspartame and saccharin. It was suggested that artificial sweeteners could lead to premature births in humans. Saccharin-exposed group had highest mortality rate of zebrafish embryos and this could suggest that saccharin consumption could lead to miscarriage in humans as saccharin can cross human placenta and bio accumulate in fetal tissues.



Scoliosis was seen in 20mg/mL of sucralose and saccharin solutions at 60 hpf. This could suggest that these sweeteners can cause notochord defects in humans. At 60 hpf some deformities were seen in all treated groups. In the control group, the larvae had a bent tail, big yolk sac with slight yellow pigmentation. Many more abnormalities were seen in all solutions. According to the results obtained, it was observed that no larvae survived for more than 7 days post fertilization and had a low survival rate. This could suggest that artificial sweetener consumption could lead to miscarriage or birth defects in embryos and if left in environment it would affect aquatic plants and organism. Using this study, the effects on human embryos have been hypothesized (by correlating with those on zebrafish embryos), however, actual studies on humans are required for a concrete conclusion.



Female zebrafish which is 4 to 5 cm in length can lay up to 200 eggs a week.

Aiman Shaikh, TYBSc

The impact of deprivation of the circadian rhythm on transpiration in plants.

FUNFACTS

A leaf transpires about 90% of the water evaporated from a water surface of the same area even though the combined area of stomatal pores is only 1-2% of the total leaf area.

Seasonal Affective Disorder (SAD), in which the circadian rhythm is disrupted, has been suspected to be caused due to the death of the neurons producing norepinephrine, dopamine and serotonin, responsible for emotion, pleasure and cognition.

The plant circadian clock enables organisms to anticipate predictable environmental changes by coordinating their developmental and physiological traits. Multiple studies have recently been expressing the vitality of circadian clocks on photosynthesis and stomatal conductance, across various phylogenies, environments and scales. Transpiration is an evaporative cooling system that reduces the temperature of plants, and since it results in water loss, it must be accurately regulated. The process also helps in photosynthesis as water and minerals are pumped up the plant into the leaves. Transpiration is regulated by guard cells, which are located on each side of the stomata. Based on the stomatal clock, it has been observed that stomata open during the day and close at night.



METHODS

Cuttings of terrestrial, desert, and aquatic plants were selected. They were placed in a measuring cylinder of water and 5 of each type were exposed to either only darkness, light or equal amounts of both for 3 days. On each day the cylinders were weighed and the change in water volume was measured to determine the amount of transpiration occurring.



RESULT AND CONCLUSIONS

The highest transpiration was observed in the cuttings of the terrestrial plant exposed to light for 3 days continuously. The transpiration was low in the desert plant cuttings exposed to darkness and negligible in the submerged aquatic plant as transpiration does not occur in submerged plants.

Therefore, in the presence of constant light, the stomatal opening is greater to absorb carbon dioxide for photosynthesis and during this, the guard cells remain open for longer. Water vapour is a waste material which is removed from the leaves.

Indeira Rohra, TYBSc

Food additives or poison?

-Navin Chawathe, TYBSc

With the rapid growth in consumerism, most individuals of the general population experience a vast increase in the consumption of food additives on a day to day basis. Substances that are added to food to maintain or improve the safety, freshness, taste, texture, or appearance of food are known as food additives. Modern additives which use chemical synthesis for production are potential health hazards.



Danio rerio

- **Transparent** embryo.
- **70%** similar to humans.
- **84%** human diseases have a zebrafish counter part.

Hence, the Zebrafish embryos are potential model organisms to investigate the effects of Monosodium glutamate (MSG), Maltodextrin, and Sodium benzoate.



MSG is a white crystalline sodium salt of glutamic acid. It is complemented by the other flavours to produce a sixth flavour 'umami' Daily Intake of 0-12mg/kg/mass is permitted.



Maltodextrin is a polysaccharide that has a mild, sweet taste. It is generally used as a thickener or filler to increase the volume of a processed food. The ADI is not specified yet.



Sodium Benzoate is the sodium salt of benzoic acid. It acts as a preservative. The ADI for sodium benzoate is set at 0-5 mg per kg of body weight.

All embryos need to be handled with utmost care and caution. **Methylene blue** is an excellent **anti-fungal** agent which helps in prevention of infections.

- Procured zebrafish embryos (220) were then introduced in various concentrations of the chemicals that were to be studied.
- All sample embryos were studied after decided intervals of time.
- Morphometric studies were carried out under a dissection microscope.
- Body length, movement pattern, pigmentation, mortality rate, hatching rate and other developmental defects were the parameters observed.

DID YOU KNOW?

Zebrafish is one of the few fishes that has been sent to space!

THE RESULTS AND CONCLUSION.

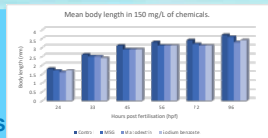
ODD MAN OUT



Answer: Snake- It is not a model organism as the rest are.

