NEWSLETTER

SCHOOL OF LIFE SCIENCES
MANIPAL UNIVERSITY

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IN FOCUS: WHAT NEXT?

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Mahesh Nair: Cover Page Photo.

EDITORS' NOTE

Why do people study Science? To become a Scientist, right? I mean….. its fairly obvious. But, truth be told, it is a pretty good question. An education in science need not always culminate in a career in scientific research. Science, as we are all aware, is all around us. As a subset of Science, Life Sciences is emerging to become the hottest new thing, with huge potential in the booming healthcare sector. What does this mean for us Life Sciences graduates? Simply put, it means the healthcare segment is open to us. We can homologously or non-homologously integrate ourselves into any area of the healthcare genome- be it the areas that code for business development, administration, industry and production, or dive into the scientific side of it all, without which all the others would cease to exist.

Life Sciences' today provides us a platform with a variety of options to choose from; and among those options, a variety of sub-options, and amongst those sub-options… well, you get the picture. But this tremendous potential also poses a very critical problem: after your Life Sciences degree, what should you go in for? Should you stay on the highway and pursue a career in Research? Should you branch off towards the Industry, or follow the left lane that leads to the Administrative side of things? If you are faced with these doubts, fear not- we are as well. In fact, this is what prompted us to theme this edition of the e-Newsletter 'What next?' to shed some light on the various doors waiting to be opened by you, to help you make informed decisions. We would, however, advise you to use this issue as a guideline more than anything else, or, as we say, let this be the marker you use to sequence the genome, not the genome sequencer itself. We sincerely hope you find this interesting and useful, and look forward to your feedback after its release.

- Syamala Inumella BSc Year III, and Anant Kakar, MSc Year I

WHAT NEXT?

- Anant Kakar, MSc Year I

AN INSIGHT INTO RESEARCH

Life Science research forms the heart of the health sector, tirelessly pumping blood to the Industrial, Administrative, and Financial side of things. Life Sciences research is vast, encompassing a variety of different fields which include Physics, Chemistry, Philosophy, Mathematics, Computing and a little bit of Biology as well. What is a career in research like? It is both terribly fascinating and terribly difficult: different people are drawn to different aspects of it; if your passion outweighs the difficulties associated with it, then this option is what you should look towards. Now, at this point, you might wonder: What is the scope of research in our country? What kind of research goes on in India? A renowned medical biochemist Dr. Ram Vishwakarma, who was a guest of honour during the Annual Day celebrations recently, spoke about the current status and future prospects of drug discovery and development in our country, stating (paraphrasing) that Drug Discovery has always relied on a conceptually simple and effective process: identifying molecules (usually obtained from nature), that have the potential to revert pathological conditions and optimizing their therapeutic potential whilst minimizing, if not eliminating, their possible adverse effects. However, in order to optimize the Drug Discovery process, we must allocate more of our resources (funding, labs, and scientists) to unlock nature's full potential – in other words, to investigate and study compounds that are produced by plants and microbes all around us. These compounds hold great pharmaceutical potential. (His entire interview can be found on page 29).

Drug Discovery, however, in all its vastness, forms just one tiny aspect of Life Sciences research. Research in the health sector can be broadly categorized into fundamental and translational research. Fundamental research is more curiosity driven than anything else. It forms the framework for Life Sciences research and provides a lot of useful information (which translational research depends on). It is research focused towards understanding the mysteries of life in general. Contrastingly, translational research expands on fundamental findings and involves product oriented research.

For example: *hey! What is this protein, and why is it here? what does it do in the cell? How does it fold, and why does it fold the way it does?*

Questions like these would come under the fundamental roof, from which translational would take over: *Hmm, so fundamental research has shown that this protein is involved in this particular function, and they have already uncovered the structure for us. And this protein seems to play a role in that pathway? The one involved in that disease… why not use this as a target then?* The said target can have a diagnostic, prognostic, therapeutic (or a combination of all three) use. In this edition, we have highlighted certain areas of Life Sciences research to help those interested narrow down their interest a little more.

The one last thing I would like to point out about research is that if you are naturally curious or motivated by therapeutic discovery (and are willing to put in the effort), then please do not take the following list too seriously, as it just showcases some of the subfields of Life Science research: remember, research is not about the field(s); it is about finding answers to the question(s) asked.

THE LIFE SCIENCES INDUSTRY:

What do you think of when you hear the word ''Life Sciences Industry''? Personally, I was under the impression that this Industry consisted of large factories with massive fermenters where raw materials were put in on one side and products were collected from the other. I mean, once a molecule passes the rigorous Drug Discovery obstacle course, it just needs to be produced in bulk and marketed, right? And how complex could that be? I realized, on the 29th of April,2016, through a fascinating interview with Dr. Narendra Chirmule, Director, R&D, Biocon India Pvt. Ltd., how many light years away I was from the truth. An excerpt:

Dr. Chirmule (paraphrasing): The industry requires a critical mix of scientific thinking & business acuity. The industry acts as a bridge between science and the people, the 'market', without which the science cannot reach them. A chemical compound needs to be produced in such a way that it is 100% pure (in some cases, it needs to be linked up to another pure compound to enable human use, example: Cetirizine Hydrochloride), and packaged in a manner that makes it completely airtight (in fact, a lot of research has gone into understanding the right amount of vacuum required between a tablet and the plastic that surrounds it), stable to temperature and pressure fluctuations, and accurately dosed: 50mg must mean 50mg, not 50.1 or 49.9. If anything were to go wrong with these processes, it could lead to a severe impact on human health.

And, the industry also has the responsibility to produce this compound in quantities that meet the market demand, which, in a country like ours, is usually quite high. On top of all this, the industry needs to make a profit, to be able to sustain itself. (The entire interview is on page 31)

So, how would you know if the Biotechnology Industry is up your alley? Well, to get a little perspective, ask yourself some of the following questions:

·Would I enjoy using my Science background to optimize production? For example, by genetically engineering microorganisms in novel ways to increase product yield, or prevent contamination? Remember, *product optimization* is a field in itself, which includes optimizing fermenter design, raw material constituents, fermentation conditions, and so on; the list is rather lengthy.

·Would I enjoy overseeing crucial upstream and downstream processes such as raw material preparation, sterilization, and so on?

·Would I enjoy being part of the *regulatory processes* of Industry, such as product purity assessment, effluent treatment, and so on?

·Would I enjoy being part of the *business development* team, conducting surveys and market research, to identify 'high demand' zones and ensure my industry stays ahead of the others?

·Would I enjoy being inside a huge fermenter, thrown around from one end to the other as I try to compete for nutrients and produce whatever it is that these people want? Hang on, sorry, that question is not for our species. *Not yet, anyway.*

This list is not exhaustive; however, I hope this has given you some idea of Life in the Life Sciences Industry, and, I also hope you enjoyed my poor attempt at subtle wordplay, which has been highlighted.

THE MBA OPTION:

The MBA pathway, which the cells use to produce high energy compounds such as – hang on, hang on, does it really matter if I choose this pathway? Well, it definitely helps. The answer would, of course, be Administrative and Financial players in the health sector, which includes Hospitals, small and large Pharmaceutical companies, the Life Science Industry, and, believe it or not, even Research Institutes!

MBA, when metaphorically expanded, stands for 'mazing people skills, business acumen, an aptitude for administration, accounts, and, of course, a (love for numbers, balance sheets, profit and loss margins, financial evaluation of a company, and so on).

On a slightly deeper note, the M.B.A. route is recommended for people who would like to combine their scientific knowledge with a business perspective to be able to:

·Showcase their company's products, the type of research carried out, and so on, in the right manner, to the correct market space.

·Assess and evaluate a company's financial worth, and look for ways by which this number can be optimized.

·Understand the needs of the most focal point of a company: the employees, to be able to create a positive work environment for them.

·Successfully administrate a company (or a particular department in a company): oversee the work carried out, delegate responsibilities, ensure assigned tasks are completed, and so on, to ensure the company runs like a well-oiled machine.

·Understand the needs of the clients the company caters to, and ensure that they are speedily met.

·Understand and enable market driven research, by scanning the market for areas of high demand with a supply deficit, and so on. It should be noted, however, that this particular task is most often carried out by PhD-MBAs, who thoroughly understand both sides of the story.

·Wear sunglasses and suits indoors.

If you feel you would enjoy this kind of a lifestyle, maybe 'Life Sciences' business side would be good for you. I also promise not to crack any more 'life' jokes.

