Symposium on Informatics, Genetics, Mycology and Antibodies - SIGMA 2018

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Department of **BIOSCIENCES**

A one-day symposium titled, **SIGMA: Symposium on Informatics, Genetics, Mycology and Antibodies** was conducted by the Dept. of Biosciences, SSSIHL on 10 February 2018. It was attended by the second year and third year students of the B.Sc. (Hons.) in Biosciences programme.

The symposium began with invocatory Vedam chanting by students followed by ceremonial lighting of the lamp by the Director of the campus and invited guest speakers. In his welcome address, **Dr. A Ashok, Associate Professor, Dept. of Biosciences, SSSIHL** alluded to the need for inter-disciplinary approach to scientific research and explained that having knowledge in diverse fields could help in developing more holistic solutions to problems in our society.

He highlighted **the significance of cell culture technology** and its enormous potential in the advancement of biological and medical research. He encouraged students to interact with the speakers and make best use of the opportunity.

Prof. D N Rao, Dept. of Biochemistry, Indian Institute of Science, Bangalore was the first speaker. He spoke on the topic, **Of Genomes, Methylomes and Acetylomes**. He gave a brief insight in to the classification of restriction enzymes and explained that the restriction systems always occur in conjunction with a modification system. The role of restriction system is to take care of the invaders and the modification system undertakes the function of modifying the nucleotides, thereby protecting the genome from damage. Thereafter, he proceeded to talk about types of DNA methylation by various methyl transferases.

He emphasized on the role of DNA methylation in prokaryotes and how the usage of single molecular real-time technology (SMRT) has revolutionized the prediction of methylation sites on the genome. He also stated that bacterial methylomes provide a wealth of information on the methylation markers present in bacterial genomes, and may open a new era in bacterial epigenetics.

He touched upon various restriction–modification systems and how deletion of particular restriction-modification systems reduces natural transformation in Helicobacter pylori strains. Later on he spoke about protein acetylation, types of acetylation [enzymatic and non-enzymatic] in bacteria and their importance in various physiological pathways.

He mentioned about consequences of acetylation in bacterial pathogenesis. He drove home the importance of acetylation and de-acetylation, as events central to phenomena governing many processes like chemotaxis, intracellular survival, acid-resistance and DNA replication.

Dr. T S Suryanarayana, Director, Vivekananda Institute of Tropical Management (VINSTROM) spoke next, on the topic **Endophytic Fungi: A Novel Source of Enzymes and Bioactive Compounds**. He started with the definition, their relation with the host plants, culture techniques. He discussed a few of the secondary metabolites produced by endophytes which function as bioactive compounds of interest to man.

He dealt with the commercial use of these bioactive compounds with great emphasis on their anti-cancer and anti-plasmodial properties. He explained the interesting transformation of endophytes turning into saprophytes after the death of the host plant and how they survive under extreme conditions like forest fires. The invincible nature of endophytes rests on two major factors: a) endophytes survive in the underground portions or rhizomes like structures in the plants b) their spores are resistant to temperatures even beyond 110°C. By explaining the

delicate balance between the endophytic and saprophytic nature, he stressed that the endophytes are a rich source of several bioactive compounds and their benifits must be harnessed.

He went on to describe their industrial applications such as enzyme production (for e.g.: L-Asparaginase for treatment of Acute Lymphoblastic Leukemia (ALL), chitinases as insecticides), use in drug manufacturing and huge potential of xylanases being used in producing biofuels. He concluded his lecture by putting forth the challenges ahead in the field of endophytic mycology research.

Prof. Mukesh Doble, Head, Dept. of Biotechnology, Indian Institute of Technology, Madras spoke on **Computer Aided Drug Design**. In this talk, he mainly focused on NSAID's (Non-Steroidal Anti-Inflammatory Drugs).

He discussed the two approaches that are currently applied in drug discovery: First one being the ligand based approach where the target is unknown and the second one being that one that is target based approach where the information about the target is available. He elucidated using the example of ligand based approach where about 8 million or more ligands are filtered through various procedures of QSAR, pharmacophore based scaffold hopping, ligand-based virtual screening using fingerprints, followed by various filters and so on, and finally arrival at about 15 clusters that are potent and have drug-like properties.