HATCHING RATE AND MORTALITY RATE. Hatching rate in Sod.Ben. was alarming as no fishes hatched. Decrease in energy of the fish causes the inability to rupture the chorion. 200mg/L was the most potent dose and killed most fish.

BODY LENGTH. All additives decrease the growth rate. Least growth is seen in the maltodextrin. Slow consistent growth in MSG. Fast inconsistent growth in Sod. Ben.



OTHER DEFECTS. Yellow pigmentation was seen in some larvae where are some others were not pigmented at all. Scoliosis was seen in two larvae.



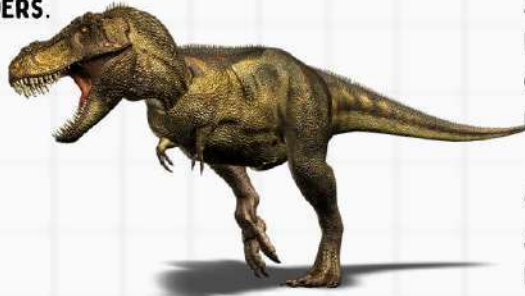
CONCLUSION. Abnormalities in the development have proved that these additives are excitotoxins which have teratogenic effects. The idea behind this study can be used to limit the addition of artificial additives to food.

TEST YOUR KNOWLEDGE



Q1] THE BRANCH OF MEDICAL SCIENCE THAT INVESTIGATES ALL THE FACTORS THAT DETERMINE THE PRESENCE OR ABSENCE OF DISEASES AND DISORDERS.

- A) PALEONTOLOGY
- B) EPIDEMIOLOGY
- C) ENTOMOLOGY
- D) GEOLOGY



Q2] THE STUDY OF PEOPLE, BOTH PAST AND PRESENT, WITH A FOCUS ON UNDERSTANDING THE HUMAN CONDITION BOTH CULTURALLY AND BIOLOGICALLY.

- A) FORENSIC SCIENCE
- B) PSYCHOLOGY
- C) ANTHROPOLOGY
- D) PHYLOGENY

Q3] A SCIENTIST WHO WON NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE 2020 FOR THE DISCOVERY OF HEPATITIS C VIRUS.

- A) HARVEY J. ALTER
- B) JAMES PEEBLES
- C) DIDIER QUELOZ
- D) AKIRA YOSHINO



Q4] A CONTAGIOUS AND LIFE-THREATENING INFECTION THAT CAN LEAD TO PNEUMONIA.

- A) MIDDLE EAST RESPIRATORY SYNDROME (MERS)
- B) DOWN SYNDROME
- C) SICKLE CELL ANEMIA
- D) SEVERE ACUTE RESPIRATORY SYNDROME (SARS)

Q5] A TECHNIQUE THAT CAN BE USED TO EDIT, KNOCK-OUT, INHIBIT, AND ACTIVATE GENES.

- A) CRSIPR (CLUSTERED REGULARLY INTERSPACED SHORT PALINDROMIC SEQUENCE)
- B) GENOME EDITING
- C) RNA SEQUENCING
- D) DNA SEQUENCING



Q6] A FOSSIL AT AUCTION FOR \$31.85 MILLION, BECOMING THE MOST EXPENSIVE DINOSAUR FOSSIL EVER SOLD.

- A) TYRANNOSAURUS REX (OR STAN)
- B) TRILOBITES
- C) BRACHIOPODS
- D) AMMONITES



Q7] THE MOST FAMOUS FOSSIL IN THE WORLD.

- A) BIVALVES
- B) SPONGES
- C) SEA URCHINS
- D) AUSTRALOPITHECUS AFARENSIS (OR LUCY)

Q8] THE FIRST KNOWN HUMAN WHO LIVED ABOUT 2.4 TO 1.4 MILLION YEARS AGO IN EASTERN AND SOUTHERN AFRICA.

- A) HOMO ERECTUS
- B) HOMO SAPIENS
- C) HOMO HABILIS
- D) HOMO RUDOLFENSIS



Q9] _____ DETERMINES A PERSON'S DNA AND THAT CAN HELP DETERMINE A PERSON'S GENDER.

- A) HAIR ROOTS
- B) TEETH
- C) NAILS
- D) CELL

Q10] IT USUALLY INVOLVES THE IDENTIFICATION OF INSECTS AND OTHER ARTHROPODS ASSOCIATED WITH HUMAN REMAINS AS AN AID TO DETERMINE THE TIME AND PLACE OF DEATH.

