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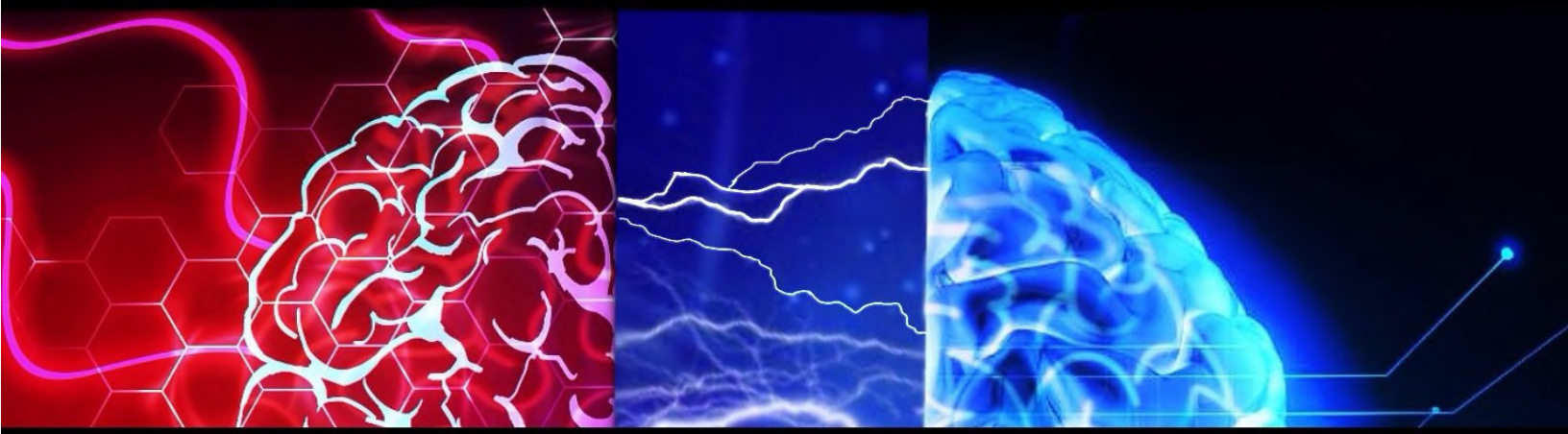
Department of Life Sciences



SYNAPSE

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Foreword

Life Sciences is concerned with the study of living organisms, including biology, botany, zoology, microbiology, biotechnology, biochemistry, forensic science and related subjects. The Life Sciences comprise all fields of science that involve the scientific study of living organisms, like plants, animals, and human beings. It also addresses global problems like climate change, an aging society, food security, energy security and infectious diseases, to name just a few. There are so many exciting things happening, thanks to the rapid advances in Life Sciences.

Amazing developments in healthcare and the medical sector such as stem-cell therapy, ICT-integrated biotechnology have helped in addressing many health challenges. Biotechnology, an integrated discipline of Biochemistry, Genetics, Microbiology etc., will become as common as having a cellphone or going online. There is going to be an even larger number of many Life Sciences related companies, both big and small, along with an increasing number of venture companies. So by 2030, it will be a realistic to say that technology in Life Sciences will become a part of our life, from drugs, medicine and therapeutics to environment friendly chemicals, fuels and materials.

The vision of the department of Life Sciences, Kristu Jayanti College is to provide quality education and research with the primary aim of holistic development of every student. The education mission of the Department of Life Sciences is to organize and teach basic and applied Life Sciences in the curriculum. Our hope is for a learning community that engages students in learning that is relevant for the 21st century and provides them the skills to be critical and ethical thinkers capable of independent and lifelong learning.

'Synapse'- an annual newsletter of the Department of Life Sciences, Kristu Jayanti College is a collection of articles and thoughts penned by the students of the Department. The students have tried to communicate new updates in the research areas of Life Sciences. It is a matter of delight that this useful collection of highly informative articles from our students conjures up the current and continued efforts in research as there are still many unknowns to many of them.

On this occasion, we congratulate the Department and the editorial board of 'Synapse' for the release of the third issue of this newsletter. During the path in the preparation of Synapse, we are certain that the creativity and the inquisitiveness of the students would have been enkindled. We hope that the newsletter will answer many questions, enable sieving through the biases of misconceptions and make everyone learn a little more about the process of science.

Rev. Fr. Josekutty P. D.
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CLIMATE CHANGE AND AUSTRALIAN BUSHFIRES

Aleena
V Sem B.Sc.,MBG

Bushfires in Australia are widespread and regular occurrences that have contributed to molding the character of the continent over many years. Eastern Australia is one of the most fire-prone regions of the world, and it's prominent eucalyptus forests have evolved to thrive on the phenomenon of bushfire. However the fire can cause significant property damage and loss of both human and animal life. Bushfires have killed approximately 800 people in Australia since 1851, and billions of animals. The most destructive fires are usually preceded by extreme high temperatures, low relative humidity and strong winds, which combine to create perfect conditions for the rapid spread of fire.

IMPACT ON WILDLIFE

Bushfires kill animals directly and also destroy local habitats, leaving the survivors vulnerable even once the fires have subsided. Australia has the highest rate of any area in the world, with fear that some of Australia's native species, like Koalas are most vulnerable because they are slow-moving. In extreme fires Koalas tend to climb up to the top of a tree and curl into a ball where they become trapped. In January 2020 it was reported that half the 50,000 Koalas on Kangaroo Island off Australia's southern coast which are kept separate to those on the mainland as insurance for the species future, are thought to have died in the previous few weeks.

IMPACT ON HUMANS

Bushfires produce particulate matter pollution -airborne particles that are small enough to enter and damage human lung tissue. As a result of intense smoke and air pollution arising from the fires, in January 2020 Canberra measured the worst air quality index of any major city in the world. The orange-tinged smoke entered homes and offices, buildings across the capital making breathing outside very difficult. This also has an increased risk of heart attack, stroke and diabetes. Professor Jalaluddin, a chief investigator with the Centre of Air pollution, Energy and Health Policy Research, says: There is increasing evidence around air pollution and (the development of) neurological conditions, for example, Parkinson's disease and Alzheimer's.

CAUSE and ECONOMIC IMPACT

The bushfires can be caused by lightning, some by human actions, including arson. Sometimes it is by the climate conditions that provide adequate fuel for the fires to grow and spread. Before the fires ignited, Australia was already enduring its hottest and driest year on record. Moody's analytics says the cost of the 2019-2020 bushfires is likely to exceed the figure of AUD$ 4.4 billion and will cripple consumer confidence and harm industries such as farming and tourism.

Science behind ancient MUMMIES

Mansi Sukhadeve
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ARCHEOLOGISTS WERE ABLE TO REVEAL THE RECIPE USED FOR MUMMIFICATION.

A mummy can be anybody with its tissues preserved after its death. This preservation can be like the ancient mummies of Egypt, or accidental frozen bodies in ice. As these bodies are well preserved, it allows scientists to learn more about ancient people.

The ancient Egyptians believed that the physical body would be important to the person in his next life. Therefore, preserving them was the ultimate goal for them.

Egyptians discovered that decomposition of the body starts from the inside or the internal organs. Thus, they realized that removing internal organs will help in preserving the body. Mummification was performed by priests who used to remove all the internal organs except the heart, because they believed that the soul resides in the heart, from the body. The body cavities were filled with preservative chemicals to prevent bacterial growth and the body was covered with salt.

Quick-drying was the most common method of mummification as it prevents bacterial and fungal growth. Archeologists were able to reveal the recipe used for mummification. The recipe used was made using plant oils, plant gum, and tree resin. Together these ingredients can protect the body from decaying along with providing anti-bacterial properties.

The Book of the Dead is a collection of writings that were placed in tombs as a means of assisting the ancient Egyptian soul on its journey through the underworld and into the afterlife. The archeologists say that they needed the body to be preserved for the spirit to have a place to reside.

BIOTECHNOLOGY: AN INTRODUCTION TO NEW MILLENIUM

Namita Menon 18LS2A1015
V Sem B.Sc., MBG

Biotechnology has been projected by many to become as dominant in the present century as electronics, including computers, were during the twenty first century. The first but forceful signs of this prediction coming true can be seen in many recent developments. Modified crops are rapidly gaining popularity and the total area under such crops, the number of countries growing them and the types of cultivars being grown are all on the rise. These crops are likely to become more acceptable to consumers as suitable technologies become available to address the concerns about their safety and more particularly, as transgenic cultivars become increasingly familiar to us.

Biotechnology products are becoming increasingly important in terms of human health we already have many recombinant DNA based diagnostic and, even therapeutic tools; human insulin produced in *E. coli* and hepatitis B vaccine produced in yeast are about two such examples. The techniques of gene therapy are being refined with a view to overcome genetic diseases, and such dreaded, but so far unimaginable, diseases as cancer, AIDS, etc. A possibility for cure of diabetes is being developed. This strategy aims to transplant insulin-producing cells contained in Nano-capsules to enable diabetics lead a normal life without any medical intervention and with minimum dietary restrictions. We already have the draft human genome sequence, and efforts are on to deduce the complete meaning of this massive 'document of human life'. This knowledge is expected to revolutionize our understanding of both the capabilities and limitations of genetic machinery and to be able to assess its vulnerabilities as well as devise protective strategies from them, most likely, on an individual-specific basis.

THE MOST IMPORTANT APPLICATIONS OF SCIENCE

Kunal
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Science is valued by society because the application of knowledge domain helps to satisfy many fundamental human needs and improve living standards. Science is usually justified to the general public as driving economic process, which is seen as a return-on-investment for public funding. During the past few decades, another goal of science has emerged: to seek out how to sensibly use natural resources so as to ensure their continuity and therefore the continuity of humanity itself; an attempt that's currently mentioned as "sustainability".

Scientists often justify their work using these and similar arguments—currently linked to non-public health and longer life expectancies, technological advancement, and/or sustainability—in order to secure funding and gain social acceptance. That means that the majority of the technologies and medicines we use today are by-products of research, from pens to rockets. This progressive application of knowledge domain is seen in Isaac Asimov's book, Chronology of science and discovery, which beautifully describes how science has shaped the planet, from the invention of fire until the 20th century.

Astronomers Have Caught a Star Literally Dragging Space-Time Around With It

Namratha
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Einstein's theory of relativity is that any spinning body drags the very fabric of space-time in its vicinity around with it. This is often referred to as "frame-dragging".

In our day to day life, frame-dragging is both undetectable and inconsequential, because the effect is so ridiculously tiny. Detecting the frame-dragging caused by the Earth's spin requires satellites like the $750 million Gravity Probe B.

Luckily for us, many gravitational laboratories exist in the universe that physicists can observe Einstein's predictions at utmost detail.

Research reveals evidence of frame-dragging on a way more noticeable scale, employing a radio reflector and a singular pair of compact stars darting around one another at excessive speeds.

The motion of those stars would have perplexed astronomers in Newton's time, as they clearly move during a warped space-time, and need Einstein's theory of relativity to elucidate their trajectories.

Understanding Biophysics.

Hariharan
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Biophysics fuses two unrelated fields: biology and physics. Where biology deals with the studying of life which focuses on its variety, complexity and uniqueness, whereas physicists search for mathematical laws of universe and make detailed predictions about the forces that drive the system. Bridging the space between the complexity of life and therefore the simplicity of physical laws is the challenge of biophysics. Studying the patterns in life by using state-of-the-art instruments and sophisticated computational models is that the most powerful process to determine how life works at the elemental level.

What are its applications?

Biophysics is the basis for innovation and instrumentation for any high-tech economy. The applications of biophysics depend upon needs on many levels. In the last century or so, great progress was made in treating disease. Biophysics helped create powerful vaccines against infectious diseases. Biophysics provided both the tools and the mastery for treating the diseases of cancer. Today rapid progress is being made in understanding how diseases work on a basic level. Moreover, numerous environmental problems of our planet also are being addressed.

Biophysical methods are extensively used in forensic science and bioremediation areas. It provides the life-saving treatment procedures of kidney dialysis, radiotherapy, and pacemakers. Biophysicists invented instruments for detecting, purifying, imaging and manipulating chemicals.

Importance of Biophysics right now

Society is facing physical and biological problems of worldwide proportions. How will we still get sufficient energy? How can we feed the world's population? How can we remediate global warming? How can we preserve biological diversity? How can we secure clean and plentiful water? These are crises that need scientific insight and innovation. Built on the principles of physics and therefore the mechanisms of biology, biophysics provides valuable insight and technologies for meeting these challenges.

The main tools of biophysics are:
- Spectroscopy
- Microscopy & Imaging
- Crystallography
- Force manipulation techniques, e.g. optical tweezers

SYNTHETIC PARTS OF VIRUS: NEW RESEARH INSIGHTS

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Scientists searching for better diagnostic tests, drugs or vaccines against a virus must first start by decoding the structure of that virus. And when the virus under study is highly pathogenic, investigating it, conducting test or developing them can be quite dangerous. Prof. Roy Bar-Ziv, Staff Scientist Dr. Shirley Shulman Daube, Dr. Ohad Vonshak, a former research student in Bar-Ziv's lab, and current research student Yiftach Divon have an original solution to this hurdle. They exhibited the production of viral parts within artificial cells.

These cells are micrometer-sized compartments engraved into a silicon chip. At the bottom of every compartment, the scientists attached DNA strands by packing them densely. The edges of these artificial cells were heavily covered with receptors that can capture the proteins produced inside the cells. To begin with, the scientists flooded their cells with everything needed to make proteins -- molecules and enzymes needed to read the DNA information and translate it into proteins.

Then, with no further human intervention, the receptor carpet trapped one of the proteins produced in the bottoms of the cells, with the rest of the viral proteins binding to each other and producing the structures that the scientists had earlier "programmed" into the system. In this case, they created assorted small parts of a virus that can infect bacteria (a bacteriophage).

"We discovered," says Bar-Ziv, "that we can control the assembly process -- both the efficiency and the final products -- through the design of the artificial cells. This included the cells' geometric structure, and the placement and organization of the genes. These all determine which proteins will be produced and, down the line, what will be made from these proteins once they are assembled."

Vonshak adds: "Since these are miniaturized artificial cells, we can place a great many of them on a single chip. We can alter the design of various cells, so that diverse tasks are performed at different locations on the same chip."

The features of the system developed at the Weizmann Institute -- including the ability to produce different small parts of a single virus at once, could give scientists around the globe a new tool for evaluating tests, drugs and vaccines against that virus. Adds Divon: "And because the artificial parts -- even if they faithfully reproduced parts of the virus -- do not include the use of actual viruses, they would be especially safe from beginning to end." "Another possible application," says Shulman Daube, "might be the development of a chip that could rapidly and efficiently conduct thousands of medical tests all at once."

Participating in this research were Stefanie Förste, Dr. Sophia Rudorf and Prof. Reinhard Lipowsky from the Max Planck Institute of Colloids and Interfaces in Potsdam, Germany, and David Garenne and Prof. Vincent Noireaux from the University of Minnesota. The research was published today in *Nature Nanotechnology*.

MOLECULAR GASTRONOMY

Madeline
V Sem B.Sc., MBG

This is a term used to describe a style of cuisine in which food enthusiasts, chefs expand the culinary process by not just limiting themselves in the kitchen but by using laboratory tools, it's also about studying the physical and chemical processes that occur while cooking.

Molecular gastronomy helps us to elaborate the chemical reactions behind the transformation of ingredients, as well as the social, artistic and technical components of culinary and gastronomic phenomena.

Molecular gastronomy is an endless sea of possibilities. It also serves a myriad of options for vegans like faux caviar and also it makes cooking and eating a fun process.
The effort put into creating each bite of food makes the food an art which can be truly perceived when savoured completely.
Molecular gastronomy research starts in the kitchen where chefs study how food tastes and behaves under different temperatures, pressures and other scientific conditions.

Many people often mistake the food that is made through this process as unhealthy, synthetic, chemical and unnatural. This is not surprising given that molecular gastronomy often relies on fuming flasks of liquid nitrogen, syringes, table top distilleries, PH meters and bottles of food chemicals with names like carrageenan, maltodextrin and xanthan.

Even though they have been purified and some of them processed, the raw material origin is usually marine, plant, animal or microbial. These additives have been approved by EU standards and are used in very, very small amounts.
Molecular gastronomy aims to create a multi-sensory dining experience with artistic dish presentations, textures, aromas, flavours and even sounds.
For chefs into molecular gastronomy the diners' palate and taste buds are their canvas.

Benefits of green coffee- A supplement to reduce fat accumulation, prevent cancer cells and altering attention

WAPANGIENLA M IMSONG 19LS2a1018
III Sem B.Sc., MBG

Green coffee has the potential to reduce the fat in the body which may be helpful for people who want to lose or maintain their weight. It also reduces or normalizes high blood pressure, in turn, lowers the risk of type two diabetes. The good thing about the green coffee extract is that the caffeine quantity is less and caffeine without sending your system into a caffeine- induced hyperactive state and making sure your body is simultaneously absorbing high amounts of chlorogenic acid. Research suggests that chlorogenic acid helps the body to burn glucose and stored body fat and reduces the absorption of carbohydrates.

People who want to reduce their body fat can take green coffee supplement with constant exercise and making sure that they take less calorie foods.

Green coffee beans are full of antioxidants which fight against damaging free radicals of body. In a 2004 study published in the journal of Agricultural and food chemistry, it was concluded that chlorogenic acid antioxidants may prevent the proliferation of four kinds of cancer cells, suggesting green coffee bean extract may even help to prevent cancer.

The American Psychological Association has concluded that caffeine has significant effects on psychomotor and cognitive performance and capable of alertness, motivation and reaction.

CHRONIC EFFECTS OF SOCIAL ISOLATION.

Samuel B Mathew
III Sem B.Sc., BBB

Chronic social isolation has debilitating effects on psychological state in mammals -- for instance, it's often related to depression and post-traumatic stress disorder in humans. Now, a team of Caltech researchers has discovered that social isolation causes the build-up of a specific chemical within the brain, and blocking this chemical eliminates the negative effects of isolation. The work has potential applications for treating psychological disorders in humans.

The work, led by postdoctoral scholar at Hughes Medical Institute, Confirmed and extended the prior observations, that prolonged social isolation results in a broad array of behavioural changes in mice. These include increased aggressiveness towards unfamiliar mice, persistent fear, and hypersensitivity to threatening stimuli. for instance, when encountering a threatening stimulus, mice that are socially isolated stay frozen in place long after the threat has passed, whereas normal mice stop freezing soon after the threat is removed. These effects are seen when mice are subjected to 2 weeks of social isolation, but to not short-term social isolation -- 24 hours -- suggesting that the observed changes in aggression and fear responses require chronic isolation.

The researchers found that chronic isolation results in a rise in Tac2 and therefore the production of NkB throughout the brain. However, administration of a drug that chemically blocks NkB-specific receptors enabled the stressed mice to behave normally, eliminating the negative effects of social isolation. Conversely, artificially increasing Tac2 levels and activating the corresponding neurons in normal, unstressed animals led them to behave just like the stressed, isolated animals.