GENETICS

Ankitha Prabhudev, MSc Year I

Sydney Brenner, writing in the 100th issue of *Trends in Genetics* (1993), made the prediction that Genetics as a separate subject would have disappeared by the year 2000, because all Biology would be gene-centered and all Biologists would be Geneticists. Although this prediction may have been realized, Genetics still offers a different view point and experimental approaches to various issues in Biology.

Genes, made of DNA and assembled into chromosomes, not only encode the structure of some cellular products, but also bear control buttons that determine when, where, and how much of that product is synthesized. Most genes encode protein products, whilst some encode RNA products necessary for cellular function. Proteins are the most important determinant of the properties of cells and organisms. They are the structural and functional components responsible for how a living thing looks (structural proteins e.g.: melanin) and functions (enzymes and hormones e.g.: insulin).

The DNA present in the nucleus of every cell is ultimately responsible for passing on the information necessary for life from cell to cell and also from parent to offspring. Genetics is a sub-discipline of Biology that studies how this happens and how each individual is unique in terms of his/her genetic makeup. In other words, Genetics is the study of genes (their functions and effects), heredity (inheritance) and genetic, epigenetic and environment-induced variation between organisms. Whether Geneticists conduct research at the molecular, cellular, organismal, familial, or evolutionary level, genes are always the focal point of their studies.

The realization that the DNA sequence information in a gene determines the amino acid sequence and structure of a protein, ultimately resulting in the phenotype of the organism, forms the basis of genetic research today.

Classically this involved the use of genetic variants (mutants) to upset the biological function of cells or organisms and, from the effect of these mutations, to deduce how these cells and organisms work. Today, the availability of sequence information and genomic analysis, together with sophisticated techniques for gene replacement and gene expression analysis (microarray technology), along with bioinformatics techniques provides us with powerful tools to look at the way genes work and interact to make us who we are, paving the way for intergenic studies and the discipline of genomics.

More recently, Epigenetics, a dynamic discipline, which challenges traditional paradigms of inheritance, has come to the forefront of genetic research. Epigenetics is the field of genetics that involves the study of cellular and physiological phenotypic trait variations caused by external or environmental factors that switch genes on and off and affect how cells read genes. Hence, Epigenetic research seeks to describe dynamic alterations in the transcriptional potential of a cell. These alterations may or may not be heritable and are independent of the nucleotide sequence of the genes.

Research in Genetics will therefore lead us to a better understanding of normal processes such as development of an organism, cell differentiation and the mechanisms of complex diseases such as diabetes, neurodegenerative disorders and cancer.

A few examples of recent research findings in the field of Genetics are listed below:

·The incredible discovery that some parts of the human microbiome (the collection of microbes inside the human body) are actually heritable, and get transferred from parent to offspring through genes! This study found a variety of heritable bacterial species such as those related to immune defense, metabolism, and so on (Goodrich et al., 2016)

·Gene expression studies have shown significant variation in the expression of many different genes in conjunctival squamous cell carcinoma (a malignancy of the ocular surface), compared to the expression pattern in healthy cells. This study has identified proteins that have been up regulated to more than 30 times their normal value; these proteins have the potential to act as valuable biomarkers for disease diagnosis, and can also be used as drug targets (Mahale et al., 2016).

·Genetic and Epigenetic studies have found that an individual's life experiences may be epigenetically passed down generations! For example, studies on the survivors of traumatic experiences have shown that the 'exposure to stress' may have a long lasting effect of subsequent generations (Houri-Ze'evi et al., 2016).

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DNA, Genes, and Chromosomes

(http://tinyurl.com/jle4ute)

MOLECULAR BIOLOGY

-Atrishi Badu, BSc Year III

What is Molecular Biology?

The branch of science that involves the study of biological activity at the molecular level is known as molecular biology. It overlaps the major fields of science, namely – Chemistry and Biology, particularly Biochemistry and Genetics. The way cellular molecules such as DNA, RNA and proteins function independently and with each other is the basic premise of molecular biology.

Who are Molecular Biologists and what do they do?

In simple terms, a person who studies Molecular Biology is a Molecular Biologist. In complex terms, a Molecular Biologist is a person who dedicates his/her life to understand the various biological mechanisms and processes that occur within a cell and how they relate to the physiology of the organism as a whole. Such people try to decipher the hidden messages lurking within the complex structures of molecules such as DNA, RNA and proteins using advanced qualitative and quantitative methods involving *in vitro* as well as *in vivo* techniques.

What is the current research in Molecular Biology?

Almost all Biological Science fields incorporate some or all aspects of Molecular Biology; therefore asking what the current research in Molecular Biology is, is a somewhat unclear question. However, a lot of exciting and interesting work is currently being conducted all around the world.

In the month of May 2016, Scientists, in particular Molecular Biologists were able to develop a novel culture system that allowed them to track the development of human embryos in vitro for a period of up to two weeks! According to the reports, this new technique would enable us to delve deeper into our own development which could, from the human health perspective, help us understand what happens, for example, during miscarriages (Deglincerti et al., 2016).

According to a recent study, the "hunger hormone" – Ghrelin – was found to not increase appetite, as previously proposed. Instead, it was found that it promotes fat storage. This study was done using transgenic mice that possess an overactive form of the receptor for ghrelin. The paper published in April 2016 suggests that the long held traditional view that ghrelin is a regulator of food intake is not entirely true (Chebani et al., 2016).

In the field of Cancer Biology, a team of Molecular Biologists and Bioengineers discovered that human breast cancer cell lines, rather than forming spheroid tumors, spread out along blood vessel endothelial cells. On further observation, the team found that these cancer cells created nanotubes which allowed the transfer of a dye from the cancer cells to endothelial cells. These nanotubes were also utilized by the cancer cells to localize microRNAs for regulation of cell adhesion and tight junction dissociation. With the help of this study, researchers are now investigating the role nanotubes play in cancer metastasis (Conner et al., 2015).

As you can see, the field of Molecular Biology is far beyond what meets the eye. With an unlimited potential for application in all areas of Science and technology, Molecular Biology is here to stay.

Some of the top Institutions to pursue Molecular Biology are listed below, although there are several more:

Harvard University, University of California – Berkeley, Johns Hopkins University, Stanford University, University of Cambridge, Karolinska Institutet, Kyoto University, and University of New South Wales, Indian Institute of Science, Centre for Cellular and Molecular Biology.

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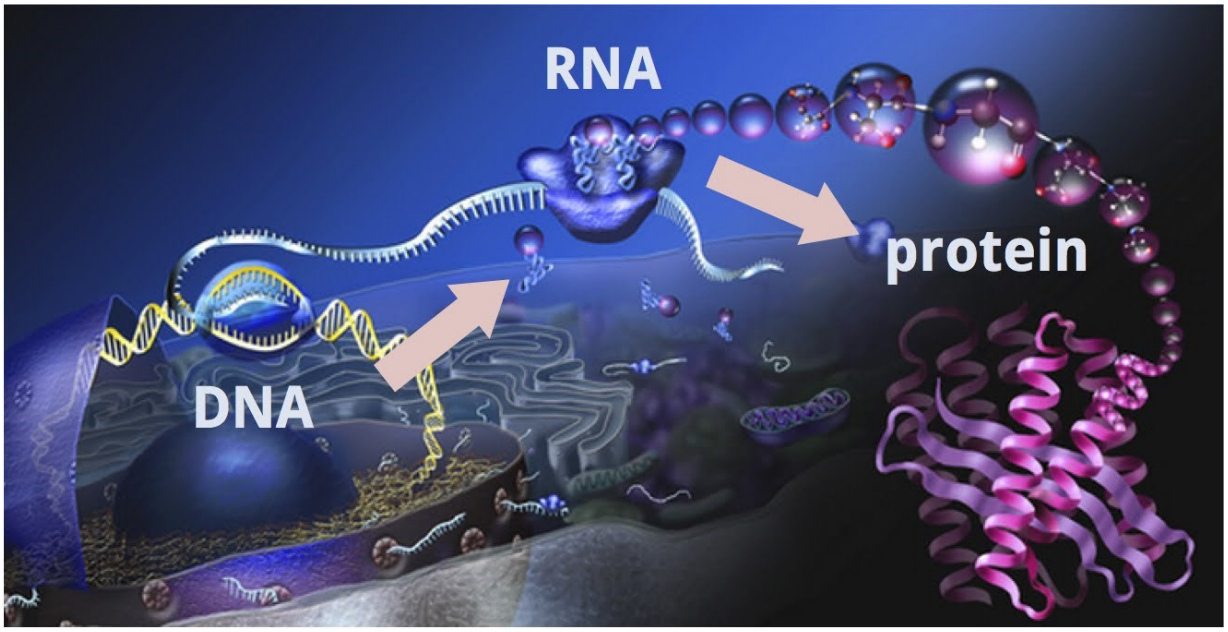

Image : The Central Dogma of Life
(https://i.ytimg.com/vi/lSqUDu4zb5k/maxresdefault.jpg)

CELL BIOLOGY

- Soujanya Padikkal, MSc Year I

Cell biology or Cytology is the study of a cell's structure and function ranging from the basic properties shared by cells to the intricate functions particular to specialized cells. It studies the organization and function of organelles, their physiological properties, metabolic processes, signaling pathways, and interactions with the environment. Understanding the mechanism of how cells work is fundamental to all fields of biological sciences and research in Cell biology requires a thorough understanding of Genetics, Molecular biology, Immunology and Developmental Biology.

