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DEPARTMENT OF LIFE SCIENCES

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SYNAPSE

THE IMPULSE OF LIFE

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Foreword

Life Sciences offers potential of enormous benefits such as addressing 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.

Researchers in this arena are striving hard for better understanding of cells, multi-cells, tissues, organs, organisms, and even communities of organisms and ultimately to develop better biotechnological applications. The genome editing of living organisms, can enhance bio-based chemicals production, increase food production and maintain a better nutritional value, or also could manufacture organs for transplant. Metabolic engineering and synthetic biology that are advancing very rapidly as well, has led to the production of fuels and materials from renewable biomass.

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.

Fr. Josekutty P. D.
Principal

Fr. Augustine George
Vice Principal

DEPARTMENT OF LIFE SCIENCES

STUDENTS' CORNER

MICROBIAL INTELLIGENCE

Communication between individual bacteria in colonies may sound absurd on a lot of levels, but is actually true. Scientists around the world through a series of experiments and theories have actually agreed on the fact that the term intelligence is not confined to our brain and nervous system alone. Even unicellular and primitive organisms like bacteria communicate among themselves for the essence of survival just like higher organisms do. This property of microbes has been coined as 'Microbial Intelligence'.

Microbes are able to make decisions based on different criteria of information and also to perform the decision-making using different mechanisms, utilizing different types of molecular networks. The decision of microbes to move toward nutrient sources or away from toxic compounds is an observation that appears "intelligent." The most studied system is that of chemotaxis in *E.coli*, with common features in other prokaryotes and eukaryotes. In order to make this decision, the cell monitors the environment by means of multiple receptors in the cell membrane. The information of the ligand binding to the receptor, and the processing of this information inside the cell, is achieved by means of a signaling pathway involving methylation and phosphorylation. Bacteria are certainly conscious; they will orient themselves to make structures. This ability to respond specifically to the environment and to act creatively, in the sense that that precise action has never been taken before, is a property of life.

Bacteria can work out how many other bacteria of their own species are in their vicinity –something known as "quorum sensing". Each individual bacterium releases a small amount of a chemical into the surrounding medium. If there are lots of other bacteria around, all releasing the same chemical, levels can reach a critical point and trigger a change in behaviour of the whole population. This "voting system" can be used to decide when to launch an attack on a host. Once they have grown to sufficient numbers to overwhelm the immune system, they collectively launch an assault on the body. On the whole, microbial intelligence is definitely an interesting area for research. Developing methods to exploit the same for our advantage would prove to be of significant importance especially in the field of medical sciences where antibiotic resistance has proved to be a great problem for treating diseases.

ROSE MATTHEW

IV B.Sc., BBG

TAILORING CYANOBACTERIAL CELL FACTORY FOR IMPROVED INDUSTRIAL PROPERTIES

Photosynthetic bio manufacturing provides a promising solution for sustainable production of biofuels and biochemicals. Cyanobacteria are among the most promising microbial platforms for the construction of photosynthetic cell factories. Metabolic engineering of cyanobacteria has enabled effective photosynthetic synthesis of diverse natural or non-natural metabolites, while commercialization of photosynthetic biomanufacturing is usually restricted by process and economic feasibilities. In actual outdoor conditions, active cell growth and product synthesis is restricted to narrow light exposure windows of the day-night cycles and is threatened by diverse physical, chemical, and biological environmental stresses. For biomass harvesting and bioproduct recovery, energy and cost consuming processing and equipment are required, which further decreases the economic and environmental competitiveness of the entire process. To facilitate scaled photosynthetic biomanufacturing, lots of efforts have been made to engineer Cyanobacteria cell properties required by robust & continual cultivation and convenient & efficient recovery. Recently reports on engineering strategies on optimizing industrial properties of cyanobacteria cells indicate that through systematic re-editing the metabolism, morphology, mutualism interaction of cyanobacteria chassis cells, the adaptabilities and compatibilities of the cyanobacteria cell factories to the industrial process could be significantly improved. Cell growth and product synthesis of the tailored cyanobacteria cells could be expanded and maintained at night and in stressful environments, while convenient biomass harvesting could also be expected. For developing more feasible cyanobacteria photosynthetic biomanufacturing in large scale, tailoring industrial properties of cyanobacteria can be exploited in the future.

LEAH

IV B.Sc., MBG

WHICH CAME FIRST? THE CHICKEN OR THE EGG?

Chickens evolved from non-chickens through small changes caused by the mixing of male and female DNA or by mutations to the DNA that produced the zygote. These changes and mutations only have an effect at the point where a new zygote is created. That is, two non-chickens mated and the DNA in their new zygote contained the mutation(s) that produced the first true chicken. That one zygote cell divided to produce the first true chicken.

Prior to that first true chicken zygote, there were only non-chickens. The zygote cell is the only place where DNA mutations could produce a new animal, and the zygote cell is housed in the chicken's egg. So, the egg must have come first. Chickens evolved from other kinds of birds, although which ones remains unclear. It wasn't flightless birds which gave rise to chickens, because they are thought to have descended from birds which could fly but lost that ability through mutation. Actually, the origin of all types of birds which live today are shrouded in mystery leading bird expert, Alan Feduccia, to proclaim, "The origin of birds is still up in the air."

RESHAN

IV B.Sc., MBG

ENGINEERS GROW FUNCTIONING HUMAN MUSCLE FROM SKIN CELLS

The advance builds on work published in 2015 when researchers at Duke University grew the first functioning human muscle tissue from cells obtained from muscle biopsies. The ability to start from cellular scratch using non-muscle tissue will allow scientists to grow far more muscle cells, provide an easier path to genome editing and cellular therapies, and develop individually tailored models of rare muscle diseases for drug discovery and basic biology studies. Starting with pluripotent stem cells that are not muscle cells, but can become all existing cells in our body, allows us to grow an unlimited number of myogenic progenitor cells. These progenitor cells resemble adult muscle stem cells called satellite cells; that can theoretically grow an entire muscle starting from a single cell.

In the new study, the researchers instead started with human induced pluripotent stem cells. These are cells taken from adult non-muscle tissues, such as skin or blood, and reprogrammed to revert to a primordial state. The pluripotent stem cells are then grown while being flooded with a molecule called Pax7 - which signals the cells to start becoming muscle. As the cells proliferated they became very similar to - but not quite as robust as - adult muscle stem cells. While previous studies had accomplished this feat, nobody has been able to then grow these intermediate cells into functioning skeletal muscle.