- A) FORENSIC SCIENCE
- B) COGNITIVE ZOOLOGY
- C) FORENSIC ENTOMOLOGY
- D) COMPARATIVE ANATOMY



TEST YOUR KNOWLEDGE



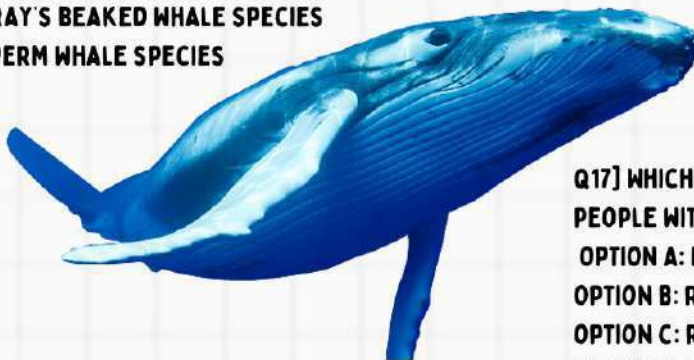
Q11] IN ALL THESE YEARS OF EVOLUTION, THERE IS CERTAINLY ONE THING WHICH HAS BEEN PASSED ON TO THE GENERATION FOR YEARS. WHAT IS IT?

- OPTION A: GOLD
- OPTION B: MONEY
- OPTION C: BRAIN
- OPTION D: FOOD



Q12] AN ELUSIVE WHALE SPECIES IN THE SOUTHERN OCEAN COULD BE RESILIENT TO NEAR-FUTURE ECOSYSTEM CHANGES. THE SPECIES IS -----

- OPTION A: BELUGA WHALE SPECIES
- OPTION B: BLUE WHALE SPECIES
- OPTION C: GRAY'S BEAKED WHALE SPECIES
- OPTION D: SPERM WHALE SPECIES



Q13] MYSTERIOUS "NUCLEAR SPECKLE" STRUCTURES INSIDE THE LIVING THE CELLS THAT ENHANCES GENE ACTIVITY, MAY HELP BLOCK ---

- OPTION A: CANCER
- OPTION B: AIDS
- OPTION C: SCURVY
- OPTION D: POLIO

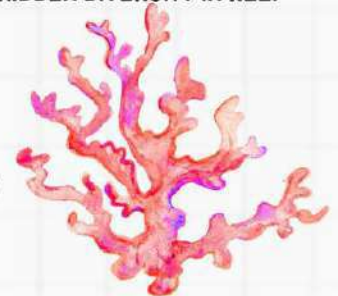
Q14] AS A CONSCIOUS VISUAL EXPERIENCE, WHICH SPECIES SHOWS "DOUBLE DISSOCIATION" PATTERNS LIKE HOW HUMANS DO?

- OPTION A: ZEBRA
- OPTION B: TIGER
- OPTION C: MONKEY
- OPTION D: CAT



Q15] IN RECENT YEARS, ADVANCEMENTS IN ----- HAVE EXPOSED A LARGE AMOUNT OF HIDDEN DIVERSITY IN REEF-BUILDING CORALS.

- OPTION A: RNA SEQUENCING
- OPTION B: DNA SEQUENCING
- OPTION C: RNA WORLD
- OPTION D: CRISPR TECHNOLOGY



Q16] A CRUCIAL GENE THAT PLAYS A ROLE IN THE FORMATION OF PORES, CALLED STOMATA, THROUGH WHICH THE PLANT EXCHANGES GASES AND REGULATES WATER CONTENT.

- OPTION A: SPEECHLESS
- OPTION B: CRY34AB1
- OPTION C: PG (SENSE OR ANTISENSE)
- OPTION D: ECBETA



Q17] WHICH IS THE RAREST BLOOD TYPE IN THE WORLD WITH ONLY 43 PEOPLE WITH IT? -

- OPTION A: RH NULL (KNOWN AS GOLDEN BLOOD)
- OPTION B: RH NEGATIVE
- OPTION C: RH POSITIVE
- OPTION D: RH Q

Q18] WHAT IS THE ONLY MAJOR ORGAN SURGERY THAT CAN BE PERFORMED WHILE THE PATIENT IS AWAKE WITH NO PAIN OR DISCOMFORT?

- OPTION A: BRAIN SURGERY
- OPTION B: HEART SURGERY
- OPTION C: LIVER SURGERY
- OPTION D: LUNGS SURGERY



Q19] WHICH RARE GENETIC DISORDER PREVENTS THE DEVELOPMENT OF FINGERPRINTS?