The researchers also inhibited the function of Tac2 and its receptors in multiple specific brain regions. They found that suppressing the Tac2 gene within the amygdale eliminated the increased fear behaviours, but not aggression, while conversely suppressing the gene within the hypothalamus eliminated increased aggression but not persistent fear. The results imply that Tac2 must increase in several brain regions to provide the varied effects of social isolation. "The approach used here allowed us both to match the consequences of various manipulations of Tac2 signalling within the same brain region, also on compare the consequences of an equivalent manipulation across different brain regions," says Anderson *Professor of Biology,*. "The rich data set generated by these experiments revealed how this neuropeptide acts globally across the brain to coordinate diverse behavioural responses to social isolation stress."

Though the work was performed in mice, it has potential implications for understanding how chronic stress affects humans. "Humans have a similar Tac2 signalling system, implying possible clinical translations of this work," says Zelikowsky *postdoctoral scholar*. "When watching the treatment of psychological disorders, we traditionally concentrate in targeting broad neurotransmitter systems like serotonin and dopamine that circulate widely throughout the brain. Manipulating these systems broadly can cause unwanted side effects. So, specifically modify a neuropeptide like Tac2 could be a promising approach to psychological treatments."

ALZHEIMER DISEASE

Shaistha Naaz
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Alzheimer's disease (AD), also mentioned simply as Alzheimer's, may be a chronic neurodegenerative disease that sometimes starts slowly and gradually worsen over time. It's the explanation for 60-70% of cases of dementia. The foremost common early symptom is difficulty in remembering recent events. Because as the disease advances, symptoms may include problems with language, disorientation (including easily getting lost), mood swings, loss of motivation, no self-care management, and behavioural issues. As an individual's condition declines, they often withdraw from family and society. Gradually, bodily functions are lost, ultimately resulting in death. Although the speed of progression can vary, the standard anticipation following diagnosis is three to nine years. The explanation for Alzheimer's disease is poorly understood. About 70% of the danger is believed to be inherited from an individual's parents, with many genes usually involved. Other risk factors include a history of head injuries, depression, and hypertension. The disease process is related to plaques and neurofibrillary tangles within the brain. A probable diagnosis is predicated on the history of the illness and cognitive testing with medical imaging and blood tests to rule out other possible causes. Initial symptoms are often mistaken for normal ageing. Examination of brain tissue is required for a particular diagnosis. Mental and physical exercise, and avoiding obesity may decrease the danger of AD; however, evidence to support these recommendations is weak. There are not any medications or supplements that are shown to decrease risk. There are no treatment as of now to stop or reverse its progression, though some may temporarily improve symptoms. Affected people increasingly depend on others for assistance, often placing a burden on the caregiver. The pressures can include psychological, physical, social and economic elements. Exercise programs could also be beneficial with regard to activities of daily living and may potentially improve outcomes. Behavioural problems or psychosis owing to dementia are often treated with antipsychotics, but this is often not usually recommended, as there's little benefit and an increased risk of early death. As the average age of populations across the world continues to extend, the incidence of AD has been rising. it's estimated that fifty million people were living with dementia in 2017, variety that's predicted to grow to over 131 million by 2050. Within the US alone, an estimated 5.8 million people over the age of 65 are currently living with the consequences of AD; this number is predicted to double within the next 30 years to 13.8 million. Concurrently, the value of caring for and treating these patients is additionally rising. The cost of health care and long-term care for persons with AD within the U.S. is estimated to be USD 290 billion and an estimated USD 234 billion, in unpaid care-giving from friends and family, and therefore the financial toll of this disease is critical.

SKIN CANCER SUPPRESSOR FOUND

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lncRNAs are molecules that are transcribed from our DNA which don't make protein and whose functions remain largely unknown. The particular group of lncRNAs, that the team was interested in were thought to be involved in cancer.

From a group of 245 lncRNAs that were associated with melanomas the team identified 1 lncRNA, called Disrupted In Renal Carcinoma 3 (DIRC3), that acted as a tumor suppressor to block the spread of human melanoma cells when grown in lab experiments.

By using gene-editing to switch off production of DIRC3 - the team saw that "anchorage-independent growth" a hallmark of malignant cancer, spread drastically and increased by two to eight times.
Furthermore the scientists showed that DIRC3 switches on the key tumor suppressor IGFBP5 gene, revealing that it plays a role in the complex networks governing the expression of genes important for melanoma growth and spread to other parts of the body.

The researchers used the clinical data from The Cancer Genome Atlas to link DIRC3 expression to melanoma patient outcomes. They discovered that melanoma patients who produced high levels of DIRC3 had statistically significant increased survival rates compared to patients who expressed low levels.

Upgradation OF THE WORLD OF SCIENCE.

Chaitra P J 18LS2A1028
V Sem B.Sc., MBG

Science is a great antidote to the poison of enthusiasm and superstition. Nothing in education is so astonishing as the amount of ignorance it accumulates in the form of inert facts. When we look back, we see so much development in the world. The world is full of gadgets and machinery. Machinery does everything in our surroundings. How did this become possible? How did we become so modern? This was possible with the help of science. Science has played a major role in the growth of our society. Furthermore, Science has made our lives immensely better and convenient.

As mentioned earlier Science has brought in many changes in our lives. First, transportation is easier now. With the help of Science it has now become easier to cover long distances. Moreover, the time of traveling has reduced. Various high-speed vehicles are available these days. These vehicles have totally changed the face of our society. Science upgraded steam engines to electric engines. In earlier times people used Bullock carts and cycles, but now everybody travels on motorcycles and cars. This saves time and effort. And all this was possible because of Science.

Second, Science made us reach the moon. But we never stopped there. It also helped us to get a view of Mars. This is one of the greatest achievements. This was only possible with Science. In recent times scientists have built satellites because of which we are able to use high-speed Internet. These satellites revolve around the earth 24 hours which we are unaware of.

Science is the backbone of our society. Science has contributed so much to our lives. This is one of the reasons that we are taught science at a very young age.

Science is not only a disciple of reason, but also, one of romance and passion.

MEDICINAL PLANTS: THE FUTURE SOURCE OF NEW DRUGS.

Dinu Davis
V Sem B.Sc., MBG

Plants are related to the event of human civilization round the whole world. However, plants are considered as rich source of phytochemical ingredients which enable to possess medicinal value. Medicinal plants are a possible source for the event of latest herbal drugs. India features a long history and powerful base for Ayurveda, which is the traditional herbal medical system. Herbal plants play a crucial role in preventing and treating of human diseases. People have been using plants as a standard medicine for thousands of years. Over the last few years, there has been a revival of interest to rediscover medicinal plants as a source of potential drug candidate.

The importance of plants as a source of latest drugs

Use of Herbal medicine is widely practiced in the world. For hundreds of years, people have turned to natural remedies to cure common ailments like colds, allergy, upset stomachs and toothaches and therefore the trend is consistently increasing. Since ages, human civilization has used several plants as food, medicine, clothing and shelter. Vegetarian foods contain high amounts of various “super-nutrients," like protective antioxidants, phytochemicals, micronutrients, that promote health and protection from diseases. Plants have several pharmacological functions like antioxidant, antiviral, anticancer, antimicrobial, antifungal and antiparasitic. Plants have radical scavenging molecules, including flavonoids, phenolics, anthocyanins and vitamins, which show antioxidant like activity. The antioxidant property of phytochemicals helps in reducing the oxidative stress within the biological system. Phytochemicals reduce the danger of many human diseases including hepatorenal disease, diabetes, cancer and neurodegenerative disorders. However, many herbal medicines are being derived directly or indirectly from plants which are considered as an important medicine currently in use for curing various human diseases.

INNOVATIVE WAYS TO COMBAT AIR POLLUTION

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The number of people now living in cities across the globe is as high as it has ever been, with the UN predicting this figure will rise and will be accompanied with a host of potential environmental issues with pollution being one of the most concerning .This pollution comes in many forms, but perhaps one of the most worrying in terms of public health is the issue of air pollution. Pollutants that are released into the air as opposed to land and water pollutants are the most harmful. Air pollution in India is a serious issue as India is the 3rd largest producer of greenhouse gases after China and US.

To combat growing levels of air pollution people have come up with some fascinating ideas such as;

- **Smog free tower:** This turns dust into jewellery – As one solution to air pollution Dutch designer Daan Roosegarde has invented a large tower that eats smog. By charging the tower with small positive current an electrode sends positive ions into the air which attach themselves to fine dust particles. A negatively charged surface will then draw the positive ions together with dust particles. The fine carbon particles collected by tower are condensed to create tiny gemstones that can be embedded in jewellery pieces like rings and cufflinks. Each of the tiny stones is equivalent to 1,000 cubic meters of air. The tower can clean up 30,000 cubic meters of air per hour and uses no more electricity than a water boiler.
- **Capturing pollution to use as ink**: This technology is the brain child of Anirudh Sharma, where a device called KAALINK is connected to the tailpipes of vehicles ,chimney stacks etc. .Soot composed of 2.5 micrometre black carbon particles found in petrol or diesel carbon emissions is captured which is then processed to remove heavy metals and carcinogens, the soot is then blended with oils and alcohol to create ink .A single air ink pen contains 30-50 minutes of pollution. 25 hours of driving can produce 1.5l of ink.
- **Algae curtains:** To combat air pollution in areas where planting trees is a big deal. It is an opaque bio plastic membrane with pillows of algae that capture and store carbon dioxide from atmosphere and release oxygen through photosynthesis. The carbon dioxide absorbed helps algae grow into organic matter which can be used for bio plastic, biofuels, food and cosmetics. They are designed to hang on the sides of buildings each 2sq m of curtain can absorb on average same amount of carbon dioxide as a mature tree which is roughly 22kg a year.
- **Vertical Forests**: Italian architect Stefano Boeri designed the first vertical forest towers 'Bosco Verticale' which are residential and are covered in 900 trees, 5,000 shrubs and over 11,000 other plants. The no. of trees and plants in this tower can transform approximately 44,000 pounds of carbon dioxide each year. The towers also provide refuge for birds and insects. Stefano Boeri is currently working to design an entire forest city in Liuzhou, China. According to the architect the new city will be home to 30,000 people with trees absorbing 10,000 tons of carbon dioxide and 57 tons of other air pollutants.
- **Air purifying buildings and clothes**: Titanium dioxide is used to coat the buildings ,it reacts with nitrogen oxides in the air through photo catalysis (a process where light speeds up naturally occurring chemical reactions) and converts it into harmless soluble nitrate salts which are removed from building's surface by rainfall .In 2015 a 13,000 sq. ft. building called Palazzo Italia was opened covered with titanium dioxide ,it is estimated to remove 1000 cars worth of air pollution from air each day. The potential of titanium dioxide to clean up the air has led inventors to create laundry detergents containing it, the idea being that when clothes are washed in the detergent they will gain a small amount of titanium dioxide and turn the wearer of the item into a walking air purifying machine. But the invention relies on mass participation to make a real impact as each person can neutralize 5 or 6 grams of nitrogen gas each day. The product is still being refined with a few issues such as the fact that it also neutralizes people's perfumes.

Innovative ways to reduce air pollution are only a part of the solution, for us to see a significant reduction in air pollution we need to be looking for measures to decrease the release of harmful pollutants into the atmosphere and switch to using renewable energy.

NEW COMPOUND WHICH KILLS ANTIBIOTIC-RESISTANT SUPERBUGS DISCOVERED

Sneha.R. 18LS2K1047
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A new compound developed by the experts of University of Sheffield have killed the antibiotic resistant gram-negative bacteria, including E. coli, during tests. New treatments for gram-negative bacteria are vital as they're rapidly becoming resistant to current drugs. Antimicrobial resistance is already liable for 25,000 deaths within the EU annually . The research could pave the way for new treatment of lethal superbugs. A replacement compound which visualizes and kills antibiotic resistant superbugs have been discovered by the scientists at the University of Sheffield and Rutherford Appleton Laboratory (RAL).

The team, led by Professor Jim Thomas, from the University of Sheffield's Department of Chemistry, is testing new compounds developed by his PhD student Kristy Smitten on antibiotic resistant gram-negative bacteria, which includes the pathogenic E.coli.

Gram-negative bacteria strains can cause infections including pneumonia, tract infections and bloodstream infections. They're difficult to treat because the cell membrane of the bacteria intercepts drugs from getting into the microbe.

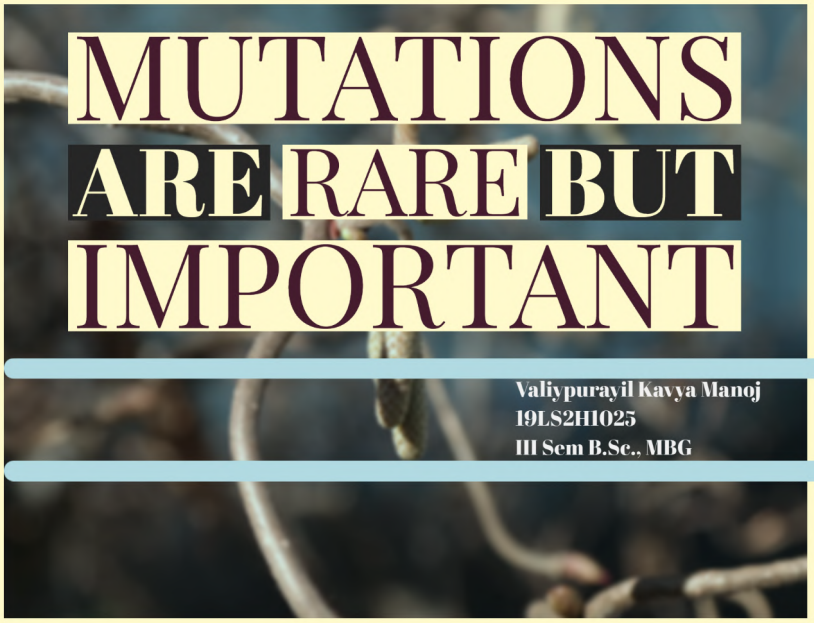
Antimicrobial resistance is already liable for 25,000 deaths within the EU annually, and unless this rapidly emerging threat is addressed, it is estimated that by 2050 an estimate of around 10 million people could die every year owing to antibiotic resistant infections. Doctors haven't had a replacement treatment for gram-negative bacteria in the last 50 years, and no clinical trials or potential drugs have entered since 2010.

The new drug compound features a range of exciting opportunities. As Professor Jim Thomas explains: because the compound is luminescent it glows when exposed to light, this suggests the uptake and effect on bacteria are often followed by the advanced microscope techniques available at RAL.

"This breakthrough could lead on to vital new treatments to life-threatening superbugs and therefore the growing risk posed by antimicrobial resistance."

The studies at Sheffield and RAL have shown the compound seems to possess several modes of action, making it harder for resistance to emerge in the bacteria. The subsequent step of the research is going to be to check it against other multi-resistant bacteria.

In a recent report on antimicrobial resistant pathogens, the World Health Organization put several gram-negative bacteria at the top of its list, stating that new treatments for these bacteria were 'Priority 1 Critical' as they cause infections with high mortality rates, are rapidly becoming immune to all current treatments and are often contracted in hospitals.



MUTATIONS ARE RARE BUT IMPORTANT

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The cells of eukaryotes contain an enormous amount of DNA. The DNA in multicellular organism is the result of a long series of replications, starting with the DNA of a single cell. Organisms have evolved many different mechanisms to avoid errors during DNA replication and to preserve the DNA from damage. Some of these mechanisms 'proof read' the replicated DNA strands for accuracy and to correct any mistakes. However, the proof reading is not perfect. If it were, no variation in the nucleotide sequence of genes would be generated.

Cells do make mistakes during replication, and the damage to the genetic material also occurs, causing mutations. However, change is rare. Limited as it may seem but the steady trickle of change that does occur is the very stuff of evolution. Every difference in the genetic messages that specify the difference in organisms arose as the result of genetic change.

Genetic changes through mutation and recombination provides the raw material for evolution. Genetic changes in somatic cells do not pass on to offspring, and so have less evolutionary consequences than germ-line cell. However, mutations in somatic cell can have significant effects on the individual.

Mutations can occur randomly anywhere in the cell's DNA. Mutational changes can be beneficial, harmful, or neutral depending on their context or location. Harmful mutation can cause genetic disorder or cancer. Cystic fibrosis is a genetic disorder which occurs in human due to mutation in a gene. Although mutations that cause changes in protein sequences can be harmful to an organism, on occasions the effect may be positive in each environment. In this case the mutation may enable the mutant organism to withstand environmental stresses better than the wild type organism. Though mutations are rare but are important for the survival of the living organisms.

DISSOCIATIVE IDENTITY DISORDER

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Dissociation identity disorder formerly called as multiple personality disorder is a condition where a person develops one or more alternative personalities that work with or without the awareness of the person's usual personality. DIDs are mental illnesses that involves disruption or breakdown of memory, identity and consciousness, these symptoms can be mild but can get severe in the course of time effecting both personal and professional life.

A history of trauma is a key feature of DID. About 90% of cases involve history of physical, mental or sexual abuse trauma. A prolonged period of isolation can also be a major factor for dissociative identity disorder. It is often considered as the coping mechanisms of the person to disconnect from the traumatic stress or memories. It is a way for a person to break connection from the outside world and create distance from an awareness of what is occurring.

Hence a person with DID has two or more personalities i.e. his core personality and an alternative personality which is also called as alters and a person may experience amnesia when an alter takes control. The person might not know when an alter gets dominant but each alter has its own traits and a personal history. Each alter has a different way of thinking and way of coping with the external world, each alter might also have different allergies than the core person.

An example of a person with 100 personalities, Kim, 50, has dissociative identity disorder (DID). She is, in effect, scores of different people – the exact number is uncertain – wrapped up in one body. These personalities are all quite different, with their own names and ages and quirks of temperament. Some are children while some are males.

AUTISM AND IT'S HERITABILITY

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Autism Spectrum Disorder (ASD), or Autism, is a wide range of conditions which include deprivation in social skills, difficulty in communication, repetitive behaviour, etc. It is considered as a spectrum disorder because we cannot generalise the actions of every autistic individual. Which means each individual affected by this disorder shows unique and distinct set of strengths and weaknesses. Each person with autism acts differently. Some might need the help of others for their daily lives, whereas, others can thrive without anyone's help since they can do most of the things on their own in their daily life.

Autism mainly affects the processing of information in the brain cell. It also effects on how nerve cells and their synapses connect and organize. But how this occurs is not well understood.

The signs of autism usually appear by the age of 2 or 3. In some, the development delays can occur earlier and can even be diagnosed at an early stage of 18 months. According to the studies conducted in the field of this disease it is found that there are several factors which influence the development of autism. Among these the most prominent factors are genetic and environmental factors. About 80% of their risk of developing the condition is due to genetic factors and only a very feeble chance, of about 1%, is due to maternal factors and the rest depends on the environmental factors. It is also accompanied by sensory sensitivities and medical issues such as gastrointestinal disorders, seizure or sleep disorder, as well as mental health challenges such as anxiety, depression and attention issues.