Once the cells were well on their way to becoming muscle, they stopped providing the Pax7 signaling molecule and started giving the cells the support and nourishment they needed to fully mature. In the study, the researchers show that after two to four weeks of 3-D culture, the resulting muscle cells form muscle fibers that contract and react to external stimuli such as electrical pulses and biochemical signals mimicking neuronal inputs just like native muscle tissue. They also implanted the newly grown muscle fibers into adult mice and showed that they survive and function for at least three weeks while progressively integrating into the native tissue through vascularization.

KARIM KINWARY

IV B.Sc., MBG

WHICH CAME FIRST- FISHES OR PLANTS?

Plants evolved during the Mesoproterozoic period around 1.2 billion years ago. However, early plants existed exclusively in the form of green algae for hundreds of millions of years, only reaching the land around half a billion years ago during the Ordovician Period.

The above artist's illustration shows the haikouichthys, one of the earliest known fishes, which lived in the Cambrian seas up to 535-million years ago, coexisting with primitive marine plant life that was already well-established at the time. Fish are a taxon of a different level: Kingdom Animalia, Phylum Chordata, and within that, Agnatha (jawless fish, like lampreys), which appeared possibly in the Cambrian about 530 million years ago, thus before land plants. Within Gnathostomata or jawed fish, cartilaginous fish (like sharks and skates) did not appear till the Devonian (also known as Age of fish) which started ~420 million years ago. The oldest ray-finned fish fossil is from 420 million years ago, and the oldest lobed finned fish from around the same time, maybe a little older.

Hence we can deduce that fishes came first.

AILEEN

IV B.Sc., BBG

WHICH IS THE MOST LIKELY TO HAVE COME FIRST: DNA, RNA, OR PROTEIN?

The general, clear consensus is that DNA came last: it is too complicated to form without sophisticated catalytic help: DNA duplication requires coordinated enzymatic action to "unzip" the double-strand, make complementary copies, and make sure the pieces "zip" together correctly, without slippage; even its deoxyribose backbone is clearly derived, via an enzymatic process, from ribose (that is already used in RNA) which is produced via simpler catalytic processes (and can even form pre-biotically in the right conditions).

Whether RNA or proteins formed first and helped the other form later is still under debate. There are essentially 3 camps:

Protein first
RNA first
Protein/RNA co-evolution

Option 1- seems simpler and more likely: no complex information molecules that need to be assembled in a particular order to be useful are required. Thus hypothesis assumes amino acids (which are shown to be formed under the right abiotic conditions) can condense into short polypeptides with little help under the right conditions (although these polypeptides would also breakdown under similar conditions, so they're somewhat unstable and short-lived). Some long(ish) Polypeptides show catalytic properties, so given enough randomly-assembled polypeptides, some are bound to (slightly) accelerate some chemical reactions more than others. The results aren't yet "life as we know it", but they have some "preference", some directionality--the reactions aren't random, entropic, and unpredictable anymore: some reactions are (slightly) more likely than others. At this point, self-reinforcing reaction loops can be born: reaction chains whose end-products help the reactions get started and to keep going. Life as we know it is full of those; and some are universal: they're present in all forms of life in this planet, simple and complex.

Option 2-looks more complex, but it might not be. Making RNA is not such a difficult endeavor as it might look like: like polypeptides, short strands can self-assemble under simple conditions--even drying up a solution of Ribonucleotides can trigger the formation of randomly ordered polyribonucleotides (short RNA strands); if some RNA strands are already present, strands (roughly) complementary to the ones present will likely form, while some others will elongate. Repeat the dissolve/mix/dry cycle a few times and you got a "decent" (but not "perfect") RNA replication engine; one with an advantage over random assembly of polypeptides in option 1: you can get (rough) copies of the RNA strands already present (polypeptides cannot be used as templates for their own assembly). There's more going for option 2: some RNA strands show catalytic properties by themselves, as polypeptides do, and therefore they also show "preference" and "directionality", and therefore can be the non-random "driving process" of self-reinforcing reaction loops. One of the strong hints that option 2 is valid is that all life forms have an "RNA engine" in them: the Ribosome and its ancillary RNA strands: the Transfer RNA and Messenger RNA. This engine is the basis for information-driven protein synthesis in every life form in this planet.

Option 3-is a hybrid, or mixture, of options 1 and 2. It posits that both mechanisms actually existed and were operational at the same time: some polypeptides formed as in option 1, while some RNA formed as in option 2. They existed at the same time and, since both had some catalytic action, they both helped direct and focus the chemical reactions happening around them. RNA, with its replication capability, helped preserve some information and order; proteins, being easier to produce and elongate, helped keep RNA together and catalyzed some reactions RNA didn't (and vice-versa). This is called Synergy: the whole is greater than the sum of its parts. In this scenario, both processes helped each other and intertwined: RNA and its molecular abilities helped preserve information--that is, RNA molecules that improved the system's performance were preserved and reproduced, while those that didn't were expelled

or dismantled. Proteins and their molecular abilities in particular via their complex 3D shapes, helped mold, select and direct the kind of molecules that were useful and destroy those that weren't. Eventually, RNA strands started encoding for some proteins that were useful and even helped to catalyze their assembly, while some proteins started helping RNA to produce more RNA and proteins without so much dissolve/mix/dry (which wreaks havoc with complex, subtle molecular arrangements). Life as we know it was well on its start.

AKHIL ANAND, IV B.Sc., MBG

PERMANENT GENETIC DAMAGE DUE TO ALCOHOL

Much previous research looking at the precise ways in which alcohol causes cancer has been done in cell cultures. Recently, researchers have used mice to show how alcohol exposure leads to permanent genetic damage. Scientists at the MRC Laboratory of Molecular Biology, Cambridge, gave diluted alcohol, chemically known as ethanol, to mice. They then used chromosome analysis and DNA sequencing to examine the genetic damage caused by acetaldehyde, a harmful chemical produced when the body processes alcohol. They found that acetaldehyde can break and damage DNA within blood stem cells leading to rearranged chromosomes and permanently altering the DNA sequences within these cells. It is important to understand how the DNA blue print with in stem cells is damaged because when healthy stem cells become faulty, they can give rise to cancer. These new findings therefore help us to understand how drinking alcohol increases the risk of developing 7 types of cancer including common types like breast and bowel.

Professor Ketan Patel, lead author of the study and scientist, part-funded by Cancer Research UK, at the MRC Laboratory of Molecular Biology, said: "Some cancers develop due to DNA damage in stem cells. While some damage occurs by chance, our findings suggest that drinking alcohol can increase the risk of this damage." The study also examined how the body tries to protect itself against damage caused by alcohol. The first line of defense is a family of enzymes called aldehyde dehydrogenases (ALDH). This enzyme breaks down harmful acetaldehyde into acetate, which our cells can use as a source of energy. Worldwide, millions of people, particularly those from South East Asia, either lack these enzymes or carry faulty versions of them. So, when they drink, acetaldehyde builds up which causes a flushed complexion, and also leads to them feeling unwell.