- OPTION A: ADERMATOGLYPHIA
- OPTION B: DERMATOGLYPHIA
- OPTION C: POLYDACTYLY
- OPTION D: MONODACTYLY

PUZZLE CORNER



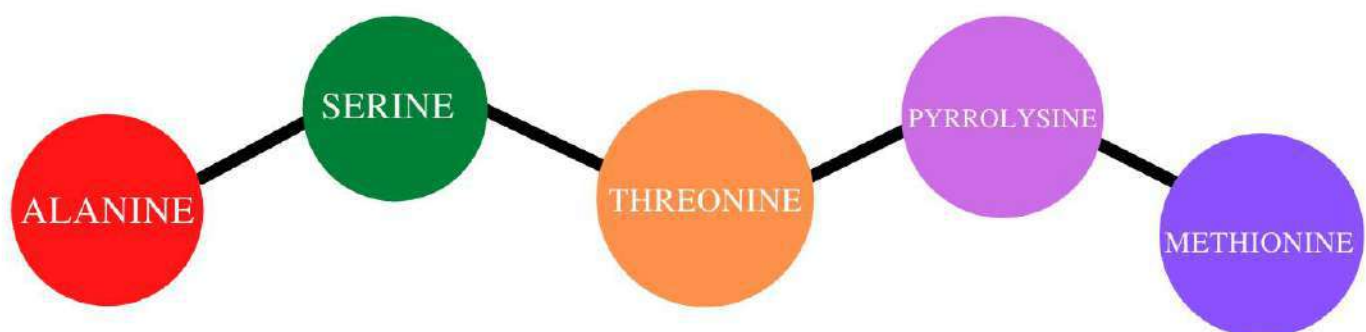
WORDSEARCH

I	N	T	E	G	R	I	N	Y	H	N	O	A	T
S	I	S	O	M	S	O	I	M	E	H	C	S	A
S	N	S	T	R	L	O	D	N	R	H	R	B	I
I	O	N	S	Y	M	S	Y	O	M	B	I	D	L
S	S	I	I	M	Y	R	M	U	A	I	I	N	S
E	O	X	S	I	G	O	A	Y	P	O	O	A	I
N	C	O	Y	N	O	S	G	C	H	C	O	P	O
E	O	T	H	I	L	N	O	C	R	A	O	R	S
G	M	O	P	E	O	E	T	C	O	T	O	O	I
A	I	R	A	N	N	S	S	O	D	A	S	B	C
T	A	U	I	Y	I	O	I	R	I	L	H	E	G
E	L	E	D	D	H	I	E	O	T	Y	S	T	P
M	I	N	E	I	R	B	L	N	E	S	S	U	I
O	R	O	O	S	E	O	C	A	I	T	I	R	G

DYNEIN
 CLEISTOGAMY
 RHINOLOGY
 HERMAPHRODITE
 CHEMIOSMOSIS
 INTEGRIN
 BIOCATALYST
 NEUROTOXIN
 CORONA
 DNA PROBE
 METAGENESIS
 NOSOCOMIAL
 DIAPHYSIS
 BIOSENSORS

2) AMINO ACID UNSCRAMBLE

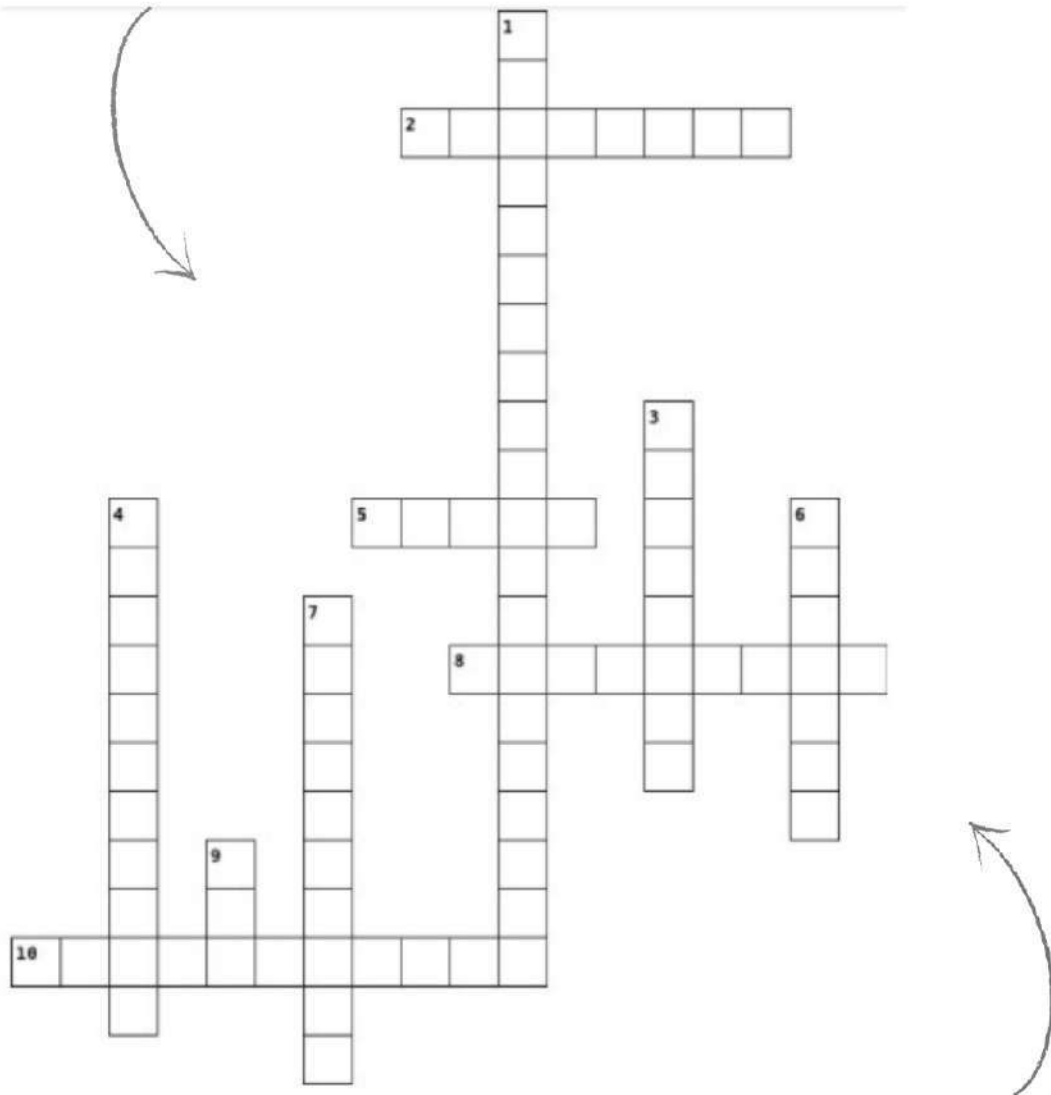
We have listed 5 amino acids and your goal is to make as many 3+ letter words as you can using only the single letter codes of the amino acids provided to you!