The high heritability of autism made the scientists focus mainly on the genetic factors affecting the transmission of autistic trait to the progeny than the environmental factors which triggers this condition in an individual. According to Paul Chaste "The recurrence risk of pervasive developmental disorder in siblings with autism is 2% to 8%; and it rises to 12% to 20% if one takes into account the siblings showing impairment in one or two of the three domains (social interaction, communication and restricted repetitive and stereotyped patterns of behaviour, interests and activities) impaired in autism respectively. "Adding on to this statement, several twin studies shows that "aggregation within families is best explained by shared genes as opposed to shared environment." The autistic traits among the general population have the heritability of 40% to 80%. Among the several twin studies conducted, the recent study shows that the monozygotic twins have higher concordance for ASD compared to the dizygotic twins.

For each autistic individual mutations in more than one gene is noticed and it might not be the same when it comes to another set of individuals. By identifying the genetic markers inherited with autism in a family, numerous candidate genes have been located, most of which encode proteins involved in neural development and function. However for most of the candidate genes, the actual mutations that increase the likelihood for autism have not been identified. Generally autism cannot be traced to a Mendelian mutation or to a single chromosome abnormality. The large number of autistic individuals with unaffected families is due to spontaneous alterations in the genetic material during the stage of meiosis where it deletes or duplicates the genetic material.

EBOLA VIRUS

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Ebola viruses are pathogenic agents that are associated with a severe, potentially fatal, systemic disease in man and great apes. Four species of Ebola viruses have been identified in west or equatorial Africa. Once the highly virulent forms enter the human population, transmission occurs primarily through contact with infected body fluids and can result in major epidemics in under-resourced settings. These viruses cause a disease characterised by systemic viral replication, immune suppression, abnormal inflammatory responses, major fluid and electrolyte losses, and high mortality. Despite recent progress on vaccines, and with no licensed prophylaxis or treatment available, case management is essentially supportive with management of severe multiple organ failure resulting from immune-mediated cell damage. The 2013–2016 outbreak was classified by WHO as a Public Health Emergency of International Concern, which drew attention to the challenges of diseases caused by infections with Ebola viruses and also questioned the scientific, clinical, and societal preparation to handle future epidemics.

Epidemiology

Since Ebola viruses were first identified in 1976 over 20 known outbreaks of Ebola disease have been identified in sub-Saharan Africa, mostly in Sudan, Uganda, Democratic Republic of Congo, and Gabon, and mainly due to the Ebola and Sudan viruses. Most of these outbreaks have occurred in isolated rural areas, but the outbreak in Gulu in 2000 was in a semi-urban area of Uganda. However, it is possible that small outbreaks might not have been identified as such. The largest outbreak to date, due to the Ebola virus, occurred in 2013–16 in West Africa, predominantly affecting Guinea, Sierra Leone, and Liberia. It included multiple countries, both rural and urban areas, and had very high incidence and mortality (>28 000 cases with >11 000 deaths).

However, because of under-reporting, the true burden might have been considerably higher. In this outbreak, the overall mean case fatality in confirmed cases with recorded clinical outcomes was 62·9% (95% CI 61·9%–64·0%). The latest outbreaks were declared in May, 2018, in a remote area in the Equateur province and in August, 2018, in the North Kivu province in the Democratic Republic of Congo. The situation became of concern in May, 2018, when the outbreak reached Mbandaka, a large city and a transit hub located at the Congo River. Fortunately, the outbreak was controlled relatively quickly, with a total of 54 cases, of which 33 died.

Vaccines and prevention

Although a wide range of vaccines had been developed over the previous decades, clinical development was impressively accelerated, under intense media attention, during the 2013–16 West-African Ebola virus disease outbreak a single dose of a recombinant vesicular stomatitis Indiana virus vectored vaccine (rVSV-ZEBOV) containing EboGP was found to be immunogenic in phase 1 trials. Arthritis was frequently described in vaccinated patients in Switzerland, but this adverse event was not confirmed in African populations. rVSV-ZEBOV was evaluated in a phase 3 trial in Guinea using a protocol of ring vaccination, the principle of which relies on the vaccination of both confirmed patients with Ebola virus disease's direct contacts .The vaccine was reported highly effective (efficacy 100% [95% CI 68·9–100], p=0·0045), although uncertainty remains about the magnitude of its efficacy. The study also showed the feasibility of a ring-vaccination approach during an outbreak of Ebola virus disease, including in response to a post-epidemic recrudescent cluster that emerged in Guinea. Ring vaccination with this vaccine was also implemented during the 2018 outbreaks in the Democratic Republic of the Congo as part of WHO's Expanded Access Framework.

Over 60, 000 individuals were vaccinated until Jan 15, 2019, and vaccination is still on-going. An important aspect of the 2018 vaccination campaign in the Democratic Republic of the Congo was that, in addition to the vaccination of contacts and first-line health-care workers, individuals in the community who might come into contact with sick people such as traditional healers, religious leaders, and motorcyclists (who might transport sick patients), were also vaccinated.

THEY SAY YOU SHOULD TRUST YOUR GUT

Benita
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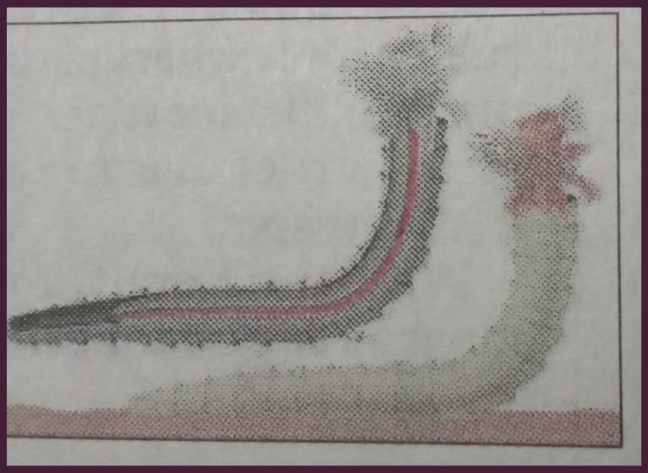

They say you should trust your gut, which is why Emmy Smith went for hunting in 2016 Smith, a field geologist found something interesting in Pahrumo , Nevada . She found some of the oldest known animal guts on planet .

The guts are those of an extinct animal called Cloudina, which looked like a worm made of a stack of ice cream cones and lived about 550 million yrs. ago.

The guts are about Cloudina's entire length, meaning they passed all the way through front and back. This gut made eating a lot more efficient, and it opened doors for other animals with through-going guts to evolve later on.

NEUROLOGICAL EFFECTS ON COVID-19 PATIENTS

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Although the most common and important presentation is with respiratory disease, reports of neurological features are increasing.

The COVID-19 pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is of a scale not seen since the 1918 influenza pandemic. Although the predominant clinical presentation is with respiratory disease, neurological manifestations are being recognised increasingly. On the basis of knowledge of other corona viruses, especially those that caused the severe acute respiratory syndrome and Middle East respiratory syndrome epidemics, cases of CNS and peripheral nervous system disease caused by SARS-CoV-2 might be expected to be rare. As of May 19, 2020, the COVID-19 pandemic, has resulted in more than 4·8 million confirmed cases worldwide and more than 300 000 deaths.1 It is the largest and most severe pandemic since the 1918 influenza pandemic. These features appear to be a combination of non-specific complications of systemic disease, the effects of direct viral infection, or inflammation of the nervous system and vasculature, which can be Para-infectious or post-infectious.

EVIDENCES FROM OTHER VIRUSES:

Before identification of SARS-CoV-2, six corona viruses were known to infect humans. Four of these corona viruses cause seasonal, predominantly mild respiratory illness, and have a high incidence globally, accounting for 15–30% of upper respiratory tract infections. The other two coronaviruses have led to major epidemics with deaths principally from respiratory disease; severe acute respiratory syndrome (SARS) was caused by SARS-CoV in 2002–03, and Middle East respiratory syndrome (MERS) by MERS-CoV in 2012. Both the more innocuous coronaviruses and these epidemic strains have been associated with occasional disease of the CNS and peripheral nervous system (PNS).

Both CNS and PNS disease were reported following SARS. SARS-CoV was detected in CSF by RT-PCR in two of three cases of encephalopathy with seizures, and was cultured from brain tissue at autopsy in the third. Four patients with severe SARS developed neuromuscular disease, predominantly motor neuropathy, myopathy, or both, which might have been SARS-specific or secondary to critical illness. CNS involvement was described for five adults with MERS; two had acute disseminated encephalomyelitis, two had cerebrovascular disease, and one had Bickerstaff's brainstem encephalitis. Neuropathy was described in three patients. Human coronavirus OC43, a seasonal coronavirus, has caused encephalitis in an infant with severe combined immunodeficiency, and acute disseminated encephalomyelitis in an older immunocompetent child. Headache, neck stiffness, and seizures were described among 22 children (median age 36 months; range 0·8–72 months) with suspected CNS infection and corona virus IgM antibodies in their serum, CSF, or both. Ten of these children had pleiocytosis and eight had brain imaging abnormalities. All 22 made a full recovery.

Projected epidemiology of COVID-19-associated neurological disease

Although neurological complications are rare in SARS, MERS, and COVID-19, the scale of the current pandemic means that even a small proportion could build up to a large number of cases. The minimum prevalence of CNS complications ranged from 0·04% for SARS to 0·20% for MERS, and PNS complications ranged from 0·05% for SARS to 0·16% for MERS, from which we have extrapolated the number of cases with neurological complications of COVID-19.Given the 4·8 million cases of COVID-19 globally, these prevalences project to a total of 1805–9671 patients with CNS complications and 2407–7737 with PNS complications. These numbers, which do not include the increasingly important syndromes of stroke-associated COVID-19 infection, will rise as the pandemic continues.

Operative decisions regarding neurological care provision during the COVID-19 pandemic.

- Implementation of a functional reorganisation plan or contingency plan addressing the resources and areas of responsibility of the neurology department
- Organisation of hospital admission and neurological emergencies
- Implementation of a remote consultations model for patients under follow-up to provide continuing care and resolve problems
- Creation of a "secure" off-site care unit for priority patients with neurological emergencies, circumstances that require attention in person, or essential treatments that must be administered during the consultation
- Implementation of models for the provision of essential in-hospital care
- Definition of responsibilities in the internal coordination of the neurology department
- Definition of specific care pathways for emergencies

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CRISPR-CAS

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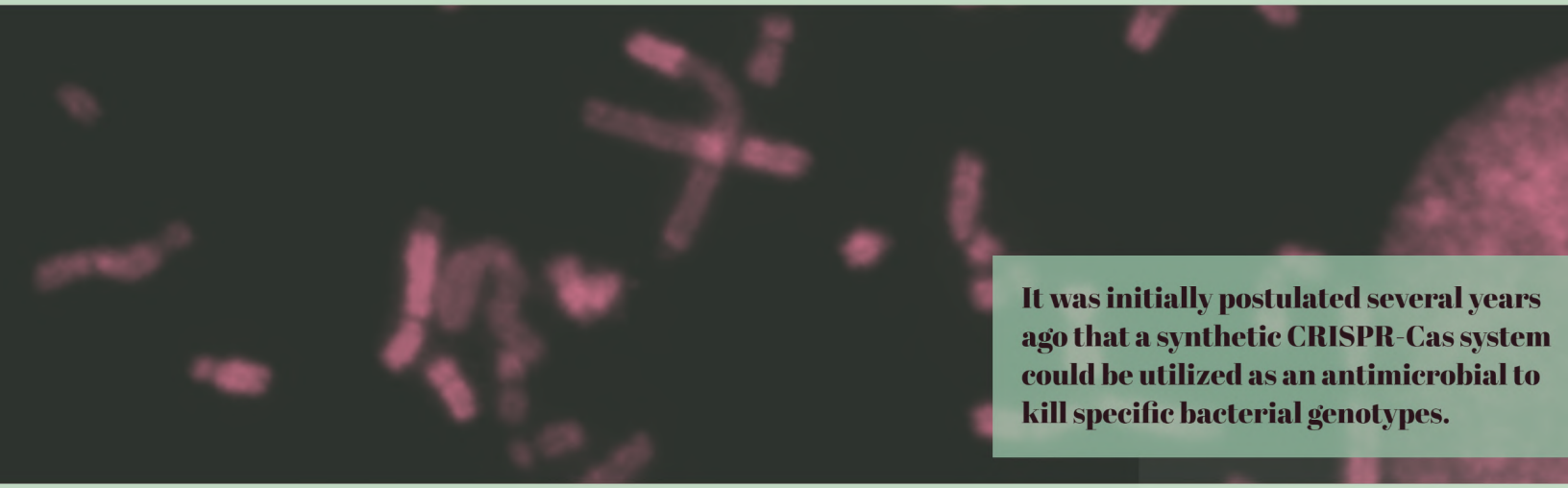

It was initially postulated several years ago that a synthetic CRISPR-Cas system could be utilized as an antimicrobial to kill specific bacterial genotypes.

Antimicrobial resistance (AMR) poses a significant threat to modern medicine and should render common infections untreatable. The creation of latest antibiotics has come to a relative standstill during the last decade, and developing novel approaches to tackle the spread of AMR genes would require significant efforts in the coming years. In 2014, several groups independently demonstrated how CRISPR-Cas (clustered regularly interspaced short palindromic repeats-CRISPR–associated), a bacterial system now widely used for genome editing, can selectively remove AMR genes from bacterial populations. Here, we discuss the present state of the sector of CRISPR-Cas antimicrobials, the challenges ahead, and the way they'll be overcome.

Using CRISPR-CA's to target AMR in bacteria -

CRISPR-Cas is a system that protects bacteria and archaea against invading nucleic acids. Short sequences called the "spacers' derived from foreign DNA or RNA elements, like bacteriophages and plasmids, are inserted in CRISPR loci on the bacterial genome and later employed by the Cas protein machinery to acknowledge and destroy invading nucleic acids carrying an equivalent sequence. CRISPR-Cas systems are divided into two classes and 6 types, during which class 1 (types I, III, and IV) have a more complex architecture, with multiple Cas proteins participating in foreign DNA recognition and cleavage processes, whereas class 2 systems (types II, V, and VI) have simpler architecture, with recognition and cleavage administered by one multi-domain enzyme. The latter class encloses the sort II CRISPR-Cas9 system, whose targeting specificity, versatility, and ease has led to several revolutionary applications in genome editing and ecological engineering. While most of these applications are thoroughly reviewed, one that has received comparatively less attention is using CRISPR-Cas to eradicate AMR genes from bacterial populations and communities.

It was initially postulated several years ago that an artificial CRISPR-Cas system might be utilized as an antimicrobial to kill specific bacterial genotypes. Newer studies have confirmed the potential for CRISPR-Cas to exactly remove bacterial strains that carry genes, including those determining drug resistances, from populations and to re-sensitize bacteria to antibiotics by selectively removing AMR-encoding plasmids.

Highlighting the specificity of CRISPR-Cas antimicrobials, individual bacterial strains were selectively far away from a mixed population of Escherichia coli genotypes by transforming the population with a plasmid encoding CRISPR-Cas that is programmed to focus on a sequence unique to every genotype. Two studies demonstrated that CRISPR-Cas9 are often delivered using phagemids (plasmids packaged in phage capsids) to selectively kill the clinically relevant bacterial pathogens E. coli and Staphylococcus aureus. One of these studies used phagemid transduction to deliver CRISPR-Cas9 constructs programmed to target AMR genes harboured on plasmids, which effectively removed these plasmids from bacteria. Additionally, delivery of CRISPR-Cas9 by conjugative plasmids was used to kill bacteria carrying AMR genes within the chromosome. The opposite study demonstrated sequence-specific killing of bacteria harboring virulence genes using phagemid-mediated delivery of CRISPR-Cas9 and also showed that this approach was ready to remove plasmids carrying AMR genes, thus effectively re-sensitizing bacteria to antibiotics. Both studies also showed that the CRISPR-Cas9 phagemids are ready to kill specific bacteria in vivo, either in bee moth larvae exposed to enterohaemorrhagic E. coli or on the skin of mice colonized with S. aureus.

While these studies showed that bacteria are often re-sensitized to antibiotic treatment using CRISPR-Cas, a clear problem was that these bacteria haven't any selective benefit over resistant ones, allowing residual resistant bacteria to be maintained within the population. In an effort to extend the selective advantage of re-sensitized bacteria, a technology using temperate and lytic phage to re-sensitize bacteria to β-lactam antibiotics was developed. During this case, CRISPR-Cas programmed to target AMR genes was delivered by a temperate phage. This CRISPR-Cas construct also showed resistance to lytic phage, providing a subsequent selective advantage to re-sensitized bacteria that were challenged with this sort of phage. an extra study implemented CRISPR-Cas9 for broad-spectrum targeting of common β-lactamase gene classes in E. coli by identifying a shared target sequence in >200 mutational variants of this gene , thus circumventing the matter of high sequence diversity among β-lactamase genes .

OPTIMIZING STEM CELLS – ORGANOIDS

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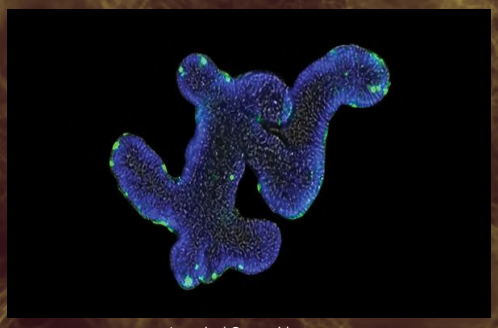
Imagine a possibility of complete avoidance of graft rejection, a possibility of having a strong alternative to trials on guinea pigs and mice in laboratories might open gates to a moral and safe scientific ways. The key to such possibilities is creating a cellular structure identical to one's own from one's stem cell- i.e., organoids.

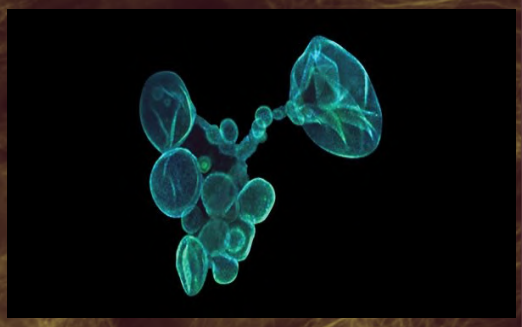
Organoids are tiny, self-organized 3D tissue cultures that are stem cells derived. Such cultures can be designed to replicate much of the complexity of an organ, or to express selected aspects of it like producing only certain types of cells. They grow from stem cells, which have the potential to divide indefinitely and produce different types of cells as part of their progeny.

An organoid, as described by its discoverers (Lancaster and Knoblich ,and Huch and Koo), is an "in vitro 3D cellular cluster derived from tissue-resident stem/progenitor cells, embryonic stem cells (ESCs) or induced pluripotent stem cells (iPSCs) capable of self-renewal and self-organisation that recapitulates the functionality of the tissue of origin". These Organoid cultures have emerged as an alternative in vitro system to recapitulate tissues in a dish.

Initiation of organoid culture requires the isolation of stem/progenitor cells, either pluripotent stem cells (PSCs) or tissue-resident stem/progenitor/differentiated cells isolated from embryonic stages or adult tissues. The cells of origin for PSC-derived organoids are ESCs or iPSCs, which are then cultured in a media supplemented with the growth factors in order to mimic the signals that the cells are exposed to during the embryonic patterning to give rise to the specific tissue. During development, a single totipotent cell, the zygote, which can form extra embryonic and embryonic tissues, proliferates and gives rise to progeny that overtime becomes increasingly lineage-restricted.