KAVYA

VI B.Sc., BBG

BACTERIA TO REFLECT 'SONAR' SIGNALS FOR ULTRASOUND IMAGING

E. coli could indeed be imaged and located within the guts of mice using ultrasound. Engineering the bacterial cells so they can bounce sound waves back and let us know their location the way a ship or submarine scatters sonar when another ship is looking for it," says Mikhail Shapiro, assistant professor of Chemical Engineering, Schlinger Scholar, and Heritage Medical Research Institute Investigator. "We want to be able to ask the bacteria, 'Where are you and how are you doing?' The first step is to learn to visualize and locate the cells, and the next step is to communicate with them. "The idea of using bacteria as medicine is not new. Probiotics have been developed to treat conditions of the gut, such as irritable bowel disease, and some early studies have shown that bacteria can be used to target and destroy cancer cells. But visualizing these bacterial cells as well as communicating with them -- both to gather intel on what's happening in the body and give the bacteria instructions about what to do next -- is not yet possible. Imaging techniques that rely on light -- such as taking pictures of cells tagged with a "reporter

gene" that codes for green fluorescent protein -- only work in tissue samples removed from the body. This is because light cannot penetrate into deeper tissues like the gut, where the bacterial cells would reside. Shapiro wants to solve this problem with ultrasound techniques because sound waves can travel deeper into bodies. He says he had a eureka moment about six years ago when he learned about gas-filled protein structures in water-dwelling bacteria that help regulate the organisms' buoyancy. Shapiro hypothesized that these structures, called gas vesicles, could bounce back sound waves in ways that make them distinguishable from other types of cells. Indeed, Shapiro and his colleagues demonstrated that the gas vesicles can be imaged with ultrasound in the guts and other tissues of mice. The team's next goal is to transfer the genes for making gas vesicles from the water-dwelling bacteria into a different type of bacteria -- *Escherichia coli*, which is commonly used in microbial therapeutics, such as probiotics.

"We wanted to teach the *E. coli* bacteria to make the gas vesicles themselves," says Shapiro. "I've been wanting to do this ever since we realized the potential of gas vesicles, but we hit some roadblocks along the way. When we finally got the system to work, we were ecstatic. "One of the challenges the team hit involved the transfer of the genetic machinery for gas vesicles into *E. coli*. They first tried to transfer gas-vesicle genes isolated from a water-dwelling bacterium called *Anabaena* flos-aquae, but this didn't work -- the *E. coli* failed to make the vesicles. They tried again using gas-vesicle genes from a closer relative of *E. coli*, a bacterium called *Bacillus megaterium*. This didn't succeed either, because the resulting gas vesicles were too small to efficiently scatter sound waves. Finally, the team tried a mix of genes from both species -- and it worked. The *E. coli* made gas vesicles on its own. The gas vesicle genes code for proteins that act like either bricks or cranes in building the final vesicle structure -- some of the proteins are the building blocks of the vesicles while some help in actually assembling the structures. "Essentially, we figured out that we need the bricks from *Anabaena* flos-aquae and the cranes from *Bacillus megaterium* in order for the *E. coli* to be able to make gas vesicles," says Bourdeau. Subsequent experiments from the team demonstrated that the engineered *E. coli* could indeed be imaged and located within the guts of mice using ultrasound. "This is the first acoustic reporter gene for use in ultrasound imaging," says Shapiro. "We hope it will ultimately do for ultrasound what green fluorescent protein has done for light-based imaging techniques, which is to really revolutionize the imaging of cells in ways there were not possible before." The researchers say the technology should be available soon to scientists who do research in animals, although it will take many more years to develop the method for use in humans.

SHIYON ANTO, IV B.Sc., BBG

NEW DRUG CAPSULE INVENTION FOR WEEKLY HIV TREATMENT

Good news in the field of medical science. Researchers at MIT and Brigham and Women's Hospital have developed a capsule that can deliver a week's worth of HIV drugs in a single dose. This advance could make it much easier for patients to adhere to the strict schedule of dosing required for the drug cocktails used to fight the virus. The new capsule is designed so that patients can take it just once a week and the drug will release gradually throughout the week. This type of delivery system could not only improve patients' adherence to their treatment schedule but also be used by people at risk of HIV exposure to help prevent them from becoming infected. One of the main barriers to treating and preventing HIV is adherence says Giovanni Traverso, a research affiliate at MIT's Koch Institute for Integrative Cancer Research and a gastroenterologist and biomedical engineer at Brigham and Women's Hospital. "The ability to make doses less frequent stands to improve adherence and make a significant impact at the patient level." Scientists from Lyndra, a company that was launched to develop this technology, also contributed to the study. Lyndra is now working toward performing a clinical trial using this delivery system. Several large clinical trials have evaluated whether antiretroviral drugs can prevent HIV infection

in healthy populations. These trials have had mixed success, and one major obstacle to preventative treatment is the difficulty in getting people to take the necessary pills every day. The MIT/BWH team believed that a drug delivery capsule they developed in 2016 might help to address this problem. Their capsule consists of a star-shaped structure with six arms that can be loaded with drugs, folded inward, and encased in a smooth coating. After the capsule is swallowed, the arms unfold and gradually release their cargo.

In a previous study, the researchers found that these capsules could remain in the stomach for up to two weeks, gradually releasing the malaria drug Ivermectin. The researchers then set out to adapt the capsule to deliver HIV drugs. In their original version, the entire star shape was made from one polymer that both provides structural support and carries the drug payload. This made it more difficult to design new capsules that would release drugs at varying rates, because any changes to the polymer composition might disrupt the capsule's structural integrity. To overcome that, the researchers designed a new version in which the backbone of the star structure is still a strong polymer, but each of the six arms can be filled with a different drug-loaded polymer. This makes it easier to design a capsule that releases drugs at different rates. Tests in pigs showed that the capsules were able to successfully lodge in the stomach and release three different HIV drugs over one week. The capsules are designed so that after the entire drug is released, the capsules disintegrate into smaller components that can pass through the digestive tract.