An insight into Cell biology at the postgraduate level deals with cell morphology, movement (how cells move using chemotaxis, contraction, cilia and flagella), cell signaling, the movement of molecules into and out of the cells through active and passive means, intracellular molecular movement, cell division, cell senescence, the effects of various compounds on cellular function, the cellular aspect of tumorigenesis and other diseases, and so on. A practical approach towards this subject involves culturing cells under specific conditions and studying their morphological and biochemical characteristics; using an array of different microscopes to enable visualization, using cells for specific processes such as immunostaining, transfection, *in situ* hybridization, and histological characterization.

A few examples of recent findings in the broad field of Cell Biology are listed below:

·Cell Biologists at the University of British Columbia have discovered a eukaryotic microbe that does not possess any mitochondria! This finding, which was published in May 2016, is the first ever report of the existence of such eukaryotes. These microbes, that belong to the genus *Monocercomonoides*, possess an alternate energy generating system called the sulfur mobilization system that performs essential mitochondrial functions (Karnkowska et al., 2016)

·The p53 tumor suppressor protein plays a key role in protection against cancer. In 2014, Scientists were able to map the structural details of how exactly p53 binds to its regulatory molecule to bring about apoptosis and thus prevent cancer. This knowledge is extremely useful in the development of drugs that could 'unleash' p53 to battle a wide range of cancers (Follis et al., 2014).

·Scientists have discovered that neurons in the adult mouse brain can shape the physiology of nearby astroglial cells, highlighting how cells with established morphologies and locations in the brain can be significantly modified, even at a transcriptomic level, by the neurons that surround them (Farmer et al., 2016)!

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BIOINFORMATICS

--Gunjan Dixit, MSc Year I

Computational Biology, otherwise called Bioinformatics, gradually took off across the globe after the Human Genome Project was declared complete in 2003. Ever since, it has helped engender the rise of diverse fields which can be currently classified under Computational Science and has turned out to be a boon to numerous fields of research, from molecular medicine through to human evolution. In the present generation, computation has become an essential part of almost every scientific research activity, primarily due to its ability to process and interpret huge amounts of data, which is required to stay in line with the rapidly advancing technology that enables huge amounts of data generation from a single experiment. The demand for expertise in this field has increased rapidly over the years, and it is said that no laboratory in today's Life Sciences environment can function without skilled computational biologists. Computational Biology consists of a lot of sectors that one can specialize in, such as Genomics, Transcriptomics, Proteomics, Metabolomics (the study of an organism's genome, transcriptome, proteome, and metabolome respectively) and a wide variety of their sub-divisions. Some general applications of Bioinformatics include protein modeling (which involves protein structure prediction and visualization), simulations of regulatory networks and metabolic pathways, phylogenetic and gene expression analysis, interpretation of nucleotide and amino acid sequences, and the development of new algorithms to store data and evaluate correlations between large data sets.

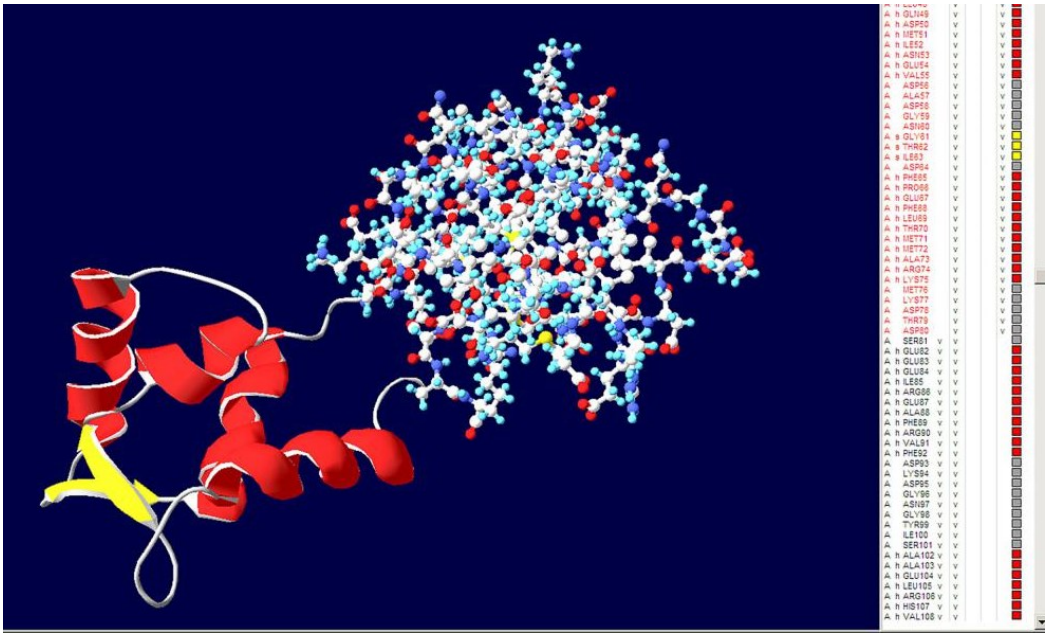

Image: Protein Modeling using Swiss PDB viewer
(http://www.romj.org/files/pictures/2013/romj-2013-0101.f.1.jpg)

A few examples of recent bioinformatics findings are mentioned below:

·A group of Bioinformaticians in 2015 developed a software that enables genome-wide microRNA (important regulators of gene expression) mining; this database was found be a lot more sensitive in discovering novel miRNAs that have not yet been registered in any miRNA database (Yu et al., 2015).

·In 2015, a group of Bioinformaticians utilized Bioinformatic tools to demonstrate the *in situ*-anti-fungal activity of a particular recombinant protein. They were also able to deduce the relationship between its structure and biological activity (Fu et al., 2015).

·In 2013, Dr. Getz and his team developed the computational tool 'MuTect', utilized for the detection of somatic mutations in tumors, which presents a unique spectrum of mutations that determine their proliferative rate and response to therapy (Cibulskis et al., 2013; Nawy, 2013).

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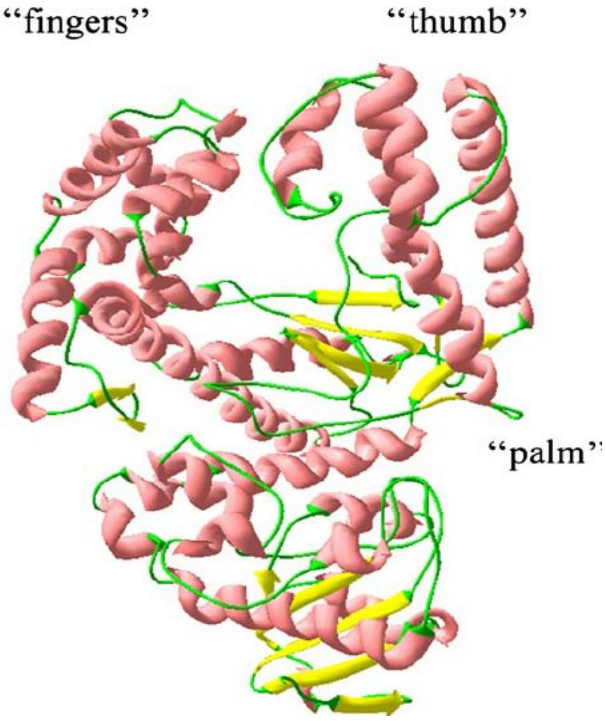

Image: Bioinformatic Representaion of DNA Polymerase

()http://tinyurl.com/jpwf7ej)

ASTROBIOLOGY

- Nishtha Singh, BSc Year I

"Man is but a foundling in the cosmos, abandoned by the forces that created him. Unparented, unassisted and undirected by omniscient or benevolent authority, he must fend for himself, and with the aid of his own limited intelligence find his way about in an indifferent universe."- Carl L. Becker

Since the beginning of time, the question of whether we are alone in the Universe or if there are actually other intelligent civilizations outside of Earth has been posed by humanity. Many speculations about little green men were envisioned because of movies, however, the thoughts of extraterrestrial beings were actually thought about as far back as the ancient Greeks. In 1894, Percival Lowell observed, through his telescope what he described as canals which, he suggested, could only have been made by intelligent beings. Satellites and robots have been sent to other planets, astronauts have walked on the moon and amino acids have been detected on meteorites that have fallen to the Earth. However, the most significant progress towards determining life on other planets was fifty years ago when Astronomer Frank Drake observed two nearby sun-like stars (Tau Ceti and Epsilon Eridani) which many presumed could be habitable planets where life existed. Dr. Drake spent over four months observing these two stars through a radio telescope. Unfortunately, the experiment did not prove there was life on these stars; it did, however, encourage other scientists to continue with their efforts of discovery. Drake formulated an equation (now known as the Drake Equation) that calculates, through different factors, how many intelligent civilizations are likely to exist in the Milky Way.