Intestinal Organoid



Liver Organoid

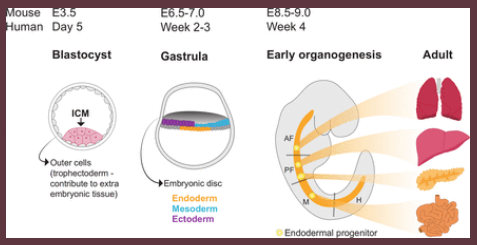


Figure 1
Organogenesis and stages for organoid progenitor isolation. Schematic depicting key stages of organogenesis timings in mice and humans.

Organoids generated from tissue-resident stem/progenitor cells require culture conditions that resemble the stem cell niche during physiological tissue self-renewal or during damage repair, rather than recapitulation of developmental processes.

POSITIVES AND POSSIBILITIES OF ORGANOIDS

- Organoids embody a promising model system to bridge the gap between 2D cultures and in vivo mouse/human models. They are more physiologically relevant than 2D culture models (which is limited to horizontal planes), while providing a reductionist model of in vivo biology in which it is possible to manipulate signaling pathways and perform genome editing.
- It holds tremendous potential for regenerative medicine, as organoids present the possibility for autologous and allogeneic cell therapy, the replacement of damaged or diseased tissue with organoid-propagated stem cell populations. Such an application would allow correction of genetic abnormalities in vitro using CRISPR/Cas9 and re-introduction of the engineered healthy cells into the patient, with subsequent integration into the tissue.
- Organoids made from patients' induced pluripotent stem cells (iPSCs) could allow personalized medicines, with potential to pre-test medical treatments i.e., to screen patient drug responses in vitro before direct administration to the patient.
- Although organoid technology is still in its infancy with respect to widespread adoption in the research community, it holds significant potential as a tool to study a wide range of subjects, including developmental biology, disease pathology, cell biology, regenerative mechanisms, precision medicine, and drug toxicity and efficacy testing. For these and other applications, organoid cultures constitute highly informative complementary approaches to the existing 2D-culture methods and animal model systems.

The researchers at Cincinnati Children's Hospital Medical Center have successfully grown a connected set of three organs i.e., the liver, pancreas and biliary ducts. Human organoids provide an advanced tool for research. But this advancement allows scientists to study how human tissues work as a complete system. With the advancement of this organoid culture technique the need for animal based medication studies will be reduced. Sharply accelerate the concept of precision medicine, and someday lead to transplantable tissues grown in labs.

Organoid researches have their own limitations like availability of only an approximation of the biology of an entire organ and do not mimic the behavior of the complete organism. They lack key in vivo features such as defined body axis, a functional immune system, and complete physiological networks. Despite its existing limitations, researchers have been working on this future potential aspect to improvise and open new avenues of regenerative medicine and many more aspects of organoids besides being a model organ system.

ROLE OF BIOTECHNOLOGY IN MEDICINAL PLANTS

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The World Health Organization estimates that approximately 80% of the population depend on medicinal plants and herbs. These medicinal plants are the most important source of life saving drugs. The drugs or the component of drugs are either derived from plants or are made to model the genotype of the plants.

Various biotechnological methods and tools are used to breed, multiply and conserve these plants. Plant tissue culture has been an important method in production of pharmaceutical molecules from medicinal plants. This plant tissue culture method has also been used for the application of faster biotechnology based breeding methods like agrobacterium mediated gene transfer and polyploidy.

In- vitro production of secondary metabolites in plant tissue suspension culture has also been observed. Bioreactors are then used for the commercial production of these secondary metabolites.

Gene editing is used to create custom designed medicinal plants with different secondary metabolites.

Plant biotechnology not only helps in the wide production of these drugs but various endangered medicinal plants have been conserved using cryopreservation.

Bio- Enzymes: A Substitute for Artificial Cleaners

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Cleaning products at home contain toxic and aggressive chemicals which are harmful to human health and the environment. Bio-Enzymes are the most inexpensive and natural way to meet cleaning requirements.

Bio-Enzymes are organic solutions which are produced by the fermentation of fruits, vegetables, sugar and water. It is a mixture of vinegar, alcohol and other organic substances such as proteins, salts etc. It was first developed by Dr.Rosukun Poompanvong from Thailand.

Bio-Enzymes can be made in a very simple way. Take jaggery, citrus peels and water, in the ratio of 1:3:10. The combination of jaggery, citrus peels and water helps to release proteins that hasten the decomposition process. Take a large air-tight container with a lid which can accommodate the solution and have about 10-15% of the space left empty. Mix all the ingredients in the container, close the lid, and label it with the date and leave it in a dark place (such as inside the kitchen, under the sink etc.). A teaspoon of yeast is added to produce bio - enzymes in 20 days.

The air- tight container promotes fermentation and prevents worms. The microorganisms in the mixture will start feeding on the sugar first and multiply. Once the sugar source has been depleted, they will start breaking down the peels and when there is no food left, they will eventually die after 3 months and leave behind the enzyme. During the fermentation process, the food waste is broken down into smaller compounds along with the release of gases such as Carbon-dioxide and Hydrogen. Before this gas fills up the container, the lid must be opened once a day (for the first week), air it out for a minute and keep it back in the dark place. From the second week onwards, the gas activity will reduce a bit and the lid can be opened every other day.

At the end of 3 months/1 month, strain the contents and squeeze out all the extra liquid. The pulp that is left after straining can be blended and used as concentrated cleaner for tough stains. The liquid that is obtained post-straining is ready to be used.

Bio-Enzymes find significant applications in day to day life,

- As a surface Cleaner : floor cleaner, tile cleaner, toilet cleaner, stove cleaner ,car wash, window cleaner.
- As a dirt remover: laundry liquid, utensil cleaner, stain remover etc.
- As an anti-bacterial and anti-viral: refrigerator cleaner, cabinet cleaner
- Bio-Enzymes are used in washing fruits and vegetables to neutralize harmful fertilizer residues on them.

HUNTINGTONS CHOREA

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As a student in college studying biotechnology and dealing with topics such as gene expression, I had the opportunity to give a seminar on disorders that are genetically inherited, caused by errors in expression and regulation of certain genes. This article will explore the genetic cause of this disorder, how it gradually impairs the nervous system and its symptoms.

One of the first descriptions of Huntington's came from an American physician Charles Oscar Waters in 1841 and was later studied in detail in 1872 by American physician George Huntington. The disease is caused by an autosomal dominant mutation in either of an individual's two copies of a gene called Huntington. "Chorea" comes from the Latin and Greek word meaning *chorus* or a *group of dances*. It was also known as "dancing disorder ".Huntington disease affects 1 to 10 of 100,000 people. The number of people affected varies depending on which part of the world they live in. It affects both sexes equally.

All humans have two copies of the Huntington gene (*HTT*), which codes for the protein Huntington (HTT). This gene is also known as *HD* and *IT15* that stands for 'interesting transcript 15'. A part of this gene is a repeated sequence called a trinucleotide repeat, which varies in length between individuals and it can change its length between generations. If the repeat is present in a healthy gene, a dynamic mutation can increase the repeat count which in turn results in a defective gene. When the length of this repeated sequence reaches a certain threshold, it produces a mutated form of the protein, called mutant Huntington protein (mHTT). This *HTT* gene is located on the short arm of chromosome no. 4. *HTT* contains a sequence of three DNA bases—cytosine-adenine-guanine (CAG)—repeated multiple times (i.e. ... CAGCAGCAG ...). CAG is the 3-letter genetic code (codon) for the amino acid glutamine, so a series of them results in the production of a chain of glutamine known as a polyglutamine tract.

The part of the brain most affected by Huntington's is a group of nerve cells at the base of the brain known collectively as the basal ganglia. The main components that compose the basal ganglia are the caudate and the putamen (together known as the striatum) and the Globus pallidus (external and internal regions). The Substantia nigra and the subthalamic nucleus are also sometimes included as a part of the basal ganglia. In an individual with Huntington's, it is still not known how the mutated copy of the gene leads to symptoms, but a suggested theory is that the additional accumulation of glutamate converts the excitatory neurotransmitter to an ' excitotoxin ', leading to nerve cell death.

During the early stages of Huntington's disease, the face, torso, and limbs may move involuntarily and rapidly. At first, the abnormal movements are barely noticeable. However, with time, the movements become more obvious. Muscles may contract briefly and rapidly, causing the arms or other part of the body to suddenly jerk, sometimes several times in a row. Movements become uncoordinated and slow. In due course the entire body is affected, making walking, sitting still, eating, speaking, and dressing extremely difficult.

Mental changes frequently occur before or as the abnormal movements develop. These changes are subtle at first. People may gradually become irritable and excitable. They may lose interest in their usual activities. They may be unable to control their impulses, losing their temper, having fits of despondency, or becoming promiscuous. In advanced disease, dementia gets severe, and results in people being confined to bed. Full-time assistance or nursing home care is needed. Death of an individual usually occurs about 13 to 15 years after symptoms begin.

SKIN STEM CELLS

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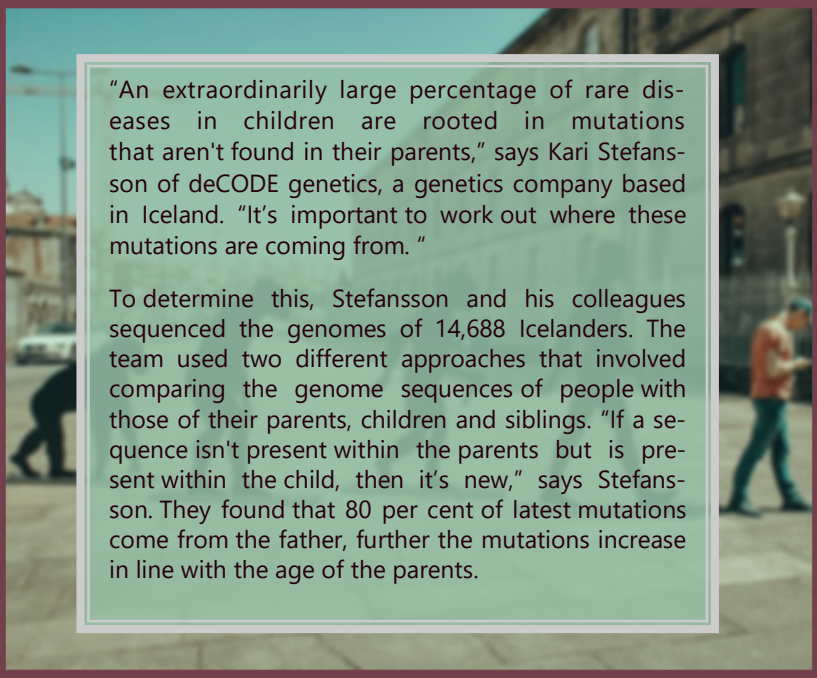
Researchers have shown by *in vitro* experiment that changes of glycans in mouse epidermal stem cells can serve as biomarker of aging. These findings hold promise for stem cell research into skin disorders specifically senile degeneration, wound healing and skin cancer. Age shows nowhere better than on skin. Now researchers at the university of Tsukuba and AIST have revealed that changes in the complex sugars called glycans that coat the surface of epidermal stem cells can serve as potential biological marker for aging. Aging impairs environmental defences and wound healing while increasing hair loss and cancer risk. A key process underlying epidermal function in health and disease in cellular glycosylation that mediates cell-cell interaction and cell matrix adhesion. The profile of all the glycans present on and in a cell - collectively the cell glycome-can reflect its functional scope and also serves as an index of its age. At first the researchers isolated the epidermal stem cells from the skin of young and old laboratory mice, including both hair follicle cells and interfollicular epidermal cells. These cells underwent glycan profiling using the lectins microarray platform. Finally to check whether the glycan changes were the cause or merely the result of aging, the research team overexpressed the up-regulated glycogens in primary epidermal mouse keratinocytes in vitro. They showed that the alterations may reflect the waning ability of aging epidermal stem cells to proliferate. Future advances in this research may help manage skin disorders at the stem cell level, including age related degenerative changes, impaired wound healing and cancer.

AS MEN AGE, DO THEY PASS ON GENETIC ABNORMALITIES TO THEIR CHILDREN?

Ananthu Vinu
III Sem B.Sc., BBG

Older fathers transmit more genetic mutations to their children than older mothers do, consistent with a study that investigated the genomes of thousands of Icelandic parents and youngsters. The researchers behind the work hope to know how such mutations put children in danger of rare diseases. New mutations are genetic alterations that appear for the first time in eggs instead of being carried for generations. They're key drivers of evolution but some are often harmful.



"An extraordinarily large percentage of rare diseases in children are rooted in mutations that aren't found in their parents," says Kari Stefansson of deCODE genetics, a genetics company based in Iceland. "It's important to work out where these mutations are coming from. "

To determine this, Stefansson and his colleagues sequenced the genomes of 14,688 Icelanders. The team used two different approaches that involved comparing the genome sequences of people with those of their parents, children and siblings. "If a sequence isn't present within the parents but is present within the child, then it's new," says Stefansson. They found that 80 per cent of latest mutations come from the father, further the mutations increase in line with the age of the parents.

It makes sense that age affects the sex cells of men more often compared to women. Women are born with all the eggs they're going to ever have. Although these cells age, they're not thought to divide. Men, on the other hand, are continually making sperm and each cellular division carries the danger of making a new mutation . These mutations won't all be harmful. We're all born with a minimum of 70 new mutations, and most of those don't affect the way our bodies and brains work. "The majority of mutations don't matter", says Leo Schalkyk at the University of Essex. "There could be the occasional mutation that's deleterious or the extremely occasional mutation that's beneficial". He compares the effect of mutations to swinging a hammer at a car engine. "There's an opportunity that you simply will improve its function, but it's far more likely that the hammer will either just bounce off or break something." Other research has shown that older fathers are more likely to possess children with autism and schizophrenia, but the team don't know if the mutations they observed are linked to either disorder. Stefansson's team found certain hotspots within the genome where new mutations seemed to cluster – although the implication of this is often not yet clear.

NANO DRUG DELIVERY

Angela Saji
III Sem B.Sc., BBG

Nano medicine and Nano drug delivery systems are relatively new but rapidly developing science where materials in the Nanoscale range are employed to serve as means of diagnostic tools or to deliver therapeutic agents to specific targeted sites in a controlled manner. Nano Drug delivery systems (NDDs) are a class of Nano materials that have abilities to increase the stability and water solubility of drugs, prolong the cycle time, increase the uptake rate of target cells or tissues and reduce enzyme degradation, thereby improving safety and effectiveness of drugs. NDDs can be administered by various routes including inhalation, oral administration or intravenous injection remaining better for bioavailability. NDDs refer to materials in which at least one of the stages shows dimensions in the range of nanometre scale (1-100 nm) or composed of them as basic units in three dimensional spaces. As an effective means to optimize drug delivery, NDDs have become a research hotspot in the field of pharmacy and biomedicine. Several common NDDs are liposomes, polymeric micellar co-delivery system, dendritic macromolecules used as Nano carrier for the administration and dissolution of insoluble targeted drugs, metal nanomaterials, inorganic non-metallic nanomaterials, composite Nano materials chitosan, alginate, xanthangum, cellulose, nanocrystals, quantum dots, protein and polysaccharide nanoparticles and so on. Nano drug delivery plays an important role in current scenarios due to its efficiency in treating various cardiovascular diseases and even cancer. Artery Stenosis is a common type of CVD which can be treated by delivering the drug to atherosclerotic plaques by Nano drug carrier, to effectively prolong the Half-Life of drug plasma, increase the concentration of lesions and reduce side effects .The treatment strategies of these Nano drug carrier includes regulating lipoprotein level, reducing the degree of inflammation, inhibiting of neovascularisation, preventing coagulation and so on. These treatment strategies are used as intervention to development of AS, reduce plaque area or stabilize vulnerable plaques. Cancer can also be treated by using various types of Nanoparticles for the delivery of an accurate amount of drug to the affected cells such as the cancer or tumour cells, without disturbing the physiology of the normal cells. The science of Nano medicine is currently the most fascinating areas of research. A lot of research in this field in the last two decades has already led to the filling of 1500 patents and completion of several dozens of clinical trials. More research on materials with more consistent uniformity and drug loading and release capacity would be further area of research. The application of metals including gold and silver both in diagnosis and therapy is an area of research that could potentially lead to wider application of Nano medicine in future. With better research and resources, in the future this field of Nano technology can help people in diagnosis and treatment of diseases that seem to be severe these days.

WILL RESEARCHERS REALLY BE ABLE TO USE GENETICS TO HELP US LIVE BOTH LONGER AND HEALTHIER?

Azza Raniya
III Sem B.Sc., BBG

Developing metrics to assist answer these questions and to know the trade-offs between lifespan and health span is the subject of a recent paper by MDI Biological Laboratory scientists in Journals of Gerontology: Biological Sciences, a publication of the Gerontological Society of America. The authors studied various parameters of health in short-lived strains of the round-worm, elegans, with the goal of developing an empirical definition of the onset of adulthood , and of teasing out which health markers are most predictive of an extended and healthy life. With the event of latest genetics tools, scientists are becoming closer to developing therapies to increase human lifespan, but the effect of such therapies on health span (the proportion of life spent in good health) is unclear. While it was always thought that therapies to increase lifespan would also extend health span, new research shows that is not always true. The growing number of anti-aging therapies on the horizon creates a requirement for the development of latest parameters to assess healthy aging. Rather than striving only to prolong longevity, as has been the case in the past, the utilization of such tools will allow scientists to focus their efforts on lifespan-enhancing therapies with the best positive effects on health. "All anti-aging interventions aren't created equal," said post-doctoral researcher Jarrod Rollins, Ph.D., one among the study's lead investigators. "A recent study in C. elegans found, for example, that the proportion of life spent during a frail state is longer in long-lived mutants than in wild-type animals. Our research is aimed toward developing tools to assist scientists assess the effect of lifespan-enhancing interventions on health span". The molecular mechanisms of aging are the centre of attention of research at the MDI Biological Laboratory, located in Bar Harbor, Maine, which is pioneering new approaches to regenerative medicine focused on creating drugs to extend healthy lifespan by enhancing the body's innate ability to repair and regenerate lost or damaged tissues and organs. One marker that the MDI Biological Laboratory scientists found to be predictive of a healthy lifespan in C. elegans was movement speed. Movement speed corresponds to walking speed in humans, which studies have found to be an accurate predictor of longevity. One of the scientists' next steps is going to be to further develop movement speed as a marker for assessing the effect of anti-aging interventions in C. elegans. "As science closes in on the mechanisms underlying aging, the trade-offs between lifespan and health span become a greater cause for concern," said Kevin Strange, Ph.D., president of the MDI Biological Laboratory. "The scientists within the Rogers laboratory are at the forefront of developing metrics to assess the impact of anti-aging interventions on quality of life."

The research was supported by grants to Rogers from the National Institute on Aging of the National Institutes of Health and the Ellison Medical Foundation, also as by Institutional Development Awards (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health.

IS STEM CELL TREATMENT REALLY PROMISING?