UPASANA DAS, IV B.Sc., MBG

HOW GOOD BACTERIA CONTROL YOUR GENES

Chemical signals from gut bacteria influence gene regulation in the gut lining. Scientists from the Babraham Institute, Cambridge in collaboration with colleagues from Brazil and Italy have discovered a way that good bacteria in the gut can control genes in our cells. The work, in Nature Communications, shows that chemical messages from bacteria can change the location of key chemical markers throughout the human genome. By communicating in this way, the bacteria may help to fight infections and to prevent cancer. The work, led by Dr Patrick Varga-Weisz shows how chemicals produced by bacteria in the gut from the digestion of fruit and vegetables can affect genes in the cells of the gut lining. These molecules, called short chain fatty acids, can move from the bacteria and into our own cells. Inside our cells, they can trigger processes that change gene activity and that ultimately affect how our cells behave. This new research shows that the short chain fatty acids increase the number of chemical markers on our genes. These markers, called crotonylation, were only discovered recently and are a new addition to the chemical annotations in the genome that are collectively called epigenetic markers. The team showed that short chain fatty acids increase the number of crotonylations by shutting down a protein called HDAC2. Scientists think that changes in crotonylation can alter gene activity by turning genes on or off.

The team studied mice that had lost most of the bacteria in their gut and showed that their cells contained more of the HDAC2 protein than normal. Other research has shown that an increase in HDAC2 can be linked to an increased risk of colorectal cancer. This could mean that regulating crotonylation in the genome of gut cells is important for preventing cancer. It also highlights the important role of good bacteria and a healthy diet in this process. Crotonylation is found in many cells but it's particularly common in the gut. This, in turn, has been implicated in cancer and offers an interesting new drug target to be studied further." This research was made possible by support from the bilateral BBSRC-Brazil fund established as part of an agreement between Research Councils UK (RCUK) and the State of Säo Paulo Research Foundation (FAPESP). Lead scientist Dr Patrick Varga-Weisz, said: "Our intestine is the home

of countless bacteria that help in the digestion of foods such as plant fibres. They also act as a barrier to harmful bacteria and educate our immune system. How these bugs affect our cells is a key part of these processes. Our work illuminates how short chain fatty acids contribute to the regulation of proteins that package the genome and, thus, they affect gene activity."

CHRISTINA SCRIA, IV B.Sc., BBG

A DEADLY FUNGUS IS INFECTING SNAKE SPECIES SEEMINGLY AT RANDOM

It doesn't matter if it's a burly rattler or a tiny garter snake. A deadly fungal disease that's infecting snakes in the eastern and midwestern United States doesn't appear to discriminate by species, size or habitat, researchers report online December 20, 2017 in Science Advances.

The infection, caused by the fungal pathogen *Ophidiomyces ophiodiicola*, can cover snakes' bodies with lesions that make it hard for the reptiles to do normal snake things like slither and eat. Many eventually die from the infection. Fungal spores hang around in the soil and can spread to snakes that pick the particles up. The disease has been likened to the chytrid fungus that's wiping out amphibian populations worldwide, or the white-nose syndrome that's killing off entire caves of bats.

In snakes, the disease not only "could result in the downfall of vulnerable species, but could also impact whole communities," says Bruce Kingsbury, a biologist at Indiana University–Purdue University Fort Wayne, who was not part of the study. Snakes are important predators in many ecosystems — if the reptiles go, then populations of small mammals that they help control could boom, throwing the ecosystem out of whack.

Snake fungal disease first gained widespread attention around 2008. It has now been documented in 23 species in the eastern and midwestern United States, says study co-author Frank Burbrink, a herpetologist at the American Museum of Natural History in New York City. He and his colleagues wanted to see whether certain risk factors might make these species more susceptible to the disease than the dozens of other types of snakes that live in the region.

Burbrink and his team hunted for patterns in the data on sick snakes — to see whether the infected species were related evolutionarily, for example, or whether they shared certain behavioral traits or habitat preferences. But the fungus appeared to be infecting species at random, the researchers found. It didn't seem to matter whether a snake was big or small, whether it lived primarily in water or burrowed on land, or whether it laid many eggs or just a few.

"It's about as bad as you can get," Burbrink says. "It seems like any snake could be a candidate."

There are still many questions about the disease. For one, scientists don't know how prevalent it actually is. Even in areas where the fungus is known to be present, many cases of sick snakes probably go unreported. And while the specific fungus that causes the infection was identified only a few years ago, it's not clear how long the disease has been around, Burbrink says.

NITHIKA BENNY

IV B.Sc., BBG

A KEY VIRUS FIGHTER IS IMPLICATED IN PREGNANCY WOES

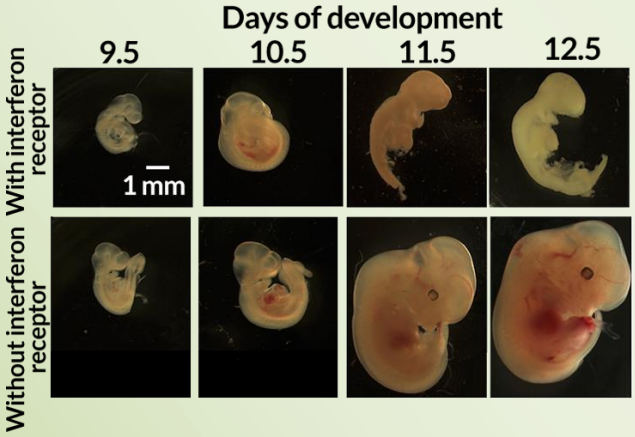
An immune system mainstay in the fight against viruses may harm rather than help a pregnancy. In Zika-infected mice, this betrayal appears to contribute to fetal abnormalities linked to the virus, researchers report online January 5, 2018 in Science Immunology. And it could explain pregnancy complications that arise from infections with other pathogens and from autoimmune disorders.

In pregnant mice infected with Zika virus, those fetuses with a docking station, or receptor, for immune system proteins called type I interferons either died or grew more poorly compared with fetuses lacking the receptor. "The type I interferon system is one of the key mechanisms for stopping viral infections," says Helen Lazear, a virologist at the University of North Carolina at Chapel Hill, who coauthored an editorial accompanying the study. "That same [immune] process is actually causing fetal damage, and that's unexpected."

Cells infected by viruses begin the fight against the intruder by producing type I interferons. These proteins latch onto their receptor on the surfaces of neighboring cells and kick-start the production of hundreds of other antiviral proteins.

Akiko Iwasaki, a Howard Hughes Medical Institute investigator and immunologist at Yale School of Medicine, and her colleagues were interested in studying what happens to fetuses when moms are sexually infected with Zika virus. The researchers mated female mice unable to make the receptor for type I interferons to males with one copy of the gene needed to make the receptor. This meant that moms would carry some pups with the receptor and some without in the same pregnancy.

Pregnant mice were infected vaginally with Zika at one of two times — one corresponding to mid–first trimester in humans, the other to late first trimester. Of the fetuses exposed to infection earlier, those that had the interferon receptor died, while those without the receptor continued to develop. For fetuses exposed to infection a bit later in the pregnancy, those with the receptor were much smaller than their receptor-lacking counterparts.