One of the world's oldest ideas--that life developed and exists in more places than just the Earth-is now one of the world's newest research programs. Astrobiology, a field that did not exist before 1995, is now a multidisciplinary approach to studying life on Earth, and in space.

The breadth of Astrobiology can be daunting. Because the field focuses on questions about the origins of life, it incorporates many aspects of Astronomy and Physics as well as Chemistry, Geology, Oceanography, Microbiology, Philosophy, and Bioinformatics. As a result, there are many different routes to a career in Astrobiology. Exobiology, for example, the study of the possibility of life on other planets — thrived with origin-of-life research in the 1950s and '60s, and really took off with the space exploration programs in the 1960s and '70s. Many different types of researchers now contribute to the field; for example, Geomicrobiologists look for extremophiles — microorganisms living in extremes of heat, cold, radiation, and pressure — and ancient organisms that derive their energy from chemosynthesis instead of photosynthesis. These organisms show that life's potentially habitable zones include terrestrial planets (say, Mars) and moons (think Europa and Titan). Meanwhile, astronomers have observed the formation of organic chemicals in stellar nebulae and discovered over 70 Jupiter-sized extra solar planets circling nearby stars.

A career in Astrobiology:

How rare is it for a recent Post-doc to work in an emerging scientific discipline? Or conduct research on fundamental problems like the origin of life on Earth, the existence of life in other parts of the Universe, or the future of life in space? How rare is it to participate in a research team spanning many scientific disciplines, including Astronomy, Biology, Chemistry, Geology, Genetics, Oceanography, Paleontology, and Planetary Science?

Only a few PhD Programs award Astrobiology degrees; students typically earn their degree in a field such as analytical Chemistry or Microbiology but focus on Astrobiology for their thesis. For example, the University of Washington in Seattle confers a certificate course in Astrobiology for graduate-level research, but graduate students retain their home-department affiliation for their doctorate. Graduates with this certificate have gone on to work as Astrobiologists or in related fields at NASA or other Institutes.

In 2005, Stockholm University launched an Astrobiology graduate school for an initial five years to gauge interest in the field, as a sort of interdisciplinary curriculum experiment. The University considered it a success, and departments including Astronomy and Geology have transferred their experience into the newly created Astrobiology center.

Astrobiology and Human Health?

Astrobiology initially comes off as a rather fundamental science; as the questions it aims to answer appear to have no significant relevance to human health. This, however, is a misconception, and to illustrate this, listed below are a few examples of how Astrobiology research could impact human health:

·One aspect of Astrobiology, namely Geomicrobiology, involves searching and characterizing extremophiles: micro-organisms that can thrive in particularly harsh or extreme conditions: for example, in 2010, NASA discovered the first micro-organism that was able to thrive and reproduce using arsenic, a toxic chemical, which it uses in place of phosphorus as a building block of its cellular components. Findings like this greatly help to further the knowledge on the fundamental characteristics of bacteria, opening up new avenues in microbiology and antibiotic discovery.

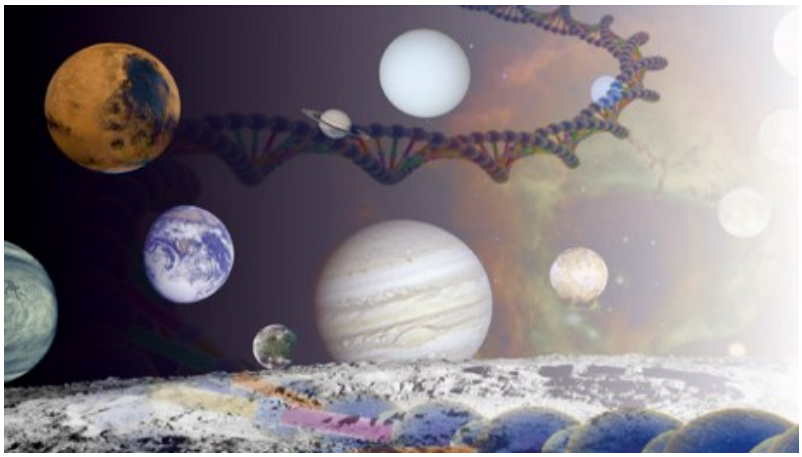

Image: Artistic Representation of the Nebula Theory (http://tinyurl.com/j22p9oz)

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In 2013, at the Arizona State University, Astrobiologists published a special issue in the journal Physics World titled 'The Physics of Cancer', where they provide a new, astrobiological perspective on the disease by researching into its origin, tracing it back to more than a billion years ago. They do this in order to understand why cancer exists at all, and help provide a fresh outlook on the mechanisms of this crippling disease to enable novel ways of mitigating it (Lineweaver et al., 2014).

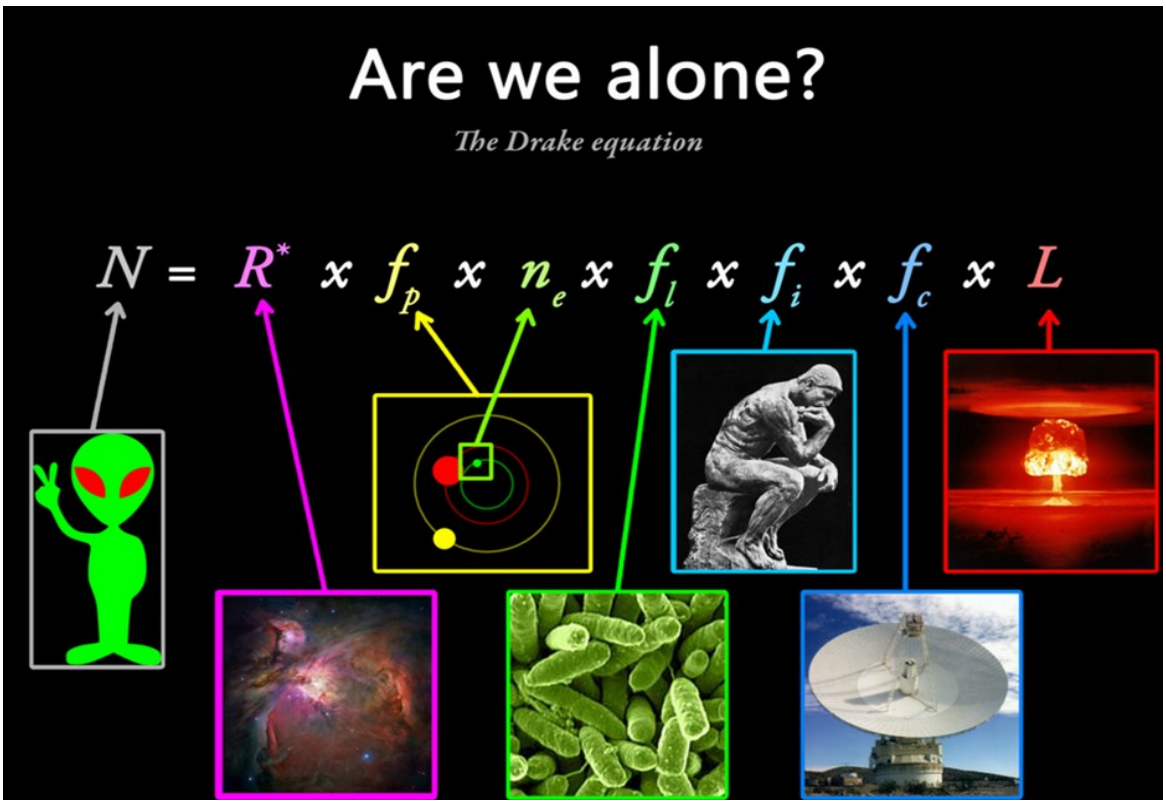

Image: Astrobiology; the Search for Life on Other Planets (http://1.bp.blogspot.com/)

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ENVIRONMENTAL BIOTECHNOLOGY

Ketki Mulay, BSc Year II

It is paradoxical that in today's world, after all that man has achieved, we have not been able to preserve the delicate balance that the Earth's environment provides in order to support life. In his quest for wealth and comfort, man has ignored the laws of Nature and thus disturbed a number of natural cycles, resulting in environmental pollution which leads to numerous health hazards. According to World Health Organization estimates, about a quarter of all human diseases are attributed to prolonged exposure to environmental pollution! Diseases such as cancer, chronic obstructive pulmonary disorder, infertility and other immunological and genetic disorders can be caused by continuous exposure to environmental pollutants. Environmental biotechnology aims to utilize biological systems to clear this pollution and develop alternative eco-friendly technologies to replace existing, polluting technologies.