Blesson Varghese
III Sem B.Sc., BBG

There is an incredible amount of interest in using stem cells for the treatment of a many diseases, and for good reason. It's already proven an efficient treatment for a few diseases that affect the blood, like leukaemia, and shows tons of promise in regenerative medicine also. Another area which researchers have decided to look into stem cells is the treatment of a genetic disorder that leads to what's called a gain of function mutation. In those instances, a mutated gene creates a protein that has new characteristics and does various things than intended in cells. Success has been seen using this system in a single patient, and investigators decided to expand on this work. A trial on patients aged 13 months to 33 years carrying a gain of function mutation within the STAT1 gene was performed after an international appeal to consortiums and transplant centres. The investigators confirmed the mutation in each patient and traced their affliction to the dysfunction within the gene. The researchers then used chemotherapy to wipe out the patient's bone marrow cells. Somatic cell cultures obtained from healthy donors were then transplanted into the patients with the hope that their bone marrow would be regenerated without mutation or disease. Of the 15 patients, only six survived the regimen. However, of these six, five were totally cured of their ailments.

In India, efforts are being made on several fronts to promote this area in an integrated way. The important features of the strategy are: explore the complete potential of adult and embryonic stem cells (ESCs) through basic and translational research; generate patient specific human ESC lines; enhance creation of animal models for pre-clinical studies; virtual network of centres; creation institutions; generation of well-trained manpower; build partnership with large companies in path-breaking areas; promote closer interactions amongst basic scientists, clinical researchers and the industry. Newer initiatives include: establishment of a dedicated institute for somatic cell science and regenerative medicine with its translational units; GMP and pristine room facilities in medical schools; creation of a system for multi-centric clinical studies using autologous adult somatic cells; national and international training courses for providing training to the students and the young scientists in the both embryonic and adult stem cells; and formulation of guidelines to conduct stem cell research during a responsible and ethically sensitive manner within the country. The core capacity must be nurtured and built to make the specified critical mass to have impact.

The researchers have suggested improvements; in the future, only patients with the worst cases of STAT1-GOF would be selected, and a milder chemotherapy regimen should be utilized. They add, however, that the chemotherapy still must be strong enough to properly eradicate the diseased marrow. A final suggestion is that selected patients should be as young as possible.

A NEW UNIVERSAL LAW ON CONSERVATION OF BRAIN CONNECTIVITY HAS BEEN PROPOSED

Chris Melvina. M
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The study revealed a universal law: Conservation of Brain Connectivity. "This law denotes that the efficiency of information transfer in the brain's neural network is equal in all mammals, including humans". We also discovered a compensation mechanism which balances the connectivity in every mammalian brain. This mechanism ensures that high connectivity in a specific area of the brain, possibly manifested through some special talent (e.g. sports or music) is always countered by relatively low connectivity in another part of the brain. They discovered that brain connectivity namely the efficiency of information transfer through the neural network does not depend on either the size or structure of any specific brain .In other words, the brains of all mammals, from tiny mice through humans to large bulls and dolphins, exhibit equal connectivity, and information travels with the same efficiency within them. They also found that the brain preserves this balance via a special compensation mechanism: when connectivity between the hemispheres is high, connectivity within each hemisphere is relatively low, and vice versa." "Many scientists have assumed that connectivity in the human brain is significantly higher compared to other animals, as a possible explanation for the superior functioning of the human animals. "On the other hand, according to this research "key features are conserved throughout the evolutionary process. Thus, for example, all mammals have four limbs. In this project they wished to explore the possibility that brain connectivity may be a key feature of this kind, maintained in all mammals regardless of their size or brain structure. To this end they used advanced research tools." The project began with advanced diffusion MRI scans of the brains of about 130 mammals, from tiny bats weighing 10 grams to dolphins whose weight can reach hundreds of kilograms (each representing a different species). Brains were removed from dead animals, and no animals were euthanized for the purposes of this study. The next challenge was comparing the scans of different types of animals. And by performing it they discovered that overall brain connectivity remains the same for all mammals, large or small, including humans. In other words, information travels from one location to another through the same number of synapses. It must be said, however, that different brains use different strategies to preserve this equal measure of overall connectivity: some exhibit strong inter hemispheric connectivity and weaker connectivity within the hemispheres, while others displayed the opposite. In future projects they will be investigating on how the brain compensates for the enhanced connectivity associated with specific capabilities and learning processes.

COVAXIN

Deepa R,
III Sem B.Sc., BBG

Indigenous COVID -19 vaccine by Bharat biotech is developed with association with the Indian council of Medical Research ICMR, National Institute of virology NIV. The indigenous, inactivated vaccine is developed and made in Bharat Biotech BSL -3 (BIO-SAFETY LEVEL 3) high containment facility. The vaccine received DCGI approval for phase I and phase II Human Clinical Trials and the trails will commence across India from July, 2020. The primary phase of human clinical trials of indigenous covid-19 vaccine called COVAXIN began in SRM Medical College Hospital and Research Centre in Chennai on Thursday (16-7-2020).

Dr. Satyajit Mohapatra, who is the PI for the clinical trials at the hospital confirm the commencement of the human trials. SRM is one among the 12 institutions chosen by ICMR to conduct trials for the vaccine developed by Hyderabad based Bharat biotech together with ICMR and NIV. "The vaccine springs from a strain of SARS-CoV -2 isolated by ICMR National institute of virology Pune. ICMR and BBIL are jointly working for the preclinical also as clinical development of this vaccine", a politician said. NIV isolated a strain of the novel coronavirus from an asymptomatic Covid-19 patient and transferred it to BBIL early in May. The firm then used it to figure on developing an "inactivated" vaccine - a vaccine that uses the dead virus — at its high-containment facility in Hyderabad. Once the vaccine is injected into a person, it has no potential to infect or replicate, since it's a killed virus. It just serves to the immune system as a dead virus and mounts an antibody response towards the virus," said the corporate, adding that inactivated vaccines usually have a proven safety record. Covaxin then underwent pre-clinical testing on animals like guinea pigs and mice to ascertain if it's safe before the firm approached CDSCO for approval to advance to human trials.

CANCER VACCINES: PREVENTIVE, THERAPEUTIC, PERSONALIZED

Christina Rose George,
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Cancer vaccines are a form of immunotherapy that can help educate the immune system about what cancer cells "look like" so that we can recognize and eliminate them. In case of cancer, the situation is more complicated and this has made it more difficult to develop vaccines to prevent cancer. In particular, unlike bacteria and viruses, which appear foreign to immune system, cancer cells more closely resemble our normal, healthy cells. Furthermore, each individual's tumour is in some sense unique and has its own distinguishing antigens. As a result, more sophisticated approaches are necessary to develop effective cancer vaccines. Viral infections are responsible for the development of several cancers and preventive vaccines play an important role in reducing risk. For instance, cervical cancer and head and neck cancer can be caused by Human Papilloma Virus (HPV), whereas liver cancer can be caused by Hepatitis B virus (HBV). Several vaccines have been developed that can prevent HBV and HPV infection and, as a result, protect against the formation of HBV- and HPV- related cancers. Four of these preventive cancer vaccines have been approved by the U.S. Food and Drug Administration (FDA)- Cervarix, Gardasil, Gardasil-9, HEPLISAV-B.

Fortunately, doctors can now identify targets on patients' tumours that can help distinguish cancer cells from their normal cells. Sometimes these targets are normal proteins that are produced at abnormally high levels by cancer cells, such as prostatic acid phosphatase (PAP), which is often overexpressed by prostate cancer cells. Taking advantage of that insight, the Sipuleucel-T vaccine was developed and received FDA approval in 2010 for the treatment of patients with advanced prostate cancer. Additionally, virus-derived proteins expressed by virus-infected cancer cells offer another promising source of markers that can be targeted through vaccines. Another exception is Bacillus Calmette-Guerin, or BCG, a tuberculosis vaccine that acts as a general immune stimulant. In 1990, BCG became the first immunotherapy of any type to be approved by the FDA and is still used for the treatment of early-stage bladder cancer. In contrast to normal-yet-over expressed proteins like PAP, tumour also displays unique targets that arise as a result of mutations. These are referred to as neoantigens ("new antigens") and they are expressed exclusively by tumour cells and not by any of a patient's healthy cells. With neoantigen vaccines, it is conceivable that immune responses could be directed precisely against patients' tumour cells while sparing their healthy cells from immune attack, thus possibly preventing side effects. In addition to the previously mentioned vaccines, several types of neoantigen vaccines are currently being evaluated, both alone and in combination with other treatments, in a variety of cancer types in clinical trials.

This approach could help scientists to learn more about how hormone release influences mental health, and could eventually offer a new way to treat hormone-linked disorders. Abnormal levels of stress hormones such as adrenaline and cortisol are linked to a variety of mental health disorders, including depression and post-traumatic stress disorder (PTSD). MIT researchers have now devised a way to remotely control the release of these hormones from the adrenal gland, using magnetic nanoparticles. To achieve control over hormone release, Dekel Rosenfeld, an MIT-Technion Postdoc, has developed specialized magnetic nanoparticles that can be injected into the adrenal gland. When exposed to a weak magnetic field, the particles heat up slightly, activating heat-responsive channels that trigger hormone release. This technique can be used to stimulate an organ deep in the body with minimal invasiveness. In the new study, the research team wanted to explore the idea of treating disorders of the brain by manipulating organs. To stimulate these heat-sensitive channels, which naturally occur in adrenal cells, the researchers designed nanoparticles made of magnetite, a type of iron oxide that forms tiny magnetic crystals about 1/5000 the thickness of a human hair. In rats, they found these particles could be injected directly into the adrenal glands and remain there for at least six months. When the rats were exposed to a weak magnetic field about 50 millitesla, 100 times weaker than the fields used for magnetic resonance imaging (MRI) -- the particles heated up by about 6 degrees Celsius, enough to trigger the calcium channels to open without damaging any surrounding tissue. This stimulation triggered a hormone rush doubling cortisol production and boosting noradrenalin by about 25 percent which led to a measurable increase in the animals' heart rates. This method would offer a much less invasive alternative to potential treatments that involve implanting a medical device to electrically stimulate hormone release, which is not feasible in organs such as the adrenal glands that are soft and highly vascularised.

This technique potentially will allow us to study pain, control pain, and have some clinical applications in the future, which hopefully may offer an alternative to medications or implants for chronic pain, With further investigation of the existence of TRPV1 in other organs, the technique can potentially be extended to other peripheral organs such as the digestive system and the pancreas.

RESEARCHERS ACHIEVE REMOTE CONTROL OF HORMONE RELEASE

Dipika V,
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COLD PLASMA, A NEW HOPE IN THE FIELD OF VIRUS INACTIVATION

Gimaya Gilbert,
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Pathogen viruses are becoming an increasing burden for health, agriculture, and the global economy. Classic disinfection methods have several drawbacks, and innovative solutions for virus inactivation are urgently needed. Cold plasma (CP) can be used as an environmentally friendly tool for virus inactivation. It can inactivate different human, animal, and plant viruses in various matrices. When using CP for virus inactivation it is important to set the correct parameters and to choose treatment durations that allow particles to interact with the contaminated material. Reactive oxygen or nitrogen species have been shown to be responsible for virus inactivation through effects on capsid proteins or nucleic acids. The development of more accurate methods will provide information on which plasma particles are crucial in each experiment, and how exactly they affect viruses. Viruses can infect all cell- based organisms, from bacteria to humans, animals, and plants. They are responsible for numerous cases of hospitalization, many deaths, and widespread crop destruction, all of which result in an enormous medical, economical, and biological burden. Each of the currently used decontamination methods has important drawbacks. Cold plasma (CP) has entered this field as a novel, efficient, and clean solution for virus inactivation. Almost every study on CP inactivation of viruses is unique because they either use a specific plasma source [e.g., dielectric barrier discharge (DBD), plasma (micro) jets] with different characteristics (e.g.,. Power, gas treatment time) or they deal with the treatment of different liquid volumes (from micro litres to several millilitres), matrices (e.g., Water, other solutions, surfaces, cells), and viruses (surrogates of human viruses, human, animal, and plant viruses). Such wide diversity makes it difficult to directly compare these studies and to define the mechanistic conclusions or any universal inactivation parameters. To simplify these complexities, we consider here the individual types of viruses that have been subjected to CP treatments. CP treatments have been often focused on enteric viruses such as norovirus, adenovirus, and hepatitis A virus. These are the leading causes of acute gastroenteritis, the second most common infectious disease worldwide, which is responsible for high levels of hospitalization and mortality. Working with human viruses can pose serious health hazards, and such studies require specialized laboratories and equipment. Moreover, infectivity assessments of important enteric viruses, such as norovirus, have been limited owing to a lack of cultivation methods. For these reasons, these viruses are often replaced by surrogate viruses. Different CP sources have also been applied to the surface of various foods, such as blueberries, lettuce and meat and viruses were successfully inactivated without altering the appearance of the treated food. Application of CP in food industry for decontamination has multiple advantages over the most widely used thermal processing of food because it can sustain the freshness and quality of food with minimal impact on the environment because of shorter treatment times and energy requirements.

G4-QUADRUPLEX DNA: A DNA WITH 4 THE STRANDS

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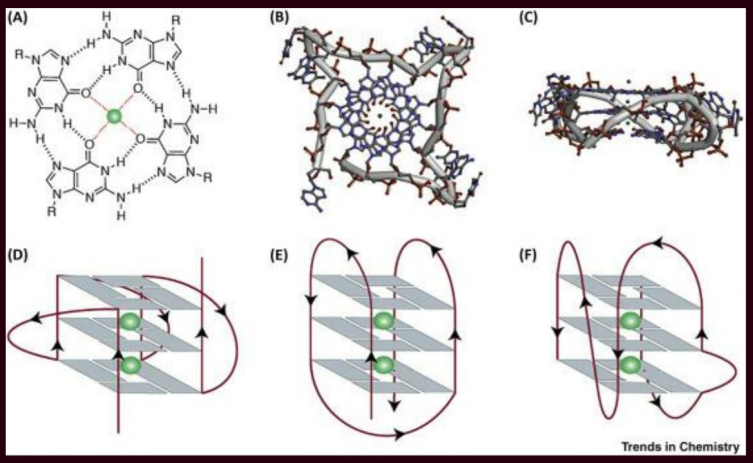

When we think about the DNA the first thing that comes in our mind is it's double helical structure, But actually DNA can take a lot of complex forms known as "supercoils". Research published in the journal Nature communications in the year 2015 October show some images of supercoiled DNA created by cryo-electron tomography together with the super computer simulations. The scientist wanted to know how that DNA crams itself into a tiny nucleus. It's really fascinating that such huge amounts of DNA accompanied in such a small place. Taken the distance between two consecutive base pairs as 0.34 nm (0.34×10^{-9}m), If the length of DNA double helix in a typical mammalian cell is calculated (simply by multiplying the total number of base pair with the distance between two consecutive base pairs, that is $6.6\times10^{9}\times0.34\times10^{9}$m/bp). It comes out to be approximately 2.2 meters. A length that is far greater than the dimension of a typical nucleus (approximately 10^{-6}m). So the scientist tried to look at it one twist and one turn at a time; thereby they found sharp bends, figure 8's, even the coils that look like handcuffs. Here is the one of the model of the Supercoils; As we know most of the research in DNA is invitro conducted in a laboratory environment; but by using an enzyme named as "Human topoisomerase-11 alpha" thereby simulating the conditions inside the human body to show that supercoiled DNA is possible. DNA molecules are known for their spiral shape, most of the DNA have two strands; but most of the people don't know that it can also have four strands which is known as the "G4-DNA" or"G4-quadruplex DNA". The 'G' in the G4 DNA refers to a base known as Guanine, one of the four bases that holds the DNA together and spells out our genetic code. Guanine-rich DNA sequences can fold into four-stranded, non-canonical secondary structures called G-quadruplexes (G4s). The G-tetrad structure was first characterized in a gelatinous substance formed by the guanosines (Gellert et al.1962).

Biologically relevant g-quadruplexes were first discovered in eukaryotic chromosomal telomeric DNA (Henderson et al1987, Sundquist and klug1989). G4-DNA is the topic scientist's want to learn more about because of its medical applications in the field of cancer and neurodegenerative disorders. In 2012 researchers from Cambridge University have claimed that they saw G4 DNA in human cells; they have used a fluorescent biomarker that has been tagged to an antibody which they have created to specifically look for the G4 DNA in human service. They found that G4 DNA turns off in the S phase of cell cycle. The formation of G4 DNA in the human telomerase has been shown to inhibit the activity of telomerase, which is activated in 80 to 85% of Cancer cells and therefore it is considered as the potential anticancer drug target. An interesting research area is the development of molecules with the specific ability to bind and stabilize the G4 structures. This could potentially be used to turn off the expression of the specific genes that are involved in the tumour formation. More recently the G4 DNA have been found the proximal location of promoters, which are mostly TATA -less in a number of human genes involved in growth and proliferation as a potential factor for the transcriptional regulator. The further research in this G-quadruplexes DNA may one day lead to a ground-breaking discovery in the field of medicine.

CANCER SCENARIO IN INDIA WITH FUTURE PERSPECTIVES

Gyan Prakash
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Among various diseases, cancer has become an enormous threat to citizens globally. As per Indian population census data, the rate of mortality thanks to cancer in India was high and alarming with about 8,06,000 existing cases by the end of the last century. Cancer is the second commonest disease in India responsible for maximum mortality with about 0.3 million deaths per year. This is often due to the poor availability of prevention, diagnosis and treatment of the disease. all kinds of cancers are reported in Indian population including the cancers of skin, lungs, breast, rectum, stomach, prostate, liver, cervix, oesophagus, bladder, blood, mouth etc. The causes of such high incidence rates of those cancers could also be both internal (genetic, mutations, hormonal, poor immune conditions) and external or environmental factors (food habits, industrialization, over growth of population, social etc.). On account of those facts, this article describes the status of varied sorts of cancers in India and its comparison at global level. Besides, attempts are made to explain the main causes of cancer along with their preventive measures. Additionally to this, efforts have also been made to predict the effect of accelerating number of cancer patients on the Indian economy.

STARING INTO SPACE

Harshitha S P
III Sem B.Sc., BBG

This year, Telescope collaboration unveiled perhaps the most memorable picture of 2019: astronomers glimpsed the blackness of a black hole for the first time ever. In April, the International Event Horizon Telescope obtained the first direct image of a black hole. To produce it, researchers coaxed a network of radio telescopes to take simultaneous readings from around the Earth. In a year that marked the 50th anniversary of the Apollo Moon landings, lunar exploration was high on the agendas of space agencies. In January, China's Chang'e-4 probe became the first spacecraft to land safely on the lunar far side. Its rover, Yutu-2, continues to roll across the dusty soils of Von Kármán crater. Other attempts to explore the Moon were not so successful. In April, an Israeli-led effort to put the first private spacecraft onto the Moon ended in a crash landing. The same thing happened to India's Vikram lander in September, although the orbiting part of that mission — known as Chandrayaan-2 is still circling the Moon as planned. On-going Mars missions returned a host of results. The French-built seismometer on NASA's Insight lander detected the first-ever 'marsquakes'. Roughly 600 kilometres away, NASA's Curiosity rover sniffed record-high levels of methane gas in the Martian atmosphere in June — a mystery that scientists have yet to explain, especially because the methane vanished in days. In February, NASA officially bid farewell to its stalwart Mars rover. In the farther reaches of the Solar System, Japan's Hayabusa2 probe collected a sample from the surface of the asteroid Ryugu in February. Then, in July, it dropped a small pellet onto the asteroid and blasted its surface, before descending to gather some of the freshly exposed material. Hayabusa2 will return its samples to Earth next year. Far beyond Pluto, NASA's New Horizons spacecraft passed a 35-kilometre-long object known as Arrokoth. Its bizarre shape, resembling two pancakes stuck together, gave humanity our closest glimpse yet at an icy, primordial world. This year even. brought a visitor from beyond the Solar System. The interstellar Comet 2I/Borisov whizzed past the Sun earlier this month. It is only the second interstellar object known to have visited our Solar System, following 2017's 'Oumuamua.