Pregnant mice were infected with Zika virus early in pregnancy (corresponding to mid–first trimester in humans). After 12 and half days, which roughly corresponds to the second trimester in humans, all of the mouse fetuses with the interferon receptor had died, while those without it continued to develop. The fetuses without the receptor still grew poorly due to the Zika infection, which is expected given their inability to fight the infection. What was striking, Iwasaki says, is that the fetuses able to fight the infection were more damaged, and were the only fetuses that died. It's unclear how this antiviral immune

response causes fetal damage. But the placentas—which, like their fetuses, had the receptor — didn't appear to provide those fetuses with enough oxygen, Iwasaki says.

The researchers also infected pregnant mice that had the receptor for type I interferons with a viral mimic — a bit of genetic material that goads the body to begin its antiviral immune response — to see if the damage happened only during a Zika infection. These fetuses also died early in the pregnancy, an indication that perhaps the immune system could cause fetal damage during other viral infections. Iwasaki and colleagues next added type I interferon to samples of human placental tissue in dishes. After 16 to 20 hours, the placental tissues developed structures that resembled syncytial knots. These knots are widespread in the placentas of pregnancies with such complications as preeclampsia and restricted fetal growth. Figuring out which of the hundreds of antiviral proteins made when type I interferon ignites the immune system can trigger placental and fetal damage is the next step, says Iwasaki. That could provide more understanding of miscarriage generally; other infections that cause congenital diseases, like toxoplasmosis and rubella; and autoimmune disorders that feature excessive type I interferon production, such as lupus, she says.

BABY THANKAM ANTONY

IV B.Sc., BBG

IMPLANTED DEVICE HELPED CATCH BREAST CANCER CELLS

In mouse experiments, a small device is implanted which helped catch breast cancer cells before they took root in other organs. A cancerous lump in the breast can be dangerous, but it seldom kills. However, if cancer cells leave that lump, the satellite tumors that form in other organs pose a much bigger threat. And those tiny new cancers can be hard to spot. Now, a study shows that implanting a small device beneath the skin might help save lives by catching cancerous cells after they begin wandering — but before they settle down to form new tumors.

The implant has not yet been tested in people. But when placed into mice with tumors, the device trapped runaway cancer cells. These cells are known as metastatic cells. They signal worsening disease. And the mice lived longer when researchers cut away the tissue around the implant, where those metastatic cells had been lurking.

The new device is about the size of a pencil eraser. It's made of the same material as the stitches that doctors use to sew up wounds. Since immune cells are programmed to recognize foreign material, they flock to the implant. There they act "like a decoy". They build up around the implant and lure metastatic cells.

CHAITHRA VAISHNAVI.C

VI B.Sc., BBG

ANTIBODY TREATMENTS FOR ZIKA VIRAL INFECTION

The remarkable potency and breadth of inhibition by ZIKV-117 has great promise as it was able to inhibit infection by strains from both Africa and America in cell culture and in animals, including during pregnancy.

Zika virus is a mosquito-borne flavivirus that was first identified in Uganda in 1947 in monkeys through a network that monitored yellow fever. It was later identified in humans in 1952 in Uganda and the United Republic of Tanzania. Monoclonal antibodies are made from a single clone of B cells, a type of white blood cell, that have been fused to myeloma (cancer) cells to form fast-growing "hybridomas." This allows researchers to quickly generate large quantities of antibodies against specific viral targets.

ARUN ROBY, VI B.Sc., BBG

AN EYE OPENER

Deep down in the depths of the sea, where there's utter darkness and no life, to the top of the mountain where there's the bright sun and no life. From the city to the countryside, from the valley to the pastures. Searched them all and found no life. Oh how have the mighty fallen? Now you may argue that if the pastures were searched and life wasn't found, what are the pastures made of? Oh yes, let me guide you through.

Long, long ago there was a big cruel group of monsters. They asserted their dominion over everything they ever saw. They claimed that they came, saw and conquered. Did they really? No one knows. Long before time, they came into existence with a humble beginning. Being created out of dust, they were to till and plough the land and eat the fruit of their work. Once the ground no longer yields her fruit, they were expected to move away and find themselves a land. It all started to change when they decided they could stay at a place and still find solace. They got into different professions; they traded their hard work for somebody else's. Life was still peaceful. Then came something called money. Now money was something that they all looked up to. It could now be used as a token of appreciation for the fruit of your sweat. But life wasn't the same again. Some had more of it, while some had less. Some earned it righteously, while some stole it by disgusting means. This caused a division among them. They gave in to being played with money. Their respect wasn't earned, but rather gains through money. The lower sections hated this but didn't want to put up a fight. They feared for their lives and so did their wives.

So, they lived on that way and got accustomed to it. But that wasn't it. They were growing in knowledge too. They had in fact made their lives so easy that they could stay at a place and do whatever they wanted to. Certainly these monsters had peaked their lives! But little did they realize they were overcome with so much greed that they were simultaneously entering self-destruct mode. They exploited everything that was at their arm's reach. And yes, all this while their wealth was still growing and it needed to be defended. That led to manufacture of the most powerful weapons. Weapons which were tools for them to hunt down predators and prey now became the tools to kill each other.

With a click of a button they could destroy the whole world. And just as they were contemplating it…No one knows what happened then. No prize for guessing who the monsters were. So remember the pastures I was talking about? Yes, they were pastures of rotting skeletons. This might be a reality soon but the future is still in our hands. Let's do what we ought to.

SANTHOSH B., IV BSc BBG

COMMON EYE MOVEMENTS THAT STRAIN THE OPTIC NERVE COULD BE A CAUSE OF GLAUCOMA FOR PEOPLE WITH NORMAL INTRAOCULAR PRESSURE

The study finds that over time, eye movements could strain the bundle of nerve fibers between the eye and brain – also known as the optic nerve – for people with normal intraocular pressure (IOP), or normal-tension glaucoma. This, in turn, could cause glaucoma, as elevated intraocular pressure within the eye is recognizing a risk factor for glaucoma. Glaucoma is the second leading cause of blindness. The researchers say that tension-lowering eye drops can improve normal-tension glaucoma and slow the associated vision loss. However; "the fact that a considerable portion of people develop glaucoma despite having never had elevated IOP suggests that there must be a mechanism that is independent of intraocular pressure that causes damage to the optic nerve. The researchers used magnetic resonance imaging (MRI) to observe the optic nerve as people gazed in several directions. They then compared the findings of people with normal-tension glaucoma to those from healthy volunteers. They found that the optic nerve and its surrounding sheath serve as a tether on the eyeball. The tether was slack in abduction (moving outward) and taut in adduction (moving inward). In the group with normal-tension glaucoma, the optic nerve and the sheath are strained in adduction. Everyday eye movements could put even more strain on the optic nerve which involves degrees of adduction that could have a physiological effect. The next step would be to investigate therapies that could possibly relieve the strain produced by eye movement; eye drops routinely prescribed to glaucoma patients to lower their intraocular eye pressure have a side effect that may benefit people with normal intraocular pressure. The drops can cause the fat around the eye to atrophy, which then causes the globe of the eye to sink back slightly into the socket. This could create needed slack in the optic nerve.