3) CROSSWORD

ACROSS

2. A main driving force for genetic variation is
5. A bone in the body that is not connected to any other bone
8. A reagent used to detect fingerprints
10. Horseshoe shaped structure located within the temporal lobe responsible for consolidating new memories, emotional responses & spatial orientation

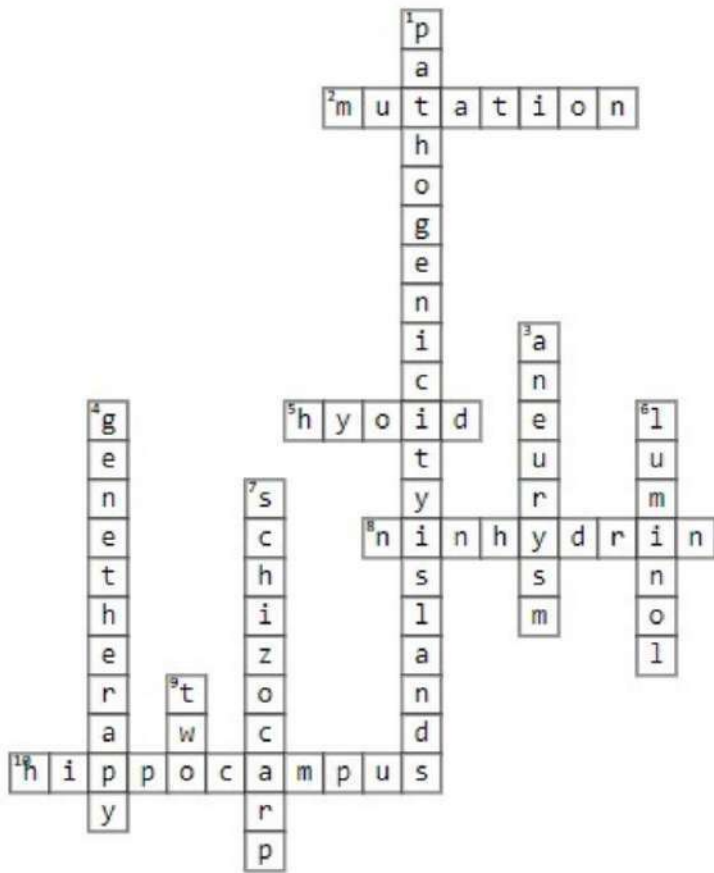


DOWN

1. A distinct class of genomic islands acquired by microorganisms through horizontal gene transfer
3. Swelling/bulging of a weak area in the wall of a cerebral artery; most common location is at the Circle of Willis
4. A technique in which the DNA is carefully selected to correct the effect of a mutated gene that is causing disease
6. A chemical used to detect trace amounts of blood stains
7. A dry fruit that splits into single-seeded parts when ripe
9. Quantitative traits that varying along a continuum, such as height or skin color, as usually the result of the influence of at least how many genes