DESIGNER PROTEIN ACTS AS A SWITCH FOR CELLULAR CIRCUITRY

Jerin Raju Varghese
III Sem B.Sc., BBG

Scientists have designed an artificial protein that controls the inner working of the cells. In a couple of papers, published on July 24 in *Nature*, the researchers demonstrated how this tool can be used to modify gene expression, manage protein binding events, and signal functional changes in the cell in response to environmental conditions. "Cells receive stimuli, then have to figure out what to do about it. They use natural systems to tune gene expression or degrade proteins, for example," says Bobby Langan, a co-author of both the studies and a former graduate student at the University of Washington in an announcement. The newly designed tool was named LOCKR for Latching, Orthogonal Cage/Key protein that manipulate the inbuilt systems by introducing bioactive peptides in their circuitry. The peptides only pop out when released by specific molecular "keys." LOCKR consists of six helixes that are tightly bound to form a cage. One of the helical structures, bound more loosely than the others, can be displaced by a specific molecule, the key. When the key fits into the place, the helix moves aside and reveals a peptide that is customized to perform a particular function. In their demonstrative studies, the researchers used this LOCKR tool to trigger cell death, degrade specific proteins, and direct the mobility of materials through living cells. Individual LOCKR proteins can also be connected to form circuits. These circuits can make changes within the cell in response to internal and external stimuli as well. The researchers first tested their tool in yeast, cells later successfully designed a modified version that could work in lab-grown human cells. "It signals the dawn of de novo designer proteins," says Ahmad Khalil, a biomedical engineer at Boston University who was not involved in the research, in an interview with *The Washington Post*. De novo proteins, designed start to finish by humans, carries advantage over repurposed natural proteins. While naturally occurring proteins may serve different functions and work via multiple mechanisms, synthetic proteins can be built to do just one thing. LOCKR that is among the first de novo proteins ever designed, can only function as a molecular switch.

LAB MADE HYBRID VIRUS RESEMBLES SARS-COV-2

Joseph Biju
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Sean Whelan, PhD, the Marvin A Brennecke Distinguished Professor and Head of the Department of Molecular Microbiology and co-senior author said that he has never ever had this many requests for a scientific material in such a short time period.

The SARS-CoV-2 deadly virus that causes COVID-19 can only be studied safely under high-level bio safety protection. Researchers handling the transmittable and infectious virus need to wear full-body biohazard suits with pressurized respirators, as well as work inside laboratories with specialized airflow systems and multiple containment levels. These safety preventative measures slow down efforts to find drugs and vaccines for COVID-19 as the required bio safety facilities are not accessible to lots of researchers. To aid remedy that, scientists at Washington University School of Medicine in St. Louis have developed a hybrid virus that will certainly make it possible for many more researchers to enter the fight against the COVID-19. By swapping one of its genes for one from SARS-CoV-2, the scientists genetically modified a mild virus. The hybrid virus infects cells and is recognized by antibodies like SARS-CoV-2, however, can be handled in a lab with ordinary safety precautions, which most of the lab has. The outcome of the research is published in Cell Host and Microbe. Sean Whelan, PhD, the Marvin A Brennecke Distinguished Professor and Head of the Department of Molecular Microbiology and co-senior author said that he has never ever had this many requests for a scientific material in such a short time period. He added that they have distributed the virus to researchers in Argentina, Brazil, Mexico, Canada, and certainly, throughout the United States. They have requests pending from Germany, and U.K. People came to know that we were working on this and started requesting the material even before we published. Whelan and his colleagues including Michael S Diamond, MD, PhD, the Herbert S Gasser Professor of Medicine and co-senior author, and Brett Case, PhD, a postdoctoral researcher in Diamond's laboratory and co-author, and Paul W Rothlauf, a graduate student in Whelan's laboratory and co-author started working with vesicular stomatitis virus (VSV) to produce a model of SARS-CoV-2 that would be safer to work with. As it is fairly innocuous and easy to manipulate genetically, this virus is a workhorse of virology labs. VSV is primarily a virus of livestock, horses, and pigs, it occasionally infects humans, causing a moderate flu-like disease that lasts 3 -5 days. Proteins are present on the surfaces of viruses which they use to attach and infect cells. The scientists removed VSV's surface-protein gene and replaced it with the one from SARS-CoV-2, referred to as a spike protein, and dubbed the hybrid virus VSV-SARS-CoV-2. The modification developed a new virus that targets cells like SARS-CoV-2 yet lacks the other genes required to cause extreme disease conditions. The scientists revealed that the hybrid virus was identified by antibodies significantly like a real SARS-CoV-2 virus that came from a COVID-19 positive patient, by using serum from COVID-19 survivors as well as purified antibodies. Serum or antibodies that protected against the hybrid virus from infecting cells likewise blocked the real SARS-CoV-2 virus from infecting the cells and causing COVID-19. Serum or antibodies that failed to stop the hybrid virus also failed to hinder the coronavirus that causes COVID-19. Additionally, a decoy molecule was similarly efficient at misdirecting both viruses and avoiding them from infecting cells. Whelan said that people certainly develop antibodies against other proteins of SARS-CoV-2, however, for protection against COVID-19, it's the antibodies against spike protein that appear to be crucial. Thus, for the human immune system, a virus with a spike protein always looks like SARS-CoV-2. This VSV-SARS-CoV-2 hybrid virus could help researchers review a series of antibody-based preventives as well as therapies against coronavirus. The hybrid virus could be used to measure whether a COVID-19 survivor has enough neutralizing antibodies to donate plasma to COVID-19 patients, to determine antibodies with the potential to be developed into antiviral medications, or to evaluate whether a speculative vaccine evokes neutralizing antibodies. Diamond, who is also a professor of molecular microbiology, and of pathology and immunology said that one of the issues in assessing neutralizing antibodies is that a lot of these examinations require a BSL-3 facility, and also the majority of clinical laboratories as well as companies don't have BSL-3 facility. Using this hybrid virus, you can take the antibodies, plasma or serum, and high-throughput evaluations at BSL-2 facility itself, which every laboratory has, without a threat of getting infected by COVID-19. As well as we know that it associates almost perfectly with the info we get from authentic contagious SARS-CoV-2 coronavirus. Diamond said that considering that the hybrid virus resembles SARS-CoV-2 to the immune system of the body yet does not develop severe disease conditions, it is a potential vaccine candidate. Diamond, Whelan, and his colleagues are performing studies on animal models to assess the possibility.

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GENETICALLY MODIFIED ORGANISMS (GMOS)

Kezia Abigail L
III Sem B.Sc., BBG

A genetically modified organism is an organism in which the genetic material has been modified through biotechnology in a way that does not occur naturally by multiplication or natural recombination. Cloned animals are also included in genetically modified organisms. People have been modifying the genomes of plants and animals for decades now by using breeding techniques. The selection for specific, desired traits artificially has resulted in a variety of different organisms, ranging from sweet corn subsequent generations, has been limited to naturally occurring variations. In recent years advances in the field of genetic engineering have allowed for precise control over the genetic changes introduced into an organism. Today, with the help of genetic engineering, we can incorporate new genes from one species into a completely unrelated species, optimizing agricultural performance or facilitating the production of commercially valuable pharmaceutical products. Crop plants, domestic animals, and soil bacteria are some of the examples of organisms that have been subject to genetic engineering. Agricultural plants are one of the most frequently stated examples of genetically modified organisms. Some benefits in Agricultural biotechnology - there is increase in crop yields, reduced costs for food or drug production, reduced need for pesticides, enhanced nutrient composition and food quality, resistance to pests and disease, greater food security, and medical benefits to the worlds growing population. There have always been advances made in developing crops that mature faster and can tolerate aluminum, boron, salt, drought, frost, and other environmental stressors, allowing plants to grow in conditions where they might not otherwise thrive. Other applications include the animals – they have also been genetically engineered to increase yield and decrease susceptibility to disease. The pharmaceutical industry is another frontier for the use of GMOs. In the year 1986, human growth hormone was the 1st protein pharmaceutical made in plants and in the year 1989, the 1st antibody was developed. Both the research groups used tobacco, which since dominated the industry as the most extensively studied produced plants species for the expression of foreign genes. As of 2003, variety of antibodies that are produced in plants had made it to clinical trials. The use of genetically modified animals has also been vital in medical research. Transgenic animals are routinely bred to carry human genes, or mutations in specific genes, thus allowing the study of progression and genetic determinants off various diseases.

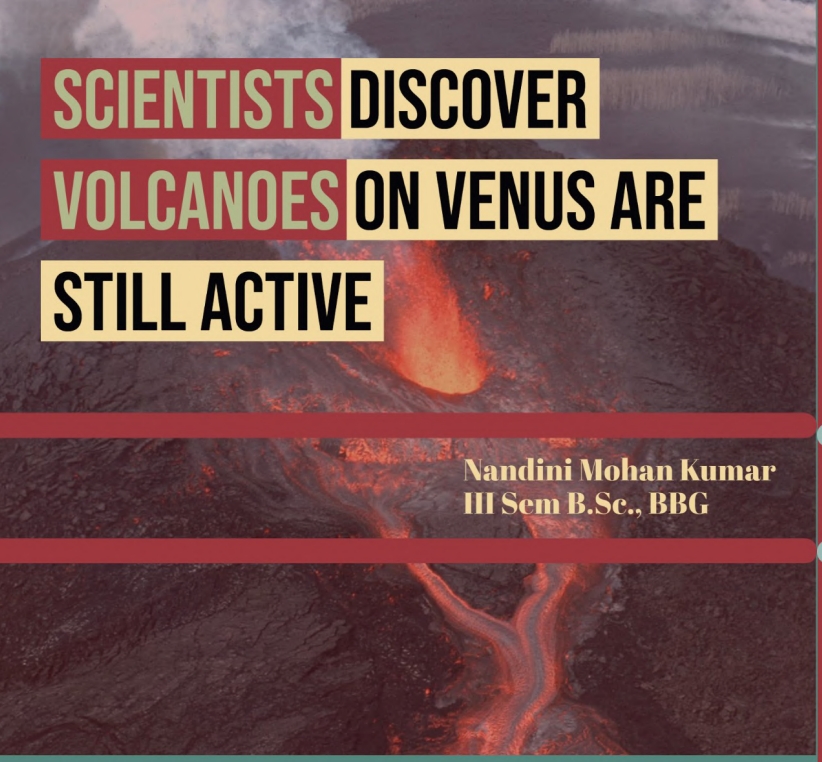
GENEPHARMA: EXPRESSION & DETECTION SYSTEM

Monisha
III Sem B.Sc., BBG

Using the genome-editing technology CRISPR, re-searchers can make targeted cuts to the genome or insert useful genes, which are called a gene knock-in. In this case, scientists successfully inserted or knocked in the cattle SRY gene, a gene responsible for initiating the male development into a bovine embryo. It was the 1st demonstration of a targeted gene knock- in for large sequences of DNA through embryo- mediated genome editing in cattle. “we anticipate Cosmo's offspring that inherit this SRY gene will grow and look like males, regardless of whether they inherit a Y chromosome” , said Alison Van Eenennaam, animal geneticist with UC (University of California) ,Davis Department of Animal Science. Van Eenennaam says part of the motivation to produce more male cattle was due to the fact that male cattle are about 15 percent more efficient at converting feed into weight gain. Therefore, they are more fuel – efficient than females. Additionally, they tend to be processed at a heavier weight.

It could also be a win for the environment, were fewer cattle are required to produce the same amount of beef. ‘Ranchers could produce some females as replacement and direct a higher proportion of male cattle for market' said Joey Owen, a postdoctoral researcher in animal science who is leading the project with Van Eenennaam.

The SRY gene was inserted into bovine chromosome 17, that is a genomic safe harbour site. This ensures the genetic elements function predictably and doesn’t disrupt the expression or regulation of adjacent genes. Chromosome 17 was chosen after the unsuccessful attempts to knock-in the gene on the X chromosome, which would have resulted in a bull that produced only male offspring. Cosmo is expected to produce 75 percent male offspring -- the normal 50 percent XY animals, and another 25 percent XX animals that inherit the SRY gene. "It took two and a half years to develop the method to insert a gene into the developing embryo and another two years to successfully establish a pregnancy," said Owen. But in April’ 2020, a healthy 110-pound male calf was born. "This has been a real labour of love," said Van Eenennaam. She said this is just the dawn of the research. Cosmo will reach sexual maturity in a year, and he will be bred to study if inheriting the SRY gene on chromosome 17 is sufficient to trigger the male developmental pathway in XX embryos, and result in offspring that will grow and look like males. Cosmo and his offspring will not enter the food supply, as the Food and Drug Administration regulates gene-editing of animals as if they were drugs. This project was supported by Biotechnology Risk Assessment Grant Program from the U.S. Department of Agriculture, the California Agricultural Experiment Station at UC Davis and the USDA NIFA National Needs Graduate and Postgraduate Fellowship



SCIENTISTS DISCOVER VOLCANOES ON VENUS ARE STILL ACTIVE

Nandini Mohan Kumar
III Sem B.Sc., BBG

A new study has identified 37 active volcanic structures on Venus recently. This study has provided some of the best evidence that Venus is still a geologically active planet. A research paper on the work that was conducted by researchers at the University of Maryland and the institute of geophysics at ETHU Zurich, Switzerland, was published in the journal nature geoscience on July 2020. "This is the first time we are able to point to specific structures and say 'Look this is not an ancient volcano but one that is active today, dormant perhaps, but not dead", said Lauren Montesi, a professor of geology at UMD and Co-author of the research paper. "This study significantly changes the view of Venus from a mostly inactive planet to one whose interior is still churning and can feed many active volcanoes". Scientists have known for some time that Venus has a younger surface than planets like Mars and Mercury that have cold interiors. Evidence of a warm interior and geologic activity dots the surface of the planet in the form of ring-like structures called as coronae that form when plumes of hot material deep inside the planet rise through the mantle layer and crust. It is similar to the way mantle plumes formed the volcanic Hawaiian Islands.

But it was thought that the coronae on Venus were probably signs of ancient activity, and that Venus had cooled enough to slow geological activity in the planets interior and harden the crust so much that any warm material from deep inside would not be able to puncture through. In addition, the exact processes by which mantle plumes formed coronae on Venus and the reasons for variation among coronae have been matters for debate. In the new study, the researchers used numerical models of thermo mechanic activity beneath the surface of Venus to create high resolution, 3D simulations of coronae formation. Their simulations provide a more detailed view of the process than ever before. The result helped Montesi and his colleagues identify features that are present only in recently active coronae. The team was then able to match those features to those observed on the surface of Venus, revealing that some of the variation in coronae across the planet represents different stages of geological development. The study provides the first evidence that coronae on Venus are still evolving, indicating that the interior of the planet is still churning. "The improved degree of realism in these models over previous studies makes it possible to identify several stages in corona evolution and define diagnostic geological features present only at currently active coronae, "Montesi said. "we are able to tell that at least 37 coronae have been very recently active. "The active coronae on Venus are clustered in a handful of locations, which suggests areas where the planet is most active, providing clues to the workings of the planet interiors. These results may help identify target areas where geologic instruments should be placed on future missions to Venus, such as Europe's Envision that is scheduled to launch in 2032.

CURRENT SCENARIO OF COVID-19 IN INDIA

Neha R
III Sem B.Sc., BBG

Globally, 15,445,043 people have been infected with the Coronavirus (Covid-19) India so far. While 8,763,516 people have recovered, as many as 632,173 fatalities have been registered till now. AIIMS Delhi on Friday administered first dose of Bharat Biotech's Covaxin to a 30-year-old male volunteer. The subject will be monitored for two weeks after which he will be given the second dose. The Covid-19 tally in India rose to 12,87,945 on July 24th, 2020 after 49,311 fresh cases were reported within a span of 24 hours. With unabated rise in the coronavirus cases, the Centre has asked all states to stay away from organising large congregation, ensure social distancing and webcast the Independence Day events. In an advisory, the Home Ministry said Covid warriors like doctors, health and sanitation workers should be invited in the ceremony as recognition of their service of battling the pandemic. It said some people who have recovered from the infection might also be invited. No school children will also participate in the celebrations this year. "At the Red Fort, instead of the 900-1,000 invitees every year, around 250 people will be present as the Prime Minister addresses the nation," an official with the Archaeological Survey of India (ASI) told The Indian Express. The final list will be prepared by the Defence Ministry. The Centre scheduled to hold a video conference with eight states, which it viewed as a "**cause of concern",** to check the spread of the virus. The meeting, scheduled for Friday, featured a detailed discussion between a team of experts from the Centre as well as senior Health Ministry officials and officers from Andhra Pradesh, Bihar, Telangana, Odisha, West Bengal, Assam, Karnataka, and Uttar Pradesh, The Indian Express has learnt. Globally, 15,445,043 people have been infected with the virus so far. While 8,763,516 people have recovered, as many as 632,173 fatalities have been registered till now. The United States continued to remain the worst-affected followed by Brazil and India.

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THE HAIR-RAISING REASON FOR GOOSE BUMPS

Nisha Jain
III Sem B.Sc., BBG

We think that the development of goose bumps in humans is a vestigial reflex. In apes, it raises the body's hair, and would have made our ancient ancestors appear larger. This in turn could help to frighten predators. Alternatively, perhaps the phenomenon helped catch air in the fur, making it more insulating. Physiologically, it's fairly straightforward. Adrenaline stimulates tiny muscles to pull on the roots of our hairs, making them stand out from our skin. That distorts the skin, causing bumps to form. Call it horripilation, and you'll be right-bristling from cold or fear. Next, the researchers confirmed that the nerve indeed targeted the stem cells. The sympathetic nervous system is normally activated at a constant low level to maintain body homeostasis, and the researchers found that this low level of nerve activity maintained the stem cells in a poised state ready for regeneration. Under prolonged cold, the nerve was activated at a much higher level and more neurotransmitters were released, causing the stem cells to activate quickly, regenerate the hair follicle, and grow new hair. The sympathetic nerve reacts to cold by contracting the muscle and causing goose bumps in the short term, and by driving hair follicle stem cell activation and new hair growth over the long term. The researchers also investigated what maintained the nerve connections to the hair follicle stem cells. When they removed the muscle connected to the hair follicle, the sympathetic nerve retracted and the nerve connection to the hair follicle stem cells was lost, showing that the muscle was a necessary structural support to bridge the sympathetic nerve to the hair follicle. With these experiments, the researchers identified a two-component system that regulates hair follicle stem cells. The nerve is the signaling component that activates the stem cells through neurotransmitters, while the muscle is the structural component that allows the nerve fibers to directly connect with hair follicle stem cells. “You can regulate hair follicle stem cells in so many different ways, and they are wonderful models to study tissue regeneration,” Yulia Shwartz, a postdoctoral fellow in the Hsu lab said. “This particular reaction is helpful for coupling tissue regeneration with changes in the outside world, such as temperature. It’s a two-layer response: Goosebumps are a quick way to provide some sort of relief in the short term. But when the cold lasts, this becomes a nice mechanism for the stem cells to know it’s maybe time to regenerate new hair coat.”