PRATHIKSHA H, IV B.Sc., BBG

THE HUMAN IMMUNE SYSTEM TARGETS TB

Every 18 seconds someone dies from tuberculosis (TB). It is the world's most deadly infectious disease. *Mycobacterium tuberculosis*, the causative agent of TB, has infected over one-third of the entire human population with an annual death toll of approximately 1.5 million people. For the first time, an international team of scientists from Monash and Harvard Universities have seen how, at a molecular level, the human immune system recognizes TB infected cells and initiates an immune response. Their findings, published in Nature Communications, are the first step toward developing new diagnostic tools and novel immunotherapies.

The main reason for current lack of knowledge is due to the complexity of the bacterium itself. Crucial to the success of *M. tuberculosis* as a pathogen is its highly unusual cell wall that not only serves as a barrier against therapeutic attack, but also modulates the host immune system. Conversely, its cell wall may also be the "Achilles' heel" of mycobacteria as it is essential for the growth and survival of these organisms. This unique cell wall is composed of multiple layers that form a rich waxy barrier, and many of these lipid -- also known as fatty acids -- components represent potential targets for T-cell surveillance. Specifically, using the Australian Synchrotron, the immune system recognizes components of the waxy barrier from the *M. tuberculosis* cell wall. This paves way for improvement in diagnosis, therapeutic design and vaccination. **RASHMI, VI B.Sc., BBG**

DEAD TREES ARE ALIVE WITH FUNGI

Fungi that live on trees perform an important function in the forest ecosystem by breaking down dead wood. This is no easy feat, because wood is very resilient. It is held together by a biopolymer known as lignin, which together with cellulose and hemicellulose form the cell wall of woody plants and give the wood its stability. Fungi are able to break down the robust lignin and the flexible cellulose fibres by releasing enzymes that cause the polymers to degrade and become mineralized. As part of the ecosystem cycle, the leftover material becomes part of the humus layer, which gives the soil its stability and forms the substrate for a new generation of trees.

Around 300 dead tree trunks of eleven different species, each up to four metres long were analysed. The trees included seven deciduous species such as beech, oak, poplar and ash and four coniferous species: spruce, Scots pine, Douglas fir and larch. Three years later they returned to see what kind of fungal communities had established themselves in the trunks. The diversity of fungi living in the trees was an order of magnitude greater than previously thought, the researchers identified between 22 and 42 operational taxonomic units (OTUs) per trunk. OTU is a scientific term used by molecular biologists to describe organisms that can be equated with individual species due to their DNA but do not already have a species name of their own. All in all, the team identified 1,254 OTUs in the dead trunks. In a previous study, researchers found just 97 fungal species living on the same logs - about 12 times fewer than the scientists have now discovered. Dead conifers generally had greater species diversity of fungi than most deciduous trees. The greatest diversity occurred on Douglas fir, larch and oak and the smallest amount of diversity on beech and hornbeam.

Soil biologists also discovered that wood-inhabiting fungi prefer certain species of trees and donor simply have a general preference for either conifers or deciduous trees, as scientists previously assumed. They discovered seven such distinct fungal communities on deciduous trees and two on coniferous species.

The results of this study have increased understanding of the biodiversity of communities living in dead wood. This is important not only because it will enable to improve the protection of wood-inhabiting fungi, which may be threatened by the expansion of forest monocultures. It is also important because the fungi that grow in dead trees include species already known as soil-dwellers, plant pathogens or symbiosis partners, which appear to use dead wood as a temporary habitat. Dead wood is an integral part of forest ecosystems.

AYESHA FIRDOSE

IV B.Sc., BBG

MODIFYING A LIVE VIRUS IN A VACCINE AGAINST INFLUENZA

By genetically weakening the constituent live virus, scientists have created a vaccine against influenza in which the virus is capable of activating the immune system but cannot replicate in healthy cells -- an approach that may become more widely used for generating live virus vaccines adapted to other viruses.

The vaccine proved effective in mice, guinea pigs and ferrets. A major challenge in developing viral vaccines is incorporating enough of the virus to elicit an immune response, while not allowing the virus to run rampant through the body, infecting healthy cells. To overcome this issue, Longlong Si and colleagues modified the genetic code of influenza A virus so that it could only infect and replicate in a cell line they engineered to be dependent on an unnatural amino acid; critically, their modified virus -- though still just as potent in terms of activating the immune system -- cannot replicate in conventional cells. In mice, administering the modified, infected cells in the form of a vaccine offered full protection against influenza.

The new vaccine was found to offer an antibody response comparable to an existing live-virus vaccine, and a second dose further increased antibody titers by a factor of six to eight. Similar beneficial effects were seen when the viral vaccine was tested against several different strains of influenza, and tested in guinea pigs and ferrets. These types of virus vaccines can be potentially adapted to almost any virus, the authors say, as long as their genome could be manipulated and packaged in a cell line.

MEGHANA

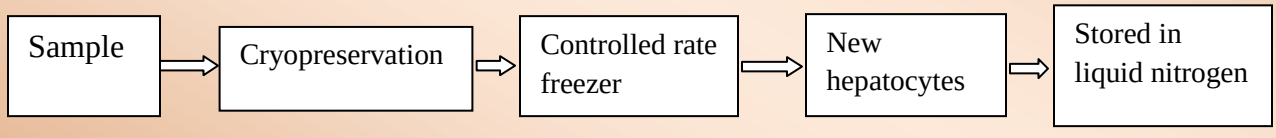
VI B.Sc., BBG

ARTIFICIAL LIVER

An artificial liver is a device which is generally made from real human liver cells. Most time it is used to help patients who suffer from acute or chronic liver failure. While the artificial liver is still under development, it shows promise in helping to keep patients alive while waiting on a transplant or during times of illness when the liver is not working at maximum function.

Method of production

The bio-artificial liver support system consists of different components including cell source, a human hepatocytes and a bio reactor and a perfusion system for blood or plasma.