ANSWERS

CROSSWORD



TEST YOUR KNOWLEDGE

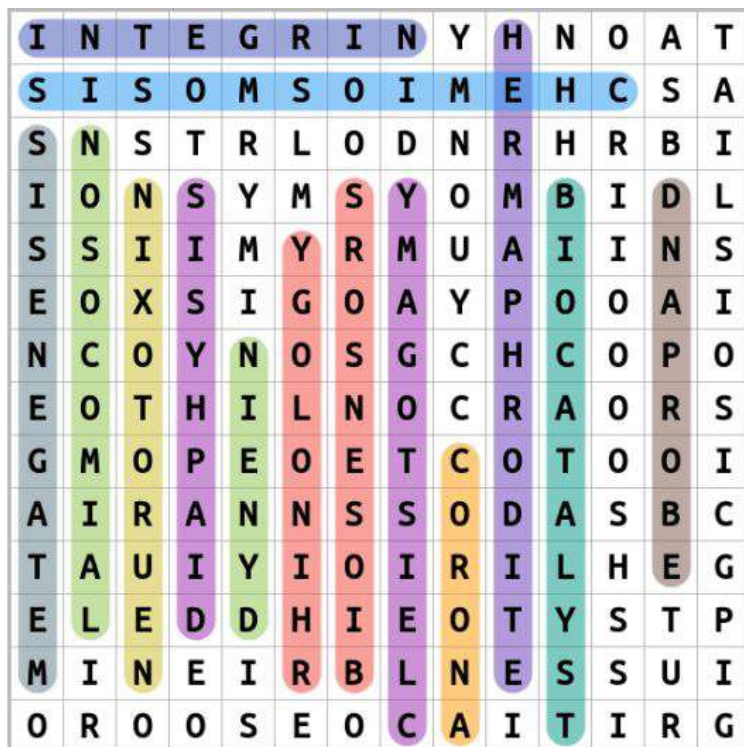
1. B) EPIDEMIOLOGY
2. C) ANTHROPOLOGY
3. A) HARVEY J ALTER
4. D) SARS
5. A) CRISPR
6. A) TYRANNOSAURUS REX
7. D) AUSTRALOPITHECUS AFARENSIS (OR LUCY)
8. C) HOMO HABILIS
9. A) HAIR ROOTS
10. C) FORENSIC ENTOMOLOGY
11. D) FOOD
12. C) GRAY'S BEAKED WHALE SPECIES
13. A) CANCER
14. C) MONKEY
15. B) DNA SEQUENCING
16. A) SPEECHLESS
17. A) RH NULL (KNOWN AS GOLDEN BLOOD)
18. A) BRAIN SURGERY
19. A) ADERMATOGLYPHIA

AMINO ACID UNSCRAMBLE

WORDS POSSIBLE:

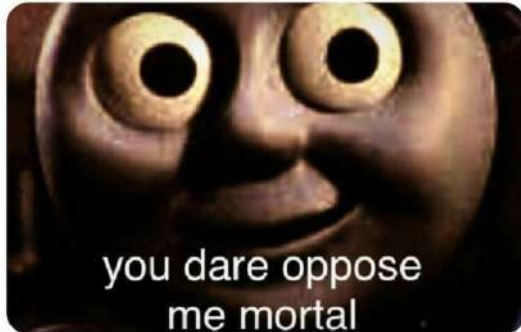
ATOMS
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 SOT
 TAO
 TAS

WORD SEARCH



Me: rubbing lab bench with ethanol

0.01% of bacteria:



MEMES MEMES MEMES
MEMES MEMES MEMES
MEMES MEMES MEMES

When you're taking your science final and you don't see any questions about what the mitochondria is



What did the DNA ligase say when it was confused at work?

I don't UNDER-STRAND I'm LAGGING behind!

Hmmm... What did it say?



nobody
literally nobody
white blood cells whenever a foreign bacteria enters the body