PLASMA THERAPY NO MAGIC CURE FOR CORONAVIRUS: EXPERTS

Sai Charan Reddy K
III Sem B.Sc., BBG

The convalescent plasma therapy is no "magic bullet" to deal with coronavirus, and only large-scale controlled trials can ascertain its efficacy as part of the treatment strategy, top medical experts said on May 4th 2020, even as several states are considering the use of the therapy to treat critically-ill COVID-19 patients. The therapy involves taking antibodies from the blood of a person who has recovered from COVID-19 and transfusing those antibodies into an active coronavirus patient to help kick start the immune system to fight the infection.

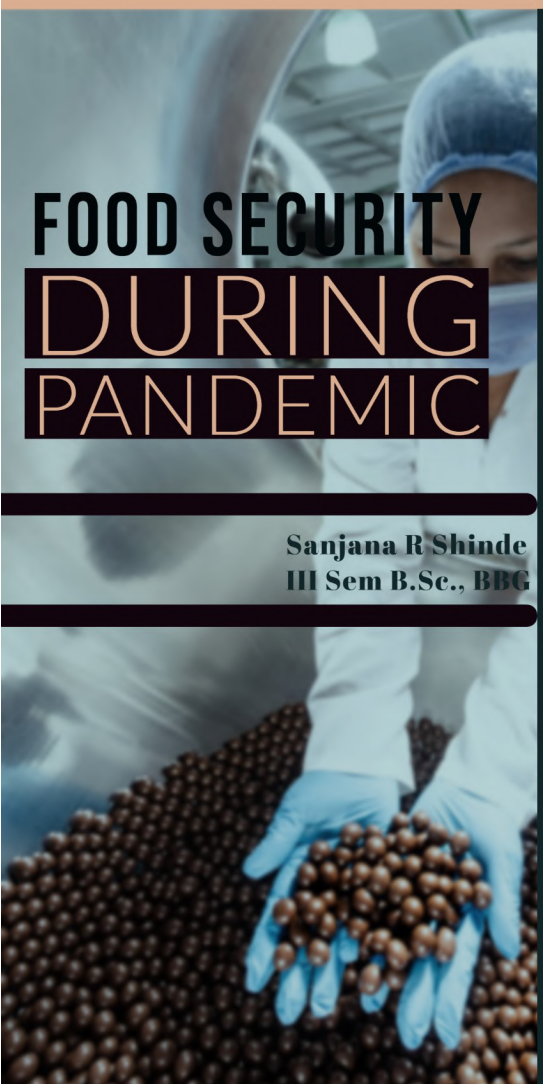
Director of AIIMS, Delhi, Randeep Guleria said there have been very few convalescent plasma therapy trials as far as COVID-19 is concerned, and only in very few patients it has shown some benefit. "It is just one part of the treatment strategy. It helps improve the person's own immunity by giving what we call passive immunity because the antibodies in the plasma enter the blood and try to help fight the virus in the afflicted individual. It is not something which will dramatically make a difference," Guleria told PTI. Research should be done on a multi-pronged treatment strategy and should not be focused on only one strategy, the AIIMS Director said. "You will need to give it to a large number of individuals, more than 200 or 300 people and then analyze the data...We should go ahead in research mode giving it to more people and do a proper well conducted study so as to know one way or the other," Guleria said.

Dr Vivek Nangia, Director Pulmonology, MICU and Sleep Disorders, Fortis Hospital, Vasant Kunj, said the therapy is only in the experimental stage, but it is promising as there is a clinical knowledge involved, and also some experiments and past experience behind it having been used for SARS and H1N1 epidemics in a limited manner. As per reports, a patient who was administered plasma therapy for the first time at a private hospital was discharged last week after being cured, while the first person to undergo plasma therapy in Maharashtra had died in Mumbai's Lilavati Hospital. Chief minister Arvind Kejriwal had said that the Delhi government will not stop clinical trials of plasma therapy to treat severally-ill COVID-19 patients as its initial results are good. Rajasthan Chief Minister Ashok Gehlot on Sunday said that with the ICMR nod, SMS hospital in Jaipur started convalescent plasma therapy on COVID-19 patients on May 4th 2020, while Maharashtra, which had started the trials in April after a nod from the ICMR, is considering continuing with it despite the Union health ministry warning. However, the degree of antibody response that a person throws and the timing is variable, making it difficult to have a predictable standard protocol, he said. It is too early to say if plasma treatment is the only way and it has its own risks also, the AIIMS professor said, adding that at present it is at best an experimental therapy and definitive answers cannot be obtained without large-scale trials. Dr Pankaj Kumar, Head of Critical Care Unit Fortis Hospital, Shalimar Bagh, echoed similar views, saying trials till now are too small to clear doubts about the therapy and large-scale trials should be done. "Theoretically speaking it should be helpful because we are taking the antibodies from a person who has had the infection. But it is still experimental and have to weigh the risks and benefits," he told PTI..

QUANTUM COMPUTING TO STUDY GENETIC DISEASES

Lalramthari
III Sem B.Sc., BBG

Researchers at the University of Virginia School of Medicine say they are exploring the potential of quantum computers to help us understand genetic disorders. Stefan Bekiranov, PhD, and colleagues have reported the development of an algorithm in their new research to allow researchers to study genetic diseases using quantum computers, once there are much more powerful quantum computers to run it. The algorithm is a complex set of operating instructions which will help advance quantum computing algorithm to be developed and this could lead to the advancement in the field of genetic research one day. Quantum computers are still in their infancy. But when they are developed fully, possibly within a decade, they will offer computing power on a scale unimaginable using traditional computers. The challenge is that the technology is technically onerous. Many quantum computers have to be kept at near absolute zero, the equivalent of more than 450 degrees below zero on the Fahrenheit scale. Even then, the movement of molecules surrounding the quantum computing elements can disturb the calculations, so algorithms not only have to contain instructions for what to do, but for how to compensate when errors occur. "Our goal was to develop a quantum classifier that we could implement on an actual IBM quantum computer. But the major quantum machine learning papers in the field were highly theoretical and required hardware that didn't exist. We finally found papers from Maria Schuld, PhD, who is a pioneer in developing implementable, near-term, quantum machine learning algorithms. Our classifier builds on those developed by Schuld," Bekiranov said. The new algorithm essentially sorts the genomic data. It can decide if a test sample comes from a disease or control sample exponentially faster than a conventional computer. For example, if they used all four building blocks of DNA for the classification, a conventional computer would execute 3 billion operations to classify the sample. The new quantum algorithm would need only 32, this will help scientists to sort through the vast amount of data required for genetic research. Also is a proof-of-concept of the usefulness of the technology for such research.



FOOD SECURITY DURING PANDEMIC

Sanjana R Shinde
III Sem B.Sc., BBG

Food security exists when all people, at all times have both physical and economic access to sufficient food to satisfy their dietary needs for productive and healthy lives.

Some groups are going to be more at risk than others for the food security impact of a pandemic. The majority at-risk populations in most emergency situations are people who are already battling hunger, health, and poverty. These populations are going to be at a greater risk during a severe pandemic. Additionally to these groups, many other households are susceptible to the impact of a severe pandemic due to the way it's going to affect economic and social systems. Any household that has not taken necessary actions to organize for a severe pandemic will face greater difficulties in dealing with the impacts of spreading disease. Groups typically in danger during pandemic are people with limited or irregular income , people that cannot build up emergency reserves of cash or food, people in poor health (especially malnutrition, chronic disease, and compromised immune systems) ,Those living with stigma (people living with HIV, prisoners and their families, the unsound , the disabled) , The isolated (living in a remote location or having no social network), The homeless or internally displaced, Those with little or no transportation, Orphans and vulnerable children , those that depend on markets for the bulk of food purchases (experts believe that market systems could also be severely impacted), People without knowledge on how to equip oneself against an epidemic , Those employed in occupations which will be severely impacted (tourism, restaurants, taxi drivers, etc.), people who depend on public transportation to reach their jobs, people that migrate for income.

In many countries food security is handled at the national level. However, during a severe pandemic, national governments would also be overwhelmed and may not be able to provide timely assistance to each municipality. The most important thing to do to is start planning for your municipality now, in the likely event that your municipality will need to become food self-sufficient for a period of time.

Municipal leaders will want to take the required steps.

Work with national governments and personal sector providers to secure essential food stocks (food availability) during successive periods (waves) of 6–12 weeks when normal supplies of food could also be disrupted.

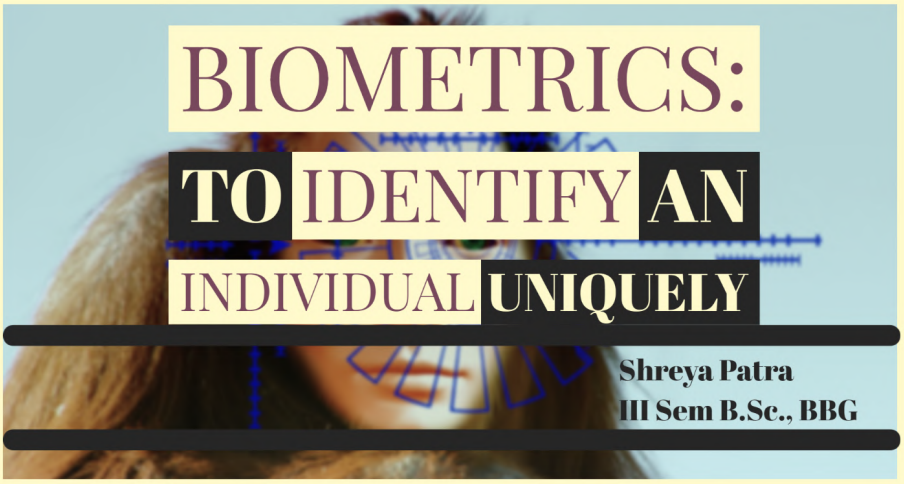
Ensure, that the population can obtain the food they have (food access), especially the most vulnerable individuals. Educate the general public about the need of increased hygiene, nutrition, and safe food and water storage. Work with national and regional governments to minimize malnutrition and other debilitating diseases in order that people's bodies can make the most of the foods they eat (food utilization).

A wide range of actions can support and protect food security during a pandemic. Most of these responses depend upon early planning, which is why preparedness is so important. After considering a variety of responses, the municipal leadership team should determine which actions best suit the local context. Municipalities can help reduce possible food emergencies by paying close attention to what's happening at the local level in terms of food security. Building community resilience is vital to surviving disasters. The way to build resilience is to discuss, plan, prepare, and invest time and money long before a disaster is present in your municipality. Your immediate actions can help reduce the negative impact that an epidemic, or other emergency, may have on the food security of your municipality because, by the time you notice food shortages it's going to be too late to supply more food locally or to expect that national governments or international agencies can get food to you in time, Transporting food to your communities are going to be difficult if transportation systems break down. Even if you manage to get food to your communities, purchasing and stockpiling food to get through a 6–12 week pandemic wave will become very expensive if food prices rise.

ANKYLOSING SPONDYLITIS

Stacey L Jacob
III Sem B.Sc., BBG

Ankylosing spondylitis may be a rare type of arthritis that affects the joints and ligaments of your spine. 'Ankylosing' means stiff and 'spondylo' means vertebra. Ankylosing spondylitis disease can affect other large joints, and may be associated with problems in your eyes, skin, bowel and heart. Ankylosing spondylitis is also called Marie-Strumpell disease or Bechterew's disease. Although there's no known cure for Marie-Strumpell disease , treatment can relieve pain and other symptoms. The causes of Marie-Strumpell disease aren't yet understood. However, doctors believe genetics may play a big role,because Ankylosing spondylitis disease tends to run in families. Also, most of the people with Ankylosing spondylitis disease share an equivalent gene. The more common symptoms include pain and stiffness at the lower back, buttocks, mid-back or neck, pain and stiffness typically worsens in the morning or after sitting for a long time. Pain and stiffness which increases with activities, joint pain and swelling, usually within the larger joints, recurrent or recalcitrant enthesopathy (tendon pain), for instance , Achilles tendon pain; lateral epicondylitis (lateral epicondylalgia or extensor tendinopathy); patella (knee cap) tendinopathy; plantar fasciitis (base of heel pain), decreased ability to do daily activities including work, home and recreational interests, fatigue or tiredness, Other organs also can be affected with on-going inflammation, including the eyes, the skin, the lungs and therefore the alimentary canal . The aim of treatment is to decrease back pain and stiffness, and stop or delay spinal deformity or other complications. Ankylosing spondylitis disease treatment includes physiotherapy, different types of exercise to strengthen your back, Stimulate movement in the spine and reduce pain. Surgery could also be recommended. Joint replacement surgery may be recommended to improve pain and movement in the affected joint if the joint has become severely damaged. However, most of the people with Ankylosing spondylitis disease don't need surgery.



BIOMETRICS: TO IDENTIFY AN INDIVIDUAL UNIQUELY

Shreya Patra
III Sem B.Sc., BBG

The physiological or behavioural identification of an individual is known as biometric. Greek 'bios' means life and 'metric' means measure. Fingerprint authentication is one of the oldest forms of biometric authentication processes. Apart from criminal detection and other security purposes, now-a-days the application of biometric authentication has got an extra edge in banking, transportation, corporate sector, libraries, educational institutes, public sectors, military departments, forensic departments and many others. In 2009, the Planning Commission of India introduced the AADHAR card system to facilitate unique identification of every Indian with the help of biometric information such as finger scan, eye scan etc. This biometric information of an individual remains valid through life. Technology has gradually developed from manual microscopic identification to identification by computerised data based algorithms. A person's biometric data which is already stored in the database is called the 'template' and the captured data is matched with the template for authentication. There are several types of biometric traits that are classified into two categories viz. behavioural and physiological biometrics. Typing rhythm (keystroke dynamics), signature, voice and gait belong to behavioural biometrics; whereas physiological biometrics include vein pattern, hand geometry, facial feature, ear feature, body odour, fingerprint, eye scan characteristics and DNA test.

- **Keystroke dynamics –** The combination of typing rhythm and the typing characteristics of a person is known as keystroke dynamics and this is one of the unique biometric features of a person.

⇒ **Signature –** Analysing the handwriting style, especially the signature of a person is very useful tool for biometric authentication

⇒ **Voice –** Recognition of voice manually or by using computer software is called auditory biometry.

⇒ **Gait –** The manner of walking or running, the gait, is the type of behavioural biometry. This is important in case of analysing the CCTV footage.

- **PHYSIOLOGICAL BIOMETRICS**

⇒ **Vein pattern –** The distribution pattern of the veins inside the palm or finger is unique for an individual and hence it is another type of biometry.

⇒ **Hand geometry –** Geometric feature of hand is also a unique feature of an individual.

⇒ **Facial features –** Recognition of facial characteristics is a commonly used process of authentication and belongs to visual biometry.

⇒ **Ear features –**Biometrics by analysing ear features.

⇒ **Odour –** The body odour is unique.and is used to identify individuals based on the unique chemical pattern

⇒ **Fingerprint –**Fingerprints are analysed to get identity.

⇒ **Eye (Iris/Retina) –**Iris and retinal scanning are known as "ocular-based" identification technologies, meaning they rely on unique physiological characteristics of the eye to identify an individual.

⇒ **DNA test –** The blueprint of DNA sequencing is known as DNA fingerprint.

⇒ 'DNA fingerprint' is the ultimate device in biometrics. However, since this is a quite expensive and complicated process, further research is required to make it usable conveniently.

CELL PROFILING METHOD SET TO ACCELERATE DISCOVERY OF DRUGS FOR TUBERCULOSIS

Skanda Athreya Dutt
III Sem B.Sc., BBG

A new technology which integrates high throughput imaging and machine learning could speed up the process of drug discoveries to fight tuberculosis, which since generations has killed vast no. of people worldwide than any other disease caused by a single agent, every day 4000 people are killed. Contemporary treatment requires multiple drugs for at least six months and sometimes years, and with growing antibiotic resistance, the urgency for finding new treatments is increasing. However, drug discovery typically requires production of hundreds of derivatives of an original compound in order to find the most effective version. The new technology called MorphEUS (Morphological Evaluation and Understanding of drug Stress) can provide a rapid, efficient, cost-effective way to detect how specific compounds act to destroy *Mycobacterium tuberculosis* (M.tb), the bacterium which causes tuberculosis. "We urgently need shorter, more effective TB therapies, and MorphEUS enables us to screen through drug candidates, see how they actually affect the cell, and learn which drugs have unique ways to kill the M. tb," said Bree Aldridge, associate professor of Molecular Biology and Microbiology at Tufts University School of Medicine and senior author on the associated paper about the new platform published online in the Proceedings of the National Academies of Sciences (PNAS) on July 17. Aldridge and her colleagues applied MorphEUS to 34 antibiotics that are currently available for which modes of action were already established and three non-commercial compounds. MorphEUS categorized the drugs correctly 94 percent of the time while, in the remaining instances, MorphEUS had identified previously unknown target pathways. The search for new TB treatments has been hindered by hurdles in identifying the biological activity of compounds early in the drug discovery process and the need to simplify the mechanism of action of existing therapies..

Antibacterial kill pathogens via specific molecular actions, for instance, they do so, by destroying the microbe's cell wall or inhibiting protein synthesis. The drugs leave clues to their particular modus operandi: characteristic physical unravelling of the bacterial cells, which may affect the length, width, shape of structures like the chromosome, staining ability, and other properties. Morphological profiling to categorize drugs by these changes is well-established with pathogens such as E. coli, but Aldridge's team was the first to test it with M. tb. "We found that conventional morphological profiling approaches didn't work with M. tb, because the bacterium's inherent response to treatment was extremely variable, and changes in morphology were much less obvious than in bacteria like E. coli," said Trever C. Smith II, co-first author on the paper and a postdoctoral researcher in the Aldridge laboratory. MorphEUS harnesses this variation by incorporating measurements of heterogeneity itself into morphological profiles and combining this enhanced feature set with machine learning and other complex analytical tools. Network webs and matrices visualize the data analysis. For instance, much of the heterogeneity in the staining patterns in M. tb is because of the thick, complex nature of the cell wall. There is increased staining and less variation in staining patterns when M. tb is treated with cell-wall targeting antibiotics compared with other classes of antibiotics. "With MorphEUS, we used the distribution of staining across a large number of bacilli to learn how each drug acts on M. tb," said Aldridge. "Similarly, we looked at staining intensity and the spread of that brightness across thousands of cells to identify more subtle patterns."