Bio-artificial liver unit

The bio reactor is a close circuit containing media reservoir and the constructional equipment's like pumps, oxygenator, and hollow fiber bioreactor cartridge with cells in it, tubing and adapters. The cartridge connects to a reservoir bottle containing growth media and hollow fibers are pre-arranged longitudinally. The oxygenated media from reservoir is allowed to reach the hollow fiber bioreactor

cartridge by means of a pump and is divided across the hollow fiber mouth for uniform flow of media into the intra capillary space of fibres. The whole circuit setup is kept in a cell culture incubator at about 37 ºC. As per manufacturer's protocol the extra capillary space of hollow fiber cartridge is coated with mouse lamina before cell loading by means of a syringe. The cultured medium from reservoir is then replaced by same volume of freshly made hepatozyme. The BAL culture medium used for culturing hepatocytes should be tested for bacterial, fungal and mycoplasma contamination in prior. The body temperature of patients is allowed above 36º C to evade hypothermia. Studies showed better neurological state, enhanced dieresis and stabilization of hemodynamics. The only identified side effect was hypotension which can be corrected within 15 minutes by fluid addition and temporary running of dopamine. The disadvantages of earlier BAL are: insufficient number of hepatocytes, and loss of function of hepatocytes.

To overcome the above demerits, most advanced type of BAL that is SRBAL is developed. Most commonly used Bio-artificial liver is spheroid Reservoir Bioartificial LIVER [SRBAL].

The type of bioartificial liver is MARS [Molecular Adsorbent Recycling System]. This was first invented in UNIVERSITY OF ROSTOCK [Germany] in the year 1993. MARS is a non-biologic therapeutic support system. MARS removed bilirubin, biliary salts, pre-fatty acids and tryptophan by maintaining the essential proteins such as albumin, alpha 1 glycoprotein, alpha 1 glycoprotein, alpha 1 antitrypsin, alpha 2 macroglobulin transferring, globulin tyrosine and hormonal systems. Mars is an extracorporeal hemodialysis system consisting of three circuits, namely blood circuit, albumin circuit, open loop-single pass dialysate circuit. It helps in the removal of albumin bound molecules and toxin from the blood. MARS are commonly used for the treatment on hepatic encephalopathy [HE]. MARS improves protein synthesis and removes water soluble and albumin bound substances.

NEHA MAHESH IV B.Sc., BBG

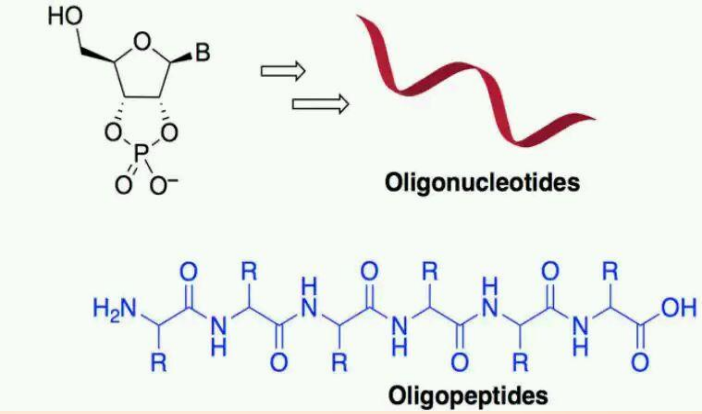
PRODUCTION OF BIODIESEL FROM RUBBER SEED OIL

Bio-diesel refers to a vegetable oil or animal fat based diesel fuel consisting of long chain alkyl/methyl/ethyl/propyl esters. It is different from the vegetable oil and waste oils that are used as fuel converted diesel engines. The National Biodiesel Board (USA) defines biodiesel as a "mono alkyl ester". The use of biodiesel potentially reduces greenhouse gas emissions, deforestation, pollution and the rate of biodegradation.

Many counties around the world are involved in the growing, use and production of biofuels, such as biodiesel, as an alternate source of energy to fossil fuels and oils. Currently, most of the biodiesel is produced from refined/edible oils. Rubber (*Hevea brasiliensis*) Seed oil was extracted and the crude oil was esterified to produce the biodiesel whose fuel properties was improved by trans-methylation. Biodiesel is produced by in situ transesterification method from the seed of rubber tree using KOH as a catalyst. After the extraction, the physical and chemical properties such as free fatty acid (FFD), viscosity etc was determined. The crude oil was then bleached and the ester fuel (methyl ester) was prepared using excess of 6M Methanol using Sodium hydroxide as a catalyst. The analysis of the properties of the oil (bleached and esterified) to commercial diesel showed that transmethylation improved the fuel properties of the oil. The result showed that the best of ratio of seeds to methanol was 1:6 (10g seeds with 60g methanol), 120 min reaction time at 60℃ reaction temperature. This result supports the study of production of biodiesel from the rubber seed oil using in situ transesterification method.

ASHWINI, IV B.Sc., BBG

CHEMICAL REACTION HELP SCIENTISTS TRACE LIFE



A team led by Indian-origin researchers has developed a fascinating new theory for how life on earth may have begun. Their experiments demonstrate that key chemical reaction that support life today could have been carried out with ingredients likely present on the planet four billion years ago.

Ramanarayanan Krishnamurthy, Associate Professor at the SCRPPS Research Institute (TSRI) in the US and his colleagues focused on a series of chemical reactions that make up what researchers refers to as the citric acid cycle to release stored energy in cells. The study outlines how two non-biological cycles - called the HKG cycle and the malonate cycle – could have come together to kick start a crude version of the citric acid cycle .

The two cycles use reactions that perform the same fundamental chemistry of α-ketoacids and β-ketoacids as in the citric acid cycle. These shared reactions include aldol addition, which bring new source molecules into the cycles, as well as beta and oxidative decarboxylation, which release the molecules as carbon dioxide. As they ran these reactions, the researchers found they could produce aminoacids in addition to CO_2, which are also the end products of citric acid cycle.

The researchers think that as biological molecules like enzymes became available they could have led to the replacement of non-biological molecules in these fundamental reactions to make them more elaborate efficient.

SABHA SAMREEN

IV B.Sc., BBG

DEPARTMENT OF LIFE SCIENCES

Curricular and co-curricular

ACADEMIC YEAR 2017-18

Sl.No	EVENT	TOPICS
1	Connoisseur and BioVentura	Intracollegiate Bio-Fests
2	BioAura	Intercollegiate Bio-Fest
3	Creatrix	Life Sciences Exhibition
4	National Conference	Genetics for Human Welfare
5	National Seminar	Microfluidics
6	Workshop	Molecular Biology Techniques
7	FDP	Data analysis on Natural sciences
8	Guest lectures	5 Guest Lectures were conducted

STUDENTS ACHIEVEMENTS- INTER COLLEGIATE FESTS 2017- 2018

Sl. No.	Fest	University/ College	Prize Won
1.	Jeevotsav (UG)	Christ University	Over all Winners (UG)
2.	Jeevotsav (PG)	Christ University	Over all Winners (PG)
3.	Wild 7.0	St. Joseph's College, Langford Road,	Winners
4.	Gardenia 2K18	Garden City University	Winners
5.	KALOPSIA 2K18	Jain University, J C Road	Over all Winners
6.	BIOQUIMICA	Reva University	Winners