The International Society for Environmental Biotechnology defines environmental biotechnology as "the development, use and regulation of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes (green manufacturing technologies and sustainable development)". Environmental biotechnology provides unbelievable scope to apply scientific knowledge to enable a cleaner, less polluting environment which, from a human health standpoint, should greatly reduce the occurrence of environment related diseases.

An environmental biotechnologist can convert plants into biofuels, create plant-based bioplastics, engineer plants or microbes to treat environmental contaminants, use geographic information systems (GIS) to map contaminated sites and the distribution of pollutants, develop remediation plans for particular contaminated sites, create processes to turn waste to biogas or other cleaner energy sources, create cleaner Industrial activities by replacing chemicals with biological processes (for example, enzymes instead of chemical catalysts), and so on.

An environmental biotechnologist can work in the private industry which provides bioremediation services or as environmental consultants to companies in the manufacturing sector. They may also be involved in research and development for biofuel firms.

Some examples of current research interests in the field of environmental biotechnology include phytoremediation, artificial photosynthesis, and plant derived bioplastics.

· **Phytoremediation of explosives using transgenic plants**

2,4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine are the two most

explosives that are major environmental pollutants. The U.S. Environmental Protection Agency has classified these explosives as Class 1 carcinogens, which are retained in the soil and are difficult to degrade. They also seep into underground water sources and thus potentially contaminate drinking water. It is therefore, important to understand the mechanism behind the metabolism of these explosives to enable enzyme mediated degradation of these explosives, followed by the introduction of these enzymes in plants (transgenic plants) for efficient phytoremediation (Panz et al., 2012).

Image : Biotechnology for a Greener Earth
(http://www.thapar.edu/images/SEE/environment-1.jpg)

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MICROBIOLOGY

-Samayitree Das, BSc Year III

Scientists who study and investigate the life forms, processes, growth patterns, and characteristics of microorganisms (bacteria, fungi, virus & others) are known as Microbiologists. Microbiological research is, and always has been of utmost importance in the health sector. Some examples of recent research findings in the field of Microbiology include:

The first-ever vaccine to combat Leishmaniasis is coming up soon: Leishmaniasis is a parasitic infection passed on through the bite of a sand fly. Using breakthrough CRISPR-cas9 gene editing technology, the researchers - hailing from Japan, Brazil, Canada and the United States - have altered the parasite's DNA to create a live-attenuated vaccine. If approved, it will be the first ever vaccine to combat a parasite(Kumar et al., 2014).

Gut bacteria can prevent & cure neurological conditions: Researchers from the University of Ontario showed that gut bacteria can be used as a cure for Post-Traumatic Stress Disorder & anxiety. It is being proved that the diversity of normal gut flora decreases when there is more anxiety & stress. On the other hand, the injection of living gut bacteria into stressed people can improve their neurological behavior(Smith P.A., 2015).

T- cells can distinguish between friends and foes by 'mechanical tugs': The security guards of the immune system (T- Cells) use a kind of mechanical "handshake" to detect the entry of harmful particles into the body. An article in The Proceedings of the National Academy of Sciences (PNAS) showed that a T cell can give precise mechanical tugs to other cells; when a tug gets released easily it signals a friend. Conversely, a stronger grip indicates a foe(Liu et al., 2016).

ZOTEN nanoparticles can fight against genital herpes: Herpes Simplex Virus-2 is the main causal agent for genital herpes in humans. The genital lesions caused by the virus increase the risk for acquiring human immunodeficiency virus, or HIV. Treatments for HSV-2 include daily topical medications to suppress the virus and shorten the duration of outbreaks. The negatively charged surfaces of tetrapod-shaped zinc-oxide nanoparticles, called ZOTEN, attracts the positively charged proteins on the outer envelope of HSV-2 virus. The attachment of nanoparticles with HSV-2 prevents infection & activates other immune cells, which in turn produce specific antibodies to destroy the virus(Antoine et al., 2016).

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3.Lui et al., DNA-based nanoparticle tension sensors reveal that T-cell receptors transmit defined pN forces to their antigens for enhanced fidelity. Proceedings of the National Academy of Sciences of the United States of America(2016) (Article in press).

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NEUROSCIENCE

- Vaishnavi Balaji, BSc Year III

Have you ever wondered how dreams are formed, how some memories are stored while some are lost, or the neural basis of emotions such as happiness, sadness and fear? All these fascinating phenomena have one common link: the brain, an organ that has intrigued and puzzled Scientists for decades; even today, a lot of questions regarding the physiology and pathophysiology of the brain remain unanswered. However, a research career in Neuroscience may yield answers to some of these questions. The brain is analogous to the internet in transmitting signals and storing information, but, at the same time, is amazingly unique, giving us a conscience, emotions and the ability to integrate information, which makes us who we are! Most of the recent discoveries in this field were possible only due to technological advancements.

There are several branches of Neuroscience, ranging from the molecular level up to the systems level. Developmental Neurobiology and Neurogenetics are two fields that help us understand the formation of neurons in different growth stages of the embryo and the genetic basis of behaviors such as drug addiction, neurodegenerative diseases and psychiatric disorders. Researchers have begun to identify which genes may play a role in a variety of psychiatric diseases including schizophrenia, bipolar disorder and depression. As said by Jordan Smoller, Director of the Psychiatric and Neurodevelopmental Genetics Unit at the Massachusetts General Hospital, “The fact is that all psychiatric mediations that are approved for treating these disorders are based on biological insights that are half a century old.” With new genetic studies, researchers might be able to identify "unforeseen biological components that could then be the targets of more effective and specific treatments.”

Computational Neuroscience is a relatively recent subject in the broad field of Neuroscience. Utilizing the concept of Physics and Mathematics, brain circuits are modeled to gain a deeper insight into neural mechanisms, and this knowledge is translated using brain-machine interfaces and robotics. Neural imaging is another interesting field which measures variables spatially and temporally to identify the localization of signals arising due to a specific behavior or disease. Its non-invasive nature is an advantage to design as well as monitor the efficacy of therapies.

Career options available after obtaining this specialization is not just limited to research. For those who expect a career different from academia, working as a consultant is a good option. This allows one to communicate the latest developments and therapeutics to medical experts who can use this knowledge to treat patients. An occupation as a Neuropsychologist, for which a Masters and Ph.D. degree is required, or a Chiropractor (for which Doctor of Chiropractic can be pursued immediately after a Bachelor’s degree) will present an opportunity to work with human subjects in a clinical setting. While all of the above require one to have completed advanced degrees, one can still be associated with this field as a Neural Engineer, Prosthetist, Speech-language pathologist, or a Neuro-imaging technician, with Masters level education.

Some examples of the current research in this field are cited below:

Extracellular vesicles in neurodegenerative disease — pathogenesis to biomarkers

The trafficking of macromolecules from the CNS to the cerebrospinal fluid and blood, mediated by extracellular vesicles (EVs), presents a promising source of CNS-specific biomarkers. EVs are released by almost all cell types and carry specific cargos of proteins and nucleic acids that vary according to the cell of origin. EV output changes with cell status and reflects intracellular events, so surface marker expression can be used to identify the cell type from which EVs originate. EVs could, therefore, provide an enriched pool of information about core neuropathogenic, cell-specific processes (Thompson et al., 2016).