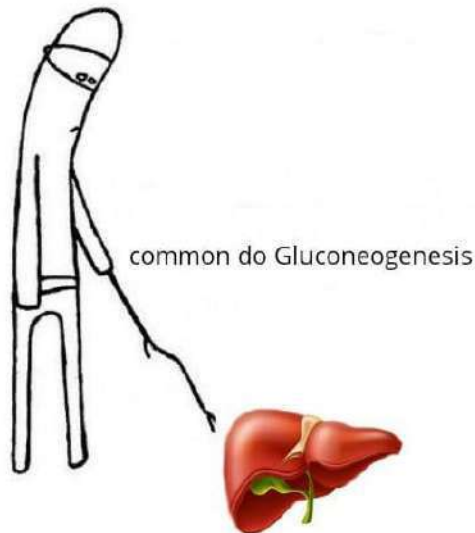
ADP during photophosphorylation



MEMES MEMES MEMES
MEMES MEMES MEMES
MEMES MEMES MEMES

**MEMES MEMES MEMES
MEMES MEMES MEMES
MEMES MEMES MEMES**

when you want to loose weight
but also don't want work out



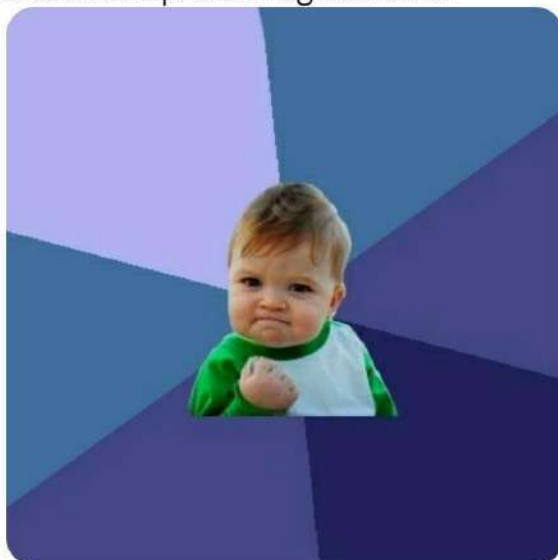
daughter cells after mitosis



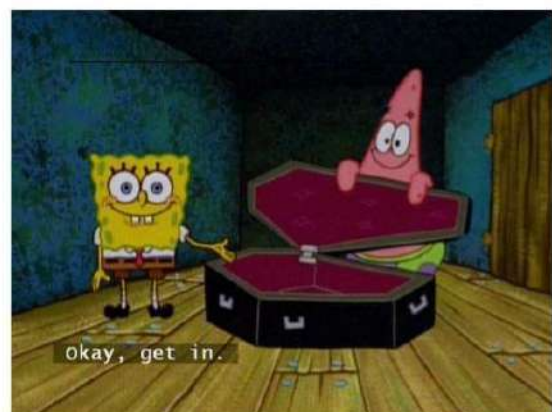
white blood cells whenever
they find a foreign bacteria



when you finally find the concentration of
unknown liquid through titration



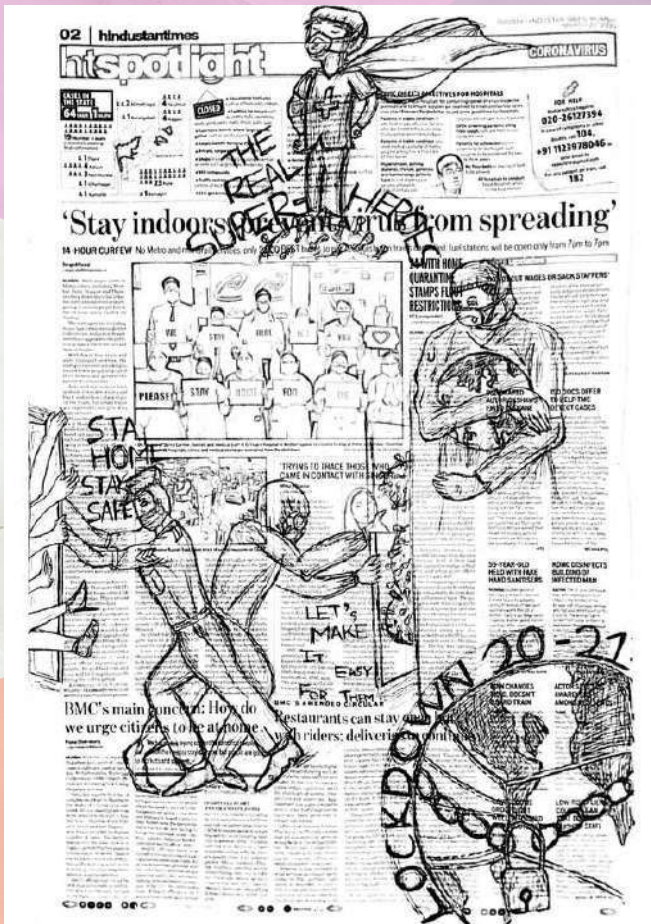
Spleen to RBC



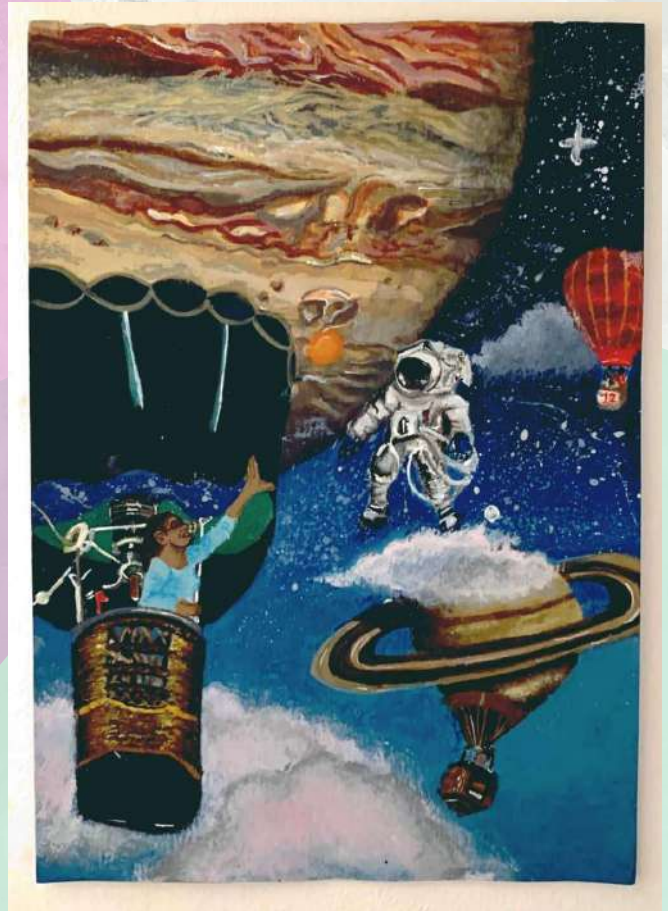
Brought to you by:
Manali Chakraborty, FYBSc.
Akash Andhale, FYBSc.
Roshni Keshwani, SYBSc.
Jheel Popat, SYBSc.