MorphEUS can also detect if the drugs have off-target or secondary effects that are otherwise difficult to identify. Such complex mechanisms of drug action can be clue in designing multidrug therapies. "We expect that the success of MorphEUS in profiling drug action in an organism like M. tb with significant inherent heterogeneity and subtle cytological responsiveness will make it useful in other pathogens and cell types," said Aldridge, who is also a core faculty member of Tufts Centre for Integrated Management of Antimicrobial Resistance, member of the immunology and molecular microbiology program faculties at Tufts Graduate School of Biomedical Sciences, and an adjunct associate professor at Tufts University's School of Engineering. MorphEUS, like the other cytological profiling techniques, is data-driven and based on the classification out of a pool of other profiles. It requires multiple representative profiles from M. tb treated with compounds known to target the same broad cellular target. As the drug set expands, the accuracy and resolution of MorphEUS will also improve. MorphEUS is also restricted in its ability to identify target pathways of compounds with novel mechanisms of action that are unlike the other profiled drugs in the reference set.

DEATH'S DUE TO CORONA VIRUS

Thousif M
III Sem B.Sc., BBG

Coronavirus, also called as COVID-19, has affected millions around the world. It basically started in China and started spreading all around the world. The deaths due to this virus have put fear in millions of people all over the world. People with mild symptoms should make a good and speedy recovery in 2 weeks and The disease can become much more serious for some and that can take a longer time, potentially months to recover. According to the recent research older people or patients with pre-existing medical conditions (such as cardiovascular disease, chronic respiratory disease and diabetes) are more vulnerable to the negative impact of the virus.

Current evidence on other coronavirus strains shows that while coronaviruses appear to be stable at low and freezing temperatures for a certain period, food hygiene and good food safety practices can prevent their transmission through food.

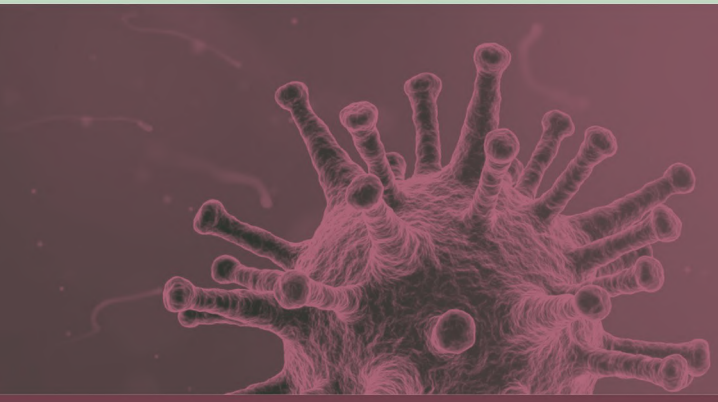
At present, it is tempting to estimate the case fatality rate by dividing the number of known deaths by the number of confirmed cases. The resulting number, however, does not represent the true case fatality rate and might be off by orders of magnitude.

The virus starts spreading through nasal release of a person and then they enter the body and infect all the cells which make human body weak and cause difficulty in breathing.

To be calm and patient during pandemic time is difficult but with the help of yoga, relaxation practice such as deep breathing and meditation can help, and good sleep may be more helpful for the immune system.

THE SOLIDARITY TRIAL

Yajushi Yashitha Vinnakota
III Sem B.Sc., BBG



An Experimental antiviral compound called remdesivir; the medications chloroquine and hydroxychloroquine; a combination of two HIV drugs, lopinavir and ritonavir; and the same combination plus interferon-beta, an immune system messenger that can help cripple viruses.

Remdesivir: The new coronavirus is giving this compound a second chance to shine. Originally developed by Gilead Sciences to combat Ebola and related viruses, remdesivir shuts down viral replication by inhibiting a key viral enzyme, the RNA-dependent RNA polymerase. Researchers tested remdesivir last year during the Ebola outbreak in the Democratic Republic of the Congo, along with three other treatments. It did not show any effect. (Two others did.) But the enzyme it targets is similar in other viruses, and in 2017 researchers at the University of North Carolina, Chapel Hill, showed in test tube and animal studies that the drug can inhibit the coronaviruses that cause SARS and MERS. The first COVID-19 patient diagnosed in the United States—a young man in Snohomish County in Washington—was given remdesivir when his condition worsened; he improved the next day, according to a case report in The New England Journal of Medicine (NEJM). A Californian patient who received remdesivir—and who doctors thought might not survive—recovered as well. Experimental treatment strategies being tested by WHO study and other clinical trials attempt to interfere with different steps (numbered) in the coronavirus replication cycle.

Chloroquine and hydroxychloroquine

The WHO scientific panel designing SOLIDARITY had originally decided to leave the duo out of the trial, but had a change of heart at a meeting in Geneva on 13 March, because the drugs "received significant attention" in many countries, according to the report of a WHO working group that looked into the drugs' potential. The widespread interested prompted "the need to examine emerging evidence to inform a decision on its potential role." The available data are thin. The drugs work by decreasing the acidity in endosomes, compartments inside cells that they use to ingest outside material and that some viruses can co -opt to enter a cell. But the main entryway for SARS-CoV-2 is a different one, using its so-called spike protein to attach to a receptor on the surface of human cells. Studies in cell culture have suggested chloroquines have some activity against SARS-CoV-2, but the doses needed are usually high—and could cause serious toxicities. Encouraging cell study results with chloroquines against two other viral diseases, dengue and chikungunya, didn't pan out in people in randomized clinical trials. And nonhuman primates infected with chikungunya did worse when given chloroquine. "Researchers have tried this drug on virus after virus, and it never works out in humans. The dose needed is just too high," says Susanne Herold, an expert on pulmonary infections at the University of Giessen. Researchers in France have published a study in which they treated 20 COVID-19 patients with hydroxychloroquine. They concluded that the drug significantly reduced viral load in nasal swabs. But it was not a randomized controlled trial and it didn't report clinical outcomes such as deaths. In guidance published by, the U.S. Society of Critical Care Medicine said "there is insufficient evidence to issue a recommendation on the use of chloroquine or hydroxychloroquine in critically ill adults with COVID-19." Hydroxychloroquine, in particular, might do more harm than good. The drug has a variety of side effects and can in rare cases harm the heart. Because people with heart conditions are at higher risk of severe COVID-19, that is a concern, says David Smith, an infectious disease physician at the University of California, San Diego. "This is a warning signal, but we still need to do the trial," he says.

Ritonavir/lopinavir and interferon-beta

SOLIDARITY will also have an arm that combines the two antivirals with interferon-beta, a molecule involved in regulating inflammation in the body that has also shown an effect in marmosets infected with MERS. A combination of the three drugs is now being tested in MERS patients in Saudi Arabia in the first randomized controlled trial for that disease. But the use of interferon-beta on patients with severe COVID-19 might be risky if it is given late in the disease; it could easily lead to worse tissue damage instead of helping patients.

Ritonavir/lopinavir

This combination drug, sold under the brand name Kaletra, was approved in the United States in 2000 to treat HIV infections. Abbott Laboratories developed lopinavir specifically to inhibit the protease of HIV, an important enzyme that cleaves a long protein chain into peptides during the assembly of new viruses. Because lopinavir is quickly broken down in the human body by our own proteases, it is given with low levels of ritonavir, another protease inhibitor, that lets lopinavir persist longer. The combination can inhibit the protease of other viruses as well, specifically coronaviruses. It has shown efficacy in marmosets infected with the MERS virus, and has also been tested in SARS and MERS patients, though results from those trials are ambiguous. The first trial with COVD-19 was not encouraging, however. Doctors in Wuhan, China, gave 199 patients two pills of lopinavir/ritonavir twice a day plus standard care or standard care alone. There was no significant difference between the groups, they reported in NEJM on 15 March. But the authors caution that patients were very ill—more than one-fifth of them died—and so the treatment may have been given too late to help. Although the drug is generally safe it may interact with drugs usually given to severely ill patients, and doctors have warned it could cause significant liver damage.

References-

https://www.sciencemag.org/news/2020/03/who-launches-global-megatrial-four-most-promising-coronavirus-treatments

MIOCENE FOSSIL FROM AFRICA PROVIDES NEW EVIDENCE FOR ORIGIN OF AMERICAN CROCODILES

Varshini Ashok
III Sem B.Sc., BBG

A team of paleontologists from Italy and Spain has compared the only well-preserved skull of *Crocodylus checchiai*, an extinct species of crocodile that lived in what is now Libya about 7 million years ago. It's found that the Ancient African reptile is closely related to American crocodiles. The findings suggest that crocodiles have migrated from Africa to America during the Miocene. In order to improve the knowledge about *Crocodylus checchiai*, Dr. Massimo Delfino tried to locate the original skull. The researchers succeeded in finding the collection at a university in Rome. They identified several new inner structures including a protrusion in the middle of the snout which had not been identified on any other African crocodile species.

They used computer tomography (CT) imaging to re-examine the well-preserved specimen. "Analyses of the evolutionary relationships between species suggest that Crocodylus *checchiai*, may be a part of the same lineage as the four American crocodile species: *Crocodylus intermedius, C. Moreletii, C. acutus*, and *C. rhombifer*. The remains of *Crocodylus checchiai* have been dated to around 7 million years ago while the oldest remains of American crocodile, the extinct *Crocodylus falconensis*, have been dated to around 5 million years ago. "Based on these findings, it's confirmed that the crocodiles have reached America by migrating westwards from Australiasia via Africa".

Reference: Enrico de Lazaro, *Sci News* 27 Jul 2020

IMMUNOPHENOTYPING OF COVID-19 AND INFLUENZA HIGHLIGHTS THE ROLE OF TYPE I INTERFERONS IN DEVELOPMENT OF SEVERE COVID-19

Mohammad Yoonus Khan,
III Sem B.Sc., BBG

Currently, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is spreading globally, and the World Health Organisation (WHO) has declared it a pandemic. As of June 2, 2020, more than million confirmed cases and more than 366,000 deaths have been reported worldwide. SARS-CoV-2 belongs to the broad family of viruses known as coronavirus and there are seven different types of coronavirus. The 2019 novel corona virus, which can infect people and cause illness ranging from a common cold to more severe disease such as Middle East Respiratory Syndrome (MERS-CoV). The novel coronavirus (nCoV) is a new strain that wasn't identified previously in humans. Coronavirus are zoonotic, meaning they are transmitted between animals and people. Investigations found that SRS-CoV was transmitted from civet cats to animals and MERS-CoV from dromedary camels to humans. Several Kinds of known coronaviruses are circulating in animals that have not yet infected humans. To identify factors driving severe progressions of COVID-19, the single cell RNA-seq was performed using peripheral blood mononuclear cells (PBMCs) obtained from healthy donors, patients with mild or severe COVID-19, and patients with severe influenza. Patients with COVID-19 exhibited hyper inflammatory indications across all types of cells among PBMCs, particularly there is upregulation of the TNF/IL-1β driven inflammatory response co- existed with the TNF/IL-1β- driven inflammation, and this was not seen in patients with milder COVID-19.

In efforts to synthesize a clear understanding of SARS-Cov-2 protective immunity, antibody analysis has been paralleled by T cell studies across asymptomatic, mild, and severe COVID-19. Defining CD4 and CD8 effector functions in protection is important considering that antibody responses appear short lived and T cell memory is potentially more durable. Although critical illness has been associated with SARS-CoV-2 induce hyper inflammation, the immune correlates of severe COVID-19 remain unclear. The peripheral blood immune perturbations was analysed in SARS-CoV-2 infected and recovered individuals. Extensive induction and activation of multiple lineages including T cell activation, oligoclonal plasma blast expansion and Fc and tracking receptor modulation on innate lymphocytes and granulocytes that distinguished severe COVID-19 cases from healthy donors SARS-CoV-2-recovered or moderate severity patients was identified. The neutrophil to lymphocyte ratio was found to be a prognostic biomarker of disease severity and organ failure. Common signs of infection include respiratory symptoms, fever, cough, shortness of breath and breathing difficulties. In more severe cases, infections can cause pneumonia, severe acute respiratory syndrome, kidney failure and even death.

Reference: Lee et al., *Science Immunology* 10 Jul 2020

MODERN TECHNOLOGY AND SCIENTIFIC TOOLS IN BIOLOGY

S Umme Rumana,
III Sem B.Sc., BBG

Scientific biology remains fluid because its full potential isn't yet clear and since researchers are exploring many problem solving approaches. In general the discipline is seen as involving the applications of engineering principles to "design and construct new biological systems and re-design "existing natural biological systems for useful purposes." Work is usually motivated by the underlying goal of creating biology easy to engineer. Synthetic biology research is conducted and facilitated by individuals that are trained in a variety of disciplines including biology, engineering, chemistry, genetics, and computational sciences. Synthetic biology also includes work to manufacture biological elements (Example, molecules genetic sequence, system, and straightforward organisms). Biological parts in scientists current inventory are capable of performing various basic functions at the cellular level. Examples include engineered biological circuits and oscillators. Engineering and Bio-computer interfaces for the creation of organisms that are capable of efficient, large-scale production of biofuel. The ultimate definitions of synthetic biology takes into account the dynamism and potential of synthetic biology which, if it achieves its potential, can change many aspects of how we live our lives. At a fundamental level, synthetic biology seeks to require the creative force of nature and harness it technologically so as to unravel problems of varying scale. In London, Huanming Yang, optimistically described synthetic biology as "a Science changing the planet and therefore the way forward for man." The motto for the field: "LIFE IS WHAT WE MAKE IT."

"EGGS"- A PASSIVE BODY OR ACTIVE PARTNER

Varsha Manoj
V Sem B.Sc., BBG

For decades scientists were of the belief that sperms had a race towards the egg and one among the few healthy sperms to reach the egg first usually fused with the egg to undergo the process of fertilization .According to the above theory of fertilization eggs were considered to be passive bodies but researchers today, no longer consider eggs to be submissive or docile cells. Egg is an equal and active partner in reproduction, adding layers of evolutionary control and selection to one of the important processes in life. Experiments have proved that eggs select sperms actively for their genetic assets.

Even when all the experiments suggest that there is an egg-sperm interaction which alters the process of fertilization, there is still no evidence to prove how it takes place .The two possibilities for this can be the difference in metabolism of vitamin B or folic acid in an egg and a sperm which acts as the deciding factor for the attraction between both and the second one may be the presence of sperms in the female reproductive tract before the eggs have completely developed. There arises a situation in the second case where the partially developed egg might influence the cell division so that its genes can also be well suited to the sperms.

EFFECTIVE BLOCKING

OF COVID–19 VIRUS USING SEAWEED EXTRACT

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Center for Biotechnology and Interdisciplinary Studies (CBIS) at Rensselear Polytechnic Institute are developing antiviral drugs from the seaweed against novel coronavirus SARS-CoV-2. Robert Linhardt, a Rensselaer Professor of chemistry and chemical biology who collaborates with Dordick developed the decoy strategy. Researchers identified decoy technique in the effect of antiviral compounds against the virus that causes COVID-19, an extract from edible seaweeds considerably surpassed Remdesivir, the current standard antiviral drug used to fight against the disease by inhibiting SARS-CoV-2 adherence and infection in mammalian cells. The spike protein on the surface of SARS-CoV-2 binds onto the angiotensin converting enzyme 2 (*ACE2*) receptor, membrane associated receptor present on the surface of human cells. The virus then inserts its own genetic material into the cell, and uses the host cellular machinery to generate the copy of viruses. But with the use of antiviral compound from seaweed, virus could be locked onto a decoy molecule that provides a similar interactive site. The neutralized virus would be trapped and eventually degrade naturally. Researchers established antiviral compound extracted from edible seaweed namely fucoidans (RPI-27 and RPI-28) compounds which are sulfated polysaccharides consists of long chains of sugar molecules, an effective decoy molecule traps SARS-CoV-2. Similar strategy of decoy technique has been used to trap other viruses which includes Zika, influenza A and dengue.

The researchers performed a dose response study of seaweed extract and standard remdesivir compound to measure the compound's inhibition (50% inhibition), an EC_{50}. RPI-27 compound from seaweed showed an effective concentration EC_{50} value of 83 nM inhibits 50% of SARS-CoV-2 viral infectivity on mammalian cells while *in vitro* test of remdesivir, standard antiviral compound showed an EC_{50} of 770 nM concentration on the same mammalian cells. This result suggested that even at lower molar concentration, the compound from seaweed extract showed more potential activity against SARS-CoV-2. These findings propose that these substances could serve as a basis for a nasal spray or oral delivery by blocking it before it enters into the body, to address potential infection. Dordick concludes that with this study is that the larger the molecule, the better the fit. The more successful compounds are the larger sulfated polysaccharides that offer a larger number of binding sites on the molecules to decoy the virus. "Sulfated polysaccharides effectively inhibit SARS-CoV-2 *in vitro*" was published in *Cell Discovery* with the support of the National Research Foundation of Korea. Drug modeling study of similar sulfated polysaccharides may reveal several interactive binding sites on the viral protein to overcome the challenges of the COVID-19 pandemic through novel therapeutic approaches and the repurposing of existing drugs.

CURRICULAR AND CO-CURRICULAR EVENTS OF LIFE SCIENCES DEPARTMENT

Every academic year the Department of Life Sciences conducts various curricular and co-curricular events which pave way for the students to showcase their creativity and talent in the diverse areas of Life Sciences.

ACADEMIC YEAR 2019-2020

Sl.No	EVENT	NUMBER OF PROGRAMME
1	Connoisseur and Bioventura	1-Intracollegiate Bio-Fests
2	Bioaura	1-Intercollegiate Bio-Fest
3	Creatrix	1-Life Sciences Exhibition
4	National Conference	1-National Conference on Inclusive Development through Bio-technology
5	FDP	1 offline + 3 online
6	Guest lectures + Expert talks	12 Expert talks were conducted
7	Research Colloquium	VIGNANA VICINTANA
8	Webinar	5- Webinars

STUDENTS ACHIEVEMENTS –CO-CURRICULAR (2019-2020)

Sl. No.	FEST	UNIVERSITY/ COLLEGE	PRIZE WON
1.	Jeevotsav (UG)	Christ University	Over all Runners Up
2.	Chemoz 2019	Christ University	Over all Runners Up
3.	ALCHEMY 2019	St. Joseph's College	Winners
4.	Synergy 2019	St. Joseph's College	Over all Winners

FACULTY PUBLICATIONS 2019-2020

BOOK PUBLISHED

Evaluation of Antidiabetic Acitivity of *Melia* and *Murraya by* Dr.S. Vijayanand.

RESEARCH ARTICLES PUBLISHED

Faculties of Life Sciences Department have published 16 articles in peer reviewed journals of UGC care, Thomson Reuters and Scopus indexed.

NATIONAL CONFERENCE

Chief guest and Delegates of National Conference

CONNOISSEUR

Inauguration of CONNOISSEUR

CREATRIX WINNERS

Students displaying the thought-provoking Model exhibits – Creatrix

Alumni judges witnessing the Model exhibition

Honoring the Alumni (Judge for the event) with Memento

BIOVENTURA

Dr. Gopalakrishna Ramaswamy, Chief guest delivering the talk on "The Role Model"

INDUSTRIAL VISIT

Industrial visit to Southern Regional Research Centre (SRRC), Mannavanur

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