Genetic link in binge-drinking teens:

Gene identified in search to determine factors for teen alcohol abuse. Mutations in the KARLN gene are directly linked to the neurologic processes of impulsiveness and binge drinking in teenagers (Peña-Oliver et al., 2016).

Prenatal Stress Could Enhance the Protective Mechanisms of Babies:

Researchers observed that increased concentrations of maternal stress hormones, depressive symptoms and general adversities during pregnancy were accompanied by epigenetic changes in the child. As a result of these changes the oxytocin receptor gene, important for social behavior and stress adaptations, is activated more easily. This mechanism could indicate that, in these cases, the babies adapt to develop more resilience to cope with future challenges and adversities (Unternaehrer et al., 2016).

Image: An Artist's Representation of the Extensive Neuronal Network (http://thiqat.net/uploaded/1444510369.jpg)

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STUDENT EXPERIENCES

DHEERAJ IN SINGAPORE

- Dheeraj Prakaash, MSc Year II

I landed in Singapore during the last week of February 2016 and explored the beautiful place before I started off with my project a week later in the Department of Biological Sciences, National University of Singapore. Nanyang Technological University is another renowned place known for its engineering-based contributions to Science and the society. The National University of Singapore (NUS) is a hub for various research activities in different fields. However, for those interested in Bioinformatics, the BIDD (Bioinformatics and Drug Designing) group encourages students to apply and pursue integrated MS (2yrs) – PhD (4yrs) studies in NUS. Subjects in Science at NUS are taught and experienced at a higher level. From a lengthy list of interesting topics, candidates applying for the integrated course are asked to choose 2 and 4 modules for the MS and PhD courses respectively. For those who are currently interested in only MS or only PhD studies, there are again a lot of options to study/pursue research in different fields of Computational Science. For the PhD coursework, candidates will supposedly be funded for their research only for 4 years and not more, which is why most of them put in all the effort to finish their research and writing the thesis at the end of the 8th semester. If you are thinking, “PhD, in 4 years?”... YES! That's right. Apart from NUS having a strong collaboration with Duke University, USA in the field of Medical Sciences (MS and MD program), the Duke-NUS Centre for Computational Biology is another interesting organization where researchers focus on Biomedical Sciences heavily depending on computational techniques. Interested folk who are looking for courses in Biotechnology apart from informatics can also review related information on the internet.

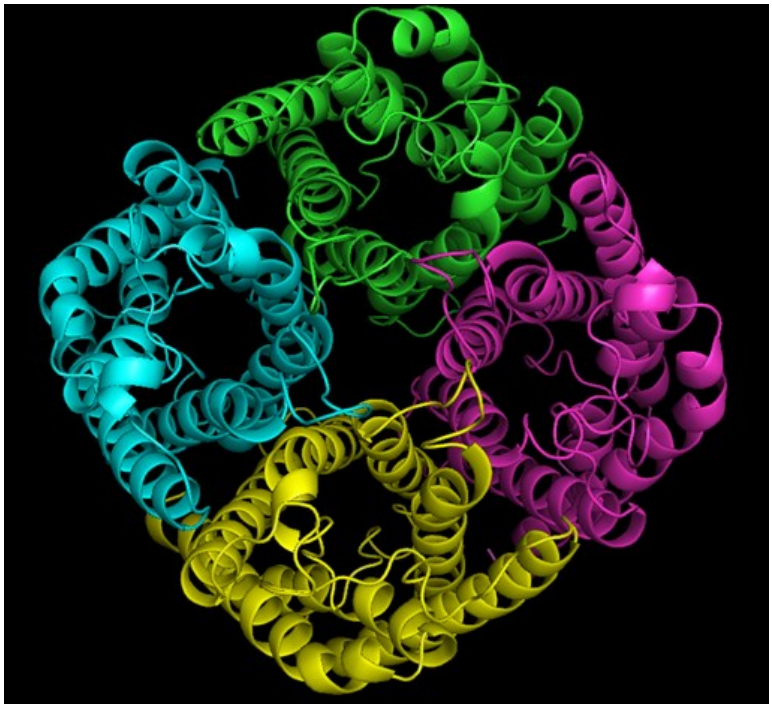

Image : AQP-Z (E. Coli AQP) top view in PyMOL GUI ,colored chain – wise

Let me give a brief insight into the work that I am doing now. The foremost and the basic purposes of research and development in the field of Biological Sciences are to provide a better understanding of life 'behind the scenes' that can ultimately aid in health or even to improve one's lifestyle. Our research, here at the Protein and Proteomics Centre in NUS, focuses on the major intrinsic proteins embedded in the cell membrane (in all kingdoms of living organisms) called Aquaporins (AQPs). These proteins are water conducting channels in the cell membranes which are impermeable to foreign species and help purify water very efficiently to meet the cell's regular needs. Although their structure is conserved across all living organisms, in E. coli these proteins are so accurate in transporting only the water molecules through the cell membrane that even ions and salts are repelled from the ends of the channel. Now, if we were to harvest such membranes in huge quantities to help purify lower grade water to 100% clean water ultimately for consumption, wouldn't it be a living miracle? Aquaporin Asia (P) Ltd. is a company which is employing a technology called Aquaporin Inside™ Technology to develop such biomimetic membranes to improve and optimize water desalination.

My project titled – "A Computational Approach to Study the Interplay of Aquaporins & the Lipid Bilayer" may be considered as a small contribution to this technology as we try throwing some light on how AqpZ (AQPs in E. coli) precisely interacts with the lipid bilayer. It emphasizes on the effect of such interactions on the structure and function of AqpZ. To this date, a dynamic simulation of molecular events, using highly accurate and powerful software, has turned out to be the closest to reality that mankind has reached in order to visualize these events at atomic levels. The beauty of these simulations has lent me a helping hand to upgrade my skills and seek an understanding of life at the molecular level.

AARUSHI IN EUROPE

- Aarushi Jain, MSc Year II

Out of my comfort zone, and building a new one

Nine months in a new continent away from India makes it ring how quickly it's all going. As clichéd as it may seem, I have always been excited about travelling to new places and living in an offbeat fashion. Being the boarding school kid growing up in schools all around the world, I jumped at the opportunity to study abroad in a new continent with the Erasmus Mundus Biohealth Computing (BioHC) Program. It all started with an intense, challenging and exciting summer school in Archamps. The overall goal was to learn how to synergize the research, medical and information sectors in the field of human healthcare.

My first semester was in Barcelona. Exactly, BARCELONA! I was enrolled at the Universitat de Barcelona, with 5 courses. With an academic background from the School of Life Sciences, most of the classes seemed to be a recapitulation, but I often found myself to be annoying one with questions at almost every lecture. One of the courses was Research seminars in which we could head out to any scientific institution in and around Barcelona to enroll in Bio health/Biomedical workshops, sessions and lectures.

.The courses felt alive, and gave an outlook towards the different fields in research with speakers from all around Europe. I attended 49 seminars/conferences in total and for the course had to present a report summarizing the seminars, giving a concluding statement perspective in the area of research. 'Applications of Biotechnology' was a motivating and insightful course, with entrepreneurs and individuals from the Industry presenting the current situation in Biotech industries and startups. Being in Barcelona, I experienced both the Spanish as well as the Catalan side of it. Sometimes I did feel at home with the loud, joyous and ever so friendly people around me. Other than being gorgeous with its fair share of surreal landscapes, the city also boasts of highly reputed research institutions such as the Institute for Research in Biomedicine (IRB) and the Barcelona Biomedical Research Park (BBRP) ,the latter being on the beach!! I literally walked through Camp Nou daily to attend University, and had my Messi moment, bliss.

Moving on from Hasta la vista, to Savoir-faire, I began my Masters project Internship at the Laboratoire de Bioénergétique Fondamentale et Appliquée in Grenoble,France. The sudden contrast from the bright city life, Grenoble being a university town just like Manipal, felt a bit dull with everything shutting down by 7 p.m. and on the weekends, but the magnificent French Alps and the allure of the sport, made up for that. Being forewarned about the French attitude bubble, I was indeed surprised as to how eager and open the French people actually were. Also, most of them have deep doubts about me being Indian, unable to figure that one out with my love for Bollywood. Working in a Scientific Lab in France is like working in a Lab in India, only now I'm using a bain-marie, instead of a water bath, along with a lot of rules and regulations. Of course I get to listen to the radio whilst pipetting protein samples but I had to sit for an exam to be able to perform cell culture; on the upside, however, I'm working only 5 days a week. I recently learnt that it came as a surprise to most people in my lab that I have indeed presented posters, since in Europe it is common for PhD students to have poster presentations but not Bachelors/Masters students, woot woot SLS.