May 2021

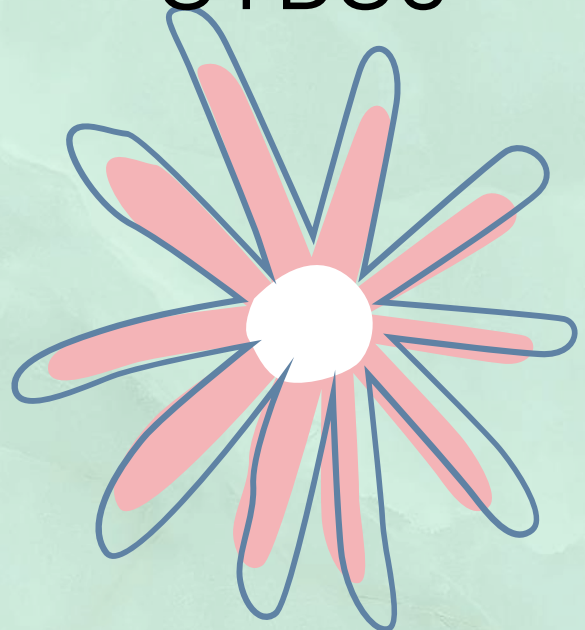
Art corner

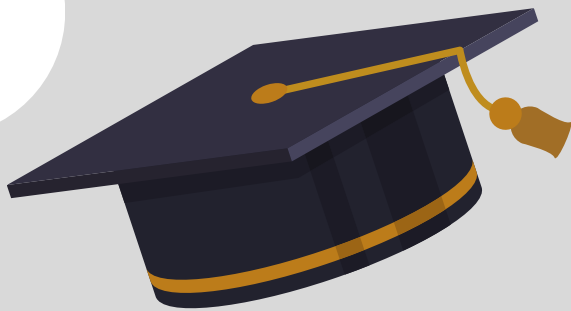
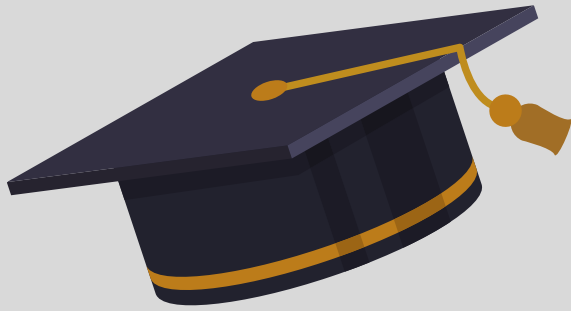


Sanika Naik,
FYBSc.



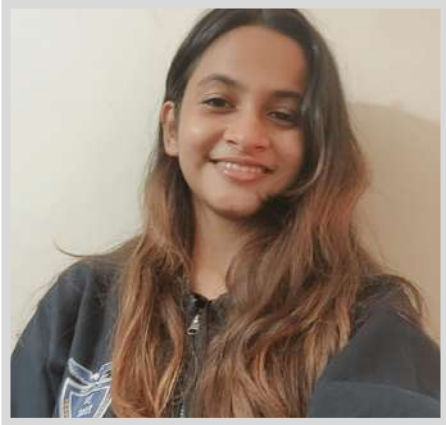
Anushka Pai,
SYBSc





CLASS OF 2021

"If they can make penicillin out of moldy bread, they can sure make something out of you"- The Corona Batch



SANYA BALLIKAR

I'm outta here! See you guys later!



GAURI BARVE

"The future belongs to those who believe in the beauty of their dreams."



JAANSI BHANSALI

"Two things are infinite: the universe and human stupidity; and I'm not sure about the universe."



NAVIN CHAWATHE

"Never make decisions out of fear, just out of spite."



TANVI CHHATWANI

"If i had a mic right now, I would drop it"



JIBAN J GOGOI

"If life shuts a door, open it back again; Cause that's how doors work."



VARISHA KHAN

"Just keep swimming and whatever Jiban said"



KUNAL JAGETIYA

"In the end, we just have our memories to cherish!!"



SHRIYA JAJULA

"Haar kar jeetne wale ko baazigar kehte hai."



AASAWARI GUPTA

"We do not remember days; we remember moment's."



SHRUTI MANDOWARA

"When life gives you lemons make a gin and tonic."



RAMSHA PATRAWALA

"Mindset is what separates the BEST from the REST"



INDEIRA ROHRA

"How was I supposed to know there would be consequences to my actions"



AIMAN SHAIKH

"Our life is one, big proverbial coin toss"



KRUTTIKA SHUKLA

If I'd to describe these three years:"The Office, Season 5, Episode 14, minute 09:12"



SIMRAN UDESHI

Like Circuit once said, "Yeh toh shuru hote hi khatam hogaya".



NEHA VADAGBALKAR

"I am rather appalled at the limit of characters for this. I am certain that I cannot fit all my thoughts of these last 3 years into such few cha"



RAGNI VERMA

"Think of the happiest things. It's the same as having wings."