DEPARTMENT OF LIFESCIENCES

FACULTY CORNER

ENDOPHYTIC MICROORGANISMS WITH THE POTENTIAL TO IMPROVE PLANT GROWTH

Dr. Sivagamasundari
Faculty, Department of Life Sciences,
Kristu Jayanti College (Autonomous), Bangalore

Beneficial plant–microbe interactions that promote plant health and development have been the subject of considerable study in agronomy. Endophytes (microorganisms that live within plants) inhabit plant tissues in their life cycle without causing any apparent harm to their host. Especially bacteria, that generally colonize the intercellular spaces, have been isolated from all plant tissues and many species constituting a great reservoir of diversity with a remarkable biotechnological potential. They differ from bio control strains in that they do not necessary inhibit pathogens but enhance plant growth through increasing nutrient uptake, N_2 fixing and by secreting phytohormones. A diverse array of bacterial species has been reported to be endophytic including *Acetobacter, Arthrobacter, Azospirillum, Bacillus, Burkholderia, Enterobacter, Herbaspirillum* and *Pseudomonas*. Most of the studies have explored the properties of these isolates in relation to agronomical inoculants as nitrogen fixing bacterial community, since there are some obstacles to successfully implementing these bacterial endophytes in agriculture; by conventional practices continue to take priority. Despite this, large scale field application of these isolates at different agro climatic condition is necessary to confirm their potentiality for formulation as effective bio-fertilizers for sustainable and eco-friendly crop production is considered more important.

BIOFILM-PROBLEMS & PROSPECTS

Dr.Challaraj Emmanuel, E.S.
Faculty, Department of Life Sciences,
Kristu Jayanti College (Autonomous), Bangalore

Bacterial biofilm is defined as a structured community of bacterial cells enclosed in a self-produced polymeric matrix and adherent to an inert or living surface. Biofilm extracellular polymeric substance is a polymeric conglomeration generally composed of extracellular DNA, proteins, and polysaccharides. Microbes form a biofilm in response to many factors, which may include cellular recognition of specific or non-specific attachment sites on a surface, nutritional cues. Bacterial aggregation is the default mode, and that subsequent biofilm development progresses by adaptation to nutritional and environmental conditions.

The pathogens that cause acute infection are generally free-floating bacteria – also referred as planktonic bacteria – those chronic bacterial forms that stick around for decades, long ago evolved ways to join together into communities. Because by doing so, they are better able to combat the cells of our immune system. A vast number of the pathogens we harbor are grouped into communities called biofilms.

Currently, research is focused on the development of antibiofilm agents that are nontoxic, as it is believed that such molecules will not lead to future drug resistance. In this review, we discuss recent discoveries of antibiofilm agents and different approaches to inhibit/disperse biofilms. Obviously, then, not all biofilms are harmful. Many play an important role in the ecology of the earth and the sustainability of life in general. The report on Global Environmental Change, points out that the basic chemistry of Earth's surface is determined by biological activity, especially that of the many trillions of microbes in soil and water.

Microbes make up the majority of the living biomass on Earth and, as such, have major roles in the recycling of elements vital to life and, as we are learning, those microbes often live in biofilm colonies on surfaces. Biofilms are pervasive and problematic in medical, industrial and environmental settings. The immediate practical difficulty posed by biofilm resistance to chemical challenge is that most real-world microbiological problems are rooted in biofilms. These insights into the fundamental basis of biofilm resistance to antimicrobial agents suggest new approaches to biofilm control. Microorganisms can cause iMBGalance in an environment if the conditions are right. Ironically, that's why microbes can be beneficial, too. A real barrier to the discovery, understanding, and development of practical biofilm control technologies is the current lack of recognized standard biofilm testing methodologies.

FACULTY PUBLICATIONS 2017- 2018

Sl. No.	Name	Title of the Article	Details of Publisher
1.	Dr. Challaraj Emmanuel.E. S.	A Study of Bacteriocin Producing Lactic acid Bacteria with Antibacterial and Antioxidant properties isolated from Plant wastes	**Journal of Pure and Applied microbiology**
2.	Dr. Challaraj Emmanuel E. S.	Purification, Characterization of Tyrosinase from Bacillus megataerium and its application for the degradation of phenolic waste in the industrial effluent	**International Journal of Advanced Scientific and Technical Research**
3.	Dr. S. Vijayanand	Phytochemical Studies of Phyllanthus eMBGlica, Ananasm comosus, Momordica charantia Extracts	**International Journal of Pharma Research and Health Sciences**
4	Dr. Joseph K. S.	Physicochemical Characteristics of the Seed and Seed Oil of the Potentially Medicinal Plant Ziziphus oenoplia	**Journal of Dietary Supplements**

5	Dr. Joseph K. S.	Garcinia gummi-gutta(L.) Robs.;a Promising feed stock for biodiesel production	**International Journal of Green Energy**
6	Dr. Calistus Jude	Larvicidal and Anti-feedant Activity of Phyllanthus eMBGlica and Syzygium cumini extracts on the Diamondback Moth: *Plutella xylostella*	**International Journal of Biology Research**
7	Dr. S. Vijayanand	Screening of Mutinga Calabura and Theobroma cacao for Potential Bioactives	**International journal of recent scientific research**
8	Dr. Challaraj Emmanuel E.S.	A study on isolation and characterization of Xylanase producing bacteria (*Brevibacterium brevis*)	**International Journal of Pharma & Biosciences**
9	Dr. Suresh K	Predicted side effects of NPC1 protein inhibitors	**International Journal of Life Sciences**
10	Dr. Sivagama Sundari U	Isolation, identification and characterization of endophytic bacteria-*Azospirillum sp*. and *Pseudomonas sp*. from Brinjal (*Solanum melongena l.*)	**International Journal of Life Sciences**
11	Dr. Durairajsekar	Identification, expression and Methylation of mRNA-7110 and its involvement in type 1 diabetes mellitus	**Gene Reports**
12	Dr. Selvam Arjunan	Microalgae Harvesting via Flocculation: Impact of PH, Algae Species and Biomass Concentration	**Methods of Microbiology and Molecular Biology**
13	Dr. Durairajsekar	MicroRNA21 and the various types of myeloid leukemia	**Cancer Gene Therapy Nature group of a Journal**

EDITORIAL TEAM

PHOTO GALLERY

Environment Awareness Day

Inter Collegiate Fest Overall Winners

Green India Essay competition 2017

Industrial Visit, Munnar, Kerala

International Expert Talk

Creatrix, 2017