I do miss my time in Barcelona because pain au chocolate has eggs while vegan is still the hipster. I can't believe that it's all coming to an end soon with the new applicants asking me the 'hows and why and whats' about this Program while I was doing the same just a few months ago. I'm currently working on the chronic effects of Cadmium in diabetes and its role in oxidative stress. I'm travelling almost every weekend, enjoying life, learning new languages, meeting people, making friends and obviously scientifically continuing my race for the Nobel Prize (or the Ig Noble prize). I have been quite lucky indeed and would like to thank the Director and the University for this opportunity. Don't let go of the chance to apply for this one. Quien lo probó lo sabe, and I do miss the Idly-sambar-and-lime juice at our own Ashok International.

Quick tips: Actions do speak a million words if you don't know the language, but never hesitate to interact and try. The French love their paper work and postal services. Visa processes can be crazy. Find accommodation soon, try colocation. Bollywood is always a great conversation starter, along with chai latte and curry! Make friends for life, cherish them, and get ready to experience seasons after Manipal.

INTERVIEWS

Dr. Ram Vishwakarma

- Atrishi Badu, BSc Year III

Dr. Ram Vishwakarma, one of the leading scientists involved in drug discovery and medicinal chemistry in India was one of the guests of honor at the School of Life Sciences Annual day, 2016. A medicinal chemist by profession, he is currently the Director of the Indian Institute of Integrative Medicine, Jammu & Kashmir. His first degree was in Organic Chemistry from Bundelkhand University and Ph.D. was obtained in the same field at CSIR, Lucknow. He later completed his post-doctoral studies with Sir Alan Battersby at Cambridge University. He has been the recipient of a great many accolades and awards throughout his career for various contributions to the field of pharmaceutical science. During his 20 minute speech at the Annual Day celebration, he was able to extensively cover his 28 years of work experience in the field of drug discovery as well as give his inputs on where we, as a nation, should focus on in the area of novel therapeutics. “Small molecules”, as he stated, are central to our understanding of disease and medicines. I was grateful for the opportunity to interview him in person and was keen on listening to his views on the current scenario of drug discovery.

The field of drug discovery is a major field of research which started during the 1950s and 1960s. Currently there is a boom in the number of companies such as Merck, Pfizer, Novartis and many others investing in drug discovery. At present there are drugs being developed and produced all over the world through the use of innovative techniques. Such techniques enable us to learn much more about not only the newly discovered drugs but also drugs discovered in the past. “Novel enquiries are now possible.” he says. With the development of technologies such as genomics, proteomics and metabolomics we have arrived at a stage where we can enable ourselves to delve deeper into small molecules that could be utilized as potential therapeutics.

Dr. Vishwakarma ponders on the question as to why certain organisms such as plants and fungi produce specific molecules and proteins. Certainly, plant associated endophytic fungi feel no ‘pain’, in that they do not possess the neural networks to feel or sense pain. Then why is it that an endophytic fungus would produce the protein that forms the anti-inflammatory drug Aspirin? Why indeed do plants make such molecules in the first place? He makes a point that scientists and researchers must spend resources to answer such questions. We have a large number of proteins being synthesized in our body. But for approximately 95% of these proteins we do not have information on how their functions are being modulated. We also do not possess small molecules that can reversibly interact with such proteins. Then how does one answer this question? “We have to go back to nature. We have to learn from the examples found in the nature.” I agree with his statement and go to the next question.

Do you think Drug Discovery should be completely reverted, I ask him. . He answers in the negative. We should not change the way we discover important clinically relevant molecules and drugs. The foundation of Drug Discovery has always and will always involve two major areas. First, to discover and identify the small molecules in nature. Second, implement synthetic chemistry to further improve those small molecules. He uses the example of penicillin. Penicillin is derived from the fungus Penicillium notatum. In its crude form it has poor oral viability and reduced pharmacokinetic properties such as half-life. However when we use synthetic chemistry and approach the synthesis of penicillin, we can make it much more viable and improve its chemical properties to be considered suitable as drugs. “Once you discover a small molecule you synthesize it in the laboratory. And once you synthesize it in the lab you make variants of it. Each variant will bring you one step closer to the final clinically approved product. Science is all about editing.” he states.

“What about Pharmacogenomics”, I ask, continuing, “Surely there must be increased costs for the common person in the case of personalized medicine. Does Pharmacogenomics fit the bill for the poor?”. He replied saying 10 years ago it would cost billions of dollars to sequence an individual’s genome. 5 years ago it cost 100,000$. And today it costs 1000$. The costs will reduce, slowly but surely. He believes that within the next 20-30 years the government will subsidize genome sequencing and everybody will be able to afford it.

He concludes by stating “India has an advantage over Western countries. The sheer amount of bio-diversity present in India is an added plus for drug discovery and innovation. However, innovation must not be burdened by costs.” I thank him for his time and have an entirely new perspective on the matter.

- Interviewed by

Syamala Inumella, BSc Year III

Dr. Ram Vishwakarma

Dr. Narendra Chirmule

By Anant Kakar, MSc year I

Dr. Narendra Chirmule, Director, R&D, Biocon India Pvt. Ltd., was one of the guests of honor at the School of Life Sciences' 10th Annual Day,2016. He delivered an enigmatic speech on the rapidly changing Biotech Industry, touching upon some of the strategies he utilizes at Biocon to get the best out of himself and his employees. He also stressed upon the need for inter-disciplinary approaches towards drug development in order to achieve the 'perfect drug', which must possess 100% efficacy without any side effects, inexpensive, and easily available to the masses.

The Editorial Committee had the opportunity to interview him the following day, hoping to better understand his area of expertise, the Biotech Industry.

Dr. Narendra Chirmule

Dr. Chirmule shed light on the arduous process of compound manufacturing, emphasizing on the need for each aspect to be thoroughly researched and validated to minimize the risk of potentially unaccounted adverse effects on human health, which could shut down an entire Industry overnight. We learnt that the breath of research required to sustain the industry is daunting; ranging from developing novel ways to genetically engineer micro-organisms and efficient fermenter set-ups, all the way up to determining the right amount of vacuum required between a tablet and the plastic that surrounds it!

He also spoke about the rapidly evolving Life Science Industry; 100,000 liter fermenters being replaced by ones ten times smaller that produce the same amount of product, machines fed with raw material at one end that produce pressed tablets at the other, and so on. He concluded by 'putting the pieces together'; in other words, by explaining how important interdisciplinary approaches are to bring a mere hypothesis into the market in the form of a potentially life saving medicine. This fascinating interview helped us appreciate the depth of the manufacturing aspect of drug discovery, ensuring we don't take medicines for granted any more.

Dr. P.P. Reddy

- Anant Kakar, MSc Year 1

Dr. P.P. Reddy, Research Director, Bhagwan Mahavir Research Institute, Hyderabad, visited the School of Life Sciences (SLS) on the 7th of May, 2016, on official duty. Despite his busy schedule, he was able to spare some time to talk to us about his pre-PhD college years, as well as his previous experiences visiting SLS.

He spoke about how he loved the way students and research scholars interacted at SLS; exchanging ideas and information without any senior-junior biases. He also appreciated the scientific interest shown by the students, which, he feels, can be explored and expanded, thanks to the infrastructure and facilities available coupled with an environment conducive to research.

He also spoke about his B.Sc. and M.Sc. college years, and how they were the best years of his life; he concluded by emphasizing the importance of seizing any available opportunities, which may not come again.

Dr. P.P. Reddy addresses the gathering

EVENTS

NATIONAL SCIENCE DAY

The School of Life Sciences celebrated National Science Day on 28th February this year. This day has been celebrated as National Science Day in India since 1986 to commemorate the discovery of the Raman Effect by Dr. Chandrashekhar Venkat Raman on the same day in 1928.

The event was inaugurated with a lot of enthusiasm in SLS on 27th February. Several models and displays from different fields of science were put up for students from nearby schools and for students and faculty members from across the colleges of Manipal. These were created and presented by our very own staff, research scholars, MSc and BSc students, and project students from other colleges. Outstanding school students from around Udupi and Manipal presented the models, as part of their Science Day Internship week at SLS.

The dazzling variety of displays included home-made lava lamps, plant tissue cultures, bubbles formed from dry ice, artistic streaking on microbiological culture plates, and a host of model organisms (including rabbits) used for experiments from our animal house. Some of the models on display were those of a laser, of an energy efficient 'super house' that could run entirely on renewable solar energy and rain water, of total internal reflection, of how electromagnetic waves work, of the CRISPR/Cas9 gene editing technology and much more. Numerous microscopic displays like cyclosis in plant cells, various stages of mitosis, *Paramecium*, different bacterial species were set up for school students. Models of common vertebrates, invertebrates and mammals were also arranged in the labs for them to get a visual idea various topics in biology. The microscopic displays and models were explained by our BSc and MSc students to many enthusiastic school children.

The SLS faculty, research scholars and students had also devised interactive games for students. There was a microbiology-based quiz to make them aware of the common microbes in their environment. There was also a provision to measure an individuals' lung vital capacity and understand the physiology of respiration. This soon became a competition to determine who had the healthiest lungs!

Informative presentations on upcoming fields such as astrobiology and the recent discovery of gravitational waves were organized for a diverse audience of everyone ranging from teachers to school students.

SPORTS DAY

The year 2015-2016 was filled with sports and athletic events at the School of Life Sciences, which saw the enthusiastic involvement of all the students, research scholars, faculty and staff. The summary of all the sports and athletics events participated during this academic year is mentioned below.

We started our inter batch sports event with basketball tournament, which was held in the month of November. The team lead by Mr. Akheel Anees won the tournament by defeating MSc 2nd years in a comprehensive manner. Six-a-side cricket held during the month of November between teams from student batches, research scholars and faculty. Student team emerged as the champions in this tournament by beating research scholars in a tense final match. Volleyball tournament was held in the month of November. The staff team comprehensively beat the research scholars team to claim the championship. Throw ball was held in the month of October. MSc team emerged as the champion by beating the BSc team. Badminton matches were held on 6th March 2016, it was the most popular event among student, faculty and research scholars. In men's singles, Mr. Pankaj Semwal (MSc 2nd year) emerged as the winner by beating Mr. Vaibhav Shukla in the single finals. The Women's singles event was comprehensively won by Ms. Alfa Rodriguez (BSc 1st year) by beating Ms. Chaitra (BTFS) in a nail biting final. The mixed double's event was won by Mr. Rukmesh (BSc 1st year) and Ms. Alfa Rodriguez of BSc 1st year. Further, inter-batch carom and chess were conducted wherein our students actively participated. The carom and chess were won by Mr. Sahil Cadiri (BSc 2nd year) and Mr. Rudranath Ghosh (BSc 2nd year) respectively. Further, our students enthusiastically participated in Manipal University Inter collegiate football (28th March), Throw ball (30th March) and Athletic meet (25th and 26th February) held at the MIT athletic ground.

LEFT: Students watching the prize distribution after a long day in the sun; RIGHT: Vineeta Kaulgud, MSc 2nd year, getting the award for Best outgoing athlete (female)

ANNUAL DAY

The 10th Annual Day Function was celebrated on 28th April 2016, at Fortune Inn valley view, Manipal. This year Dr. Ram Vishwakarma, Director, CSIR - Indian Institute of Integrative Medicine, Jammu, was the Chief Guest, along with Dr. Narendra Chirmule, Senior Vice President, Head of RND, Biocon Research Labs, Bangalore - Biocon , Dr. Helmut Brand, Professor, Maastricht University and Dr. Angela Brand, Institute for Public Health Genomics (IPHG), Maastricht University.

The function began with an invocation sung by Ms Apurva Rao. Dr. B S Satish Rao, Professor and Associate Director for Research, School of Life Sciences, formally welcomed the gathering. Director of the School of Life Sciences, Dr. K. Satyamoorthy presented the Annual Report for the year 2015-2016 and shed some light on the work that goes on in the institute. Mr. Aditya Sethi, President, Student Council, School of Life Sciences presented the Annual Report of the Student Council activities for the year 2015-2016.

This was followed by an address by Dr. Narayana Sabhahit , Registrar, Manipal University who emphasized on the importance of youth and their energy .

Dr. Vasudevan addressing the gathering

The chief guest Dr. Ram Vishwakarma, Director, CSIR - Indian Institute of Integrative Medicine, Jammu delivered a talk on how important it is to fully utilize the rich biodiversity all around us in the search for small molecules which could be made into therapeutics.

This was followed by the award ceremony which saw Ms. Anindita Mitra being awarded the Dr. J.V. Bhat Memorial Gold Medal for the Best Outgoing Student in M.Sc. Medical Biotechnology for the year 2015, Dr. KK Mahato (Head, Department of Biophysics, SLS) receiving the Dr. T.M.A. Pai Gold Medal for research, Ms. Suma Prabhu receiving the award for 'Best Publication by a Research Scholar'. The Best Teacher of the year award was won by Dr. K.S Babitha, while Mr. Gangadhar Prabhu once again walked away with the Best Supporting Staff award.

Dr. Angela Brand, Institute for Public Health Genomics (IPHG), Maastricht University stressed on the importance of recognizing and encouraging young talent. Dr. Narendra Chirmule, Senior Vice President, Head of RND, Biocon Research Labs, Bangalore - Biocon spoke about innovations in the field of biotechnology. Dr. Helmut Brand, Professor, Maastricht University reiterated the words of the Indian PM – 'Make in India'.

Dr. Padmalatha Rai S., Professor and Associate Director for Academics, School of Life Sciences proposed the vote of thanks, after which the cultural events began with a rib-tickling stand-up comedy act by Mr. Anirudh Gupta, B.Sc. III, and Mr. Anant Kakar, M.Sc. I, which was followed up by a variety of solo and group dance performances by the students and staff members of SLS. A short skit prepared by the Teachers of SLS gave the occasion a grand ending.

TOP LEFT– The audience raptly watch a performance; TOP RIGHT: Mad Ads by the BSc 1st years
BOTTOM LEFT: A screenshot of the faculty skit; BOTTOM RIGHT: A soulful dance performance by the students

BEST PHYSIQUE COMPETITION

Manipal University for the third consecutive year gave SLS the responsibility to host Manipal University inter-collegiate Best Physique competition-2016 on 21st March 2016 at the MIT Library Auditorium. The event was inaugurated and addressed by Dr. Harishchandra Hebbar, School of Information Sciences, Manipal University. Inaugural event was followed by Best Physique demonstration by Mr. Anshul Augnivansh, Alumni of MIT, Manipal University. A total of 12 participants participated under 4 different categories (65 kg, 70 kg, 75 kg & above 75 kg). The prizes were awarded by Dr. Harishchandra Hebbar accompanied by Dr. K Satyamoorthy, Director, SLS, Dr. Vinod Nayak, Secretary, Sports Council, Dr. B S Satish Rao, Sports Advisor, SLS and the Physical Directors of all the constituent Colleges of Manipal University. Mr. Angshuman Deka, final year Mechanical engineering student, Manipal Institute of Technology bagged the crown of 'Mr. MANIPAL UNIVERSITY 2016'. Overall 2015-2016 was full of fun-filled and power-packed sports activities and will be a great memory to the students, faculty and staff members of School of Life Sciences.

Mr. Angshuman poses on the stage with all the dignitaries

Photo credit: Sritama Pramanik

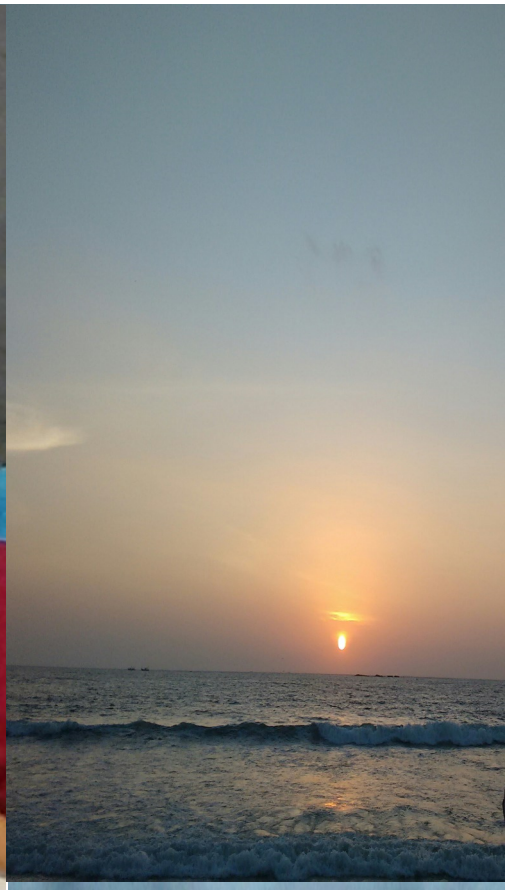

Photo credit: Saujanya Padikkal