He elaborated on the concept of 'ADME': Absorption, Distribution, Metabolism and Excretion principle and explained how each of these parameters influences the design and development of the drug. He also mentioned about importance of Lipinski's 'Rule of Five' for drug design, which was put forth by a pharmaceutical firm 'Pfizer', after analyzing 2245 compounds.

The professor then discussed about the cyclooxygenase pathway and described how blocking of cox2 led to various side-effects, since it was central to various other pathways, and how, an alternative member in this pathway, a molecule that plays a role in the end of this signaling cascade, may offer alternatives to the cox2 inhibitors.

He concluded that, all this CADD technology finally required validation from actual experimental work in a wet lab, followed by careful multi stage clinical trials.

Dr. Arun Shastry, Founder Director and Chief Scientific Officer, Dystrophy Annihilation Research Trust (DART), Bangalore, and alumnus, SSSIHL, was the last speaker of the morning session. He spoke on the topic, **Therapeutic Potential of Antisense Oligonucleotide-Mediated Exon Skipping Strategies in Duchenne Muscular Dystrophy**.

He explained the cause of muscular dystrophy, an X linked recessive disorder that cripples nearly five lakh children every year in India. This Dystrophin gene spans a genomic range of more than 2 Mb, and consists of more than 70 exons. The absence of a few exons or mutations in the dystrophin gene segment leads to the non-functionality of the gene.

Gaining knowledge from Becker's Muscular Dystrophy, he could make partially functional dystrophin by using an exon splicing enhancer bio informatics tool to identify specific exons that could be skipped in order to correct for the frame shift, and produce a partially functional protein.

His team has devised a unique cell penetration carrier molecule which attaches to the specific antisense oligonucleotide and facilitates the drug uptake to more than 90% level. Using skin biopsy from patients, they isolated fibroblasts from the tissue and transformed them in vitro into myoblasts using an adenoviral vector. These myoblasts are used in treating patients – young children.

Their novel approach includes multiple exons skipping which is different from other techniques that often employ single exon skipping. He concluded his engaging talk by throwing light on the challenges ahead and the importance of social awareness about this disease.

Dr. **S Shivakumar, Institute of Bioinformatics and Applied Biotechnology, Bangalore** was the first speaker in the post lunch session. He spoke on the topic, **Exploring the connection between waste water and the spread of antimicrobial resistance**.

He held the undivided attention of the audience as he delivered his talk in his inimitable style. He provided a bird's eye-view of the discovery of various antibiotics, which are a part of the major discoveries of the last century.

He highlighted the fact that after the discovery of Penicillin, a humongous number of antibiotics have come in to existence, but many of them have proved to be impotent against many diseases.

The major reason of failure of antibiotics is the rise of antibiotic resistance, especially among bacteria, which spreads through various means, across the populations with alarming rapidity.

He clarified the differences between the horizontal and the vertical gene transfer and how the process of horizontal gene transfer plays a crucial role for the spread of the MDR bacterial species. In their study twenty nine Multiple Drug Resistant UPEC isolates were characterized.

They found to their surprise that the MDR bugs were sensitive to Chloramphenicol, and the reason for this, is the rarity in the usage of this antibiotic, owing to its high side-effects of toxicity in humans. He presented the results which clearly indicated that the blaTEM always was found to co-circulate with blaCTX-M-15 and it was never found alone, thereby providing an experimental evidence for the rapid spread of tolerance to beta-lactum antibiotics.

He presented a twelve minute documentary to bring to the fore the dangers of irresponsible usage of antibiotics leading to the very real possibility of resulting large scale deaths due mounting antibiotic-resistance among pathogens. The documentary depicted a fictitious, but a not-so-far future situation when all antibiotics would become ineffective, leading to quarantining of people and households.

The next speaker was **Prof. V Venugopal Rao, Convener of Research Committee, St. Ann's College for Women, Hyderabad**, who spoke on the topic of **Human Genetics - Its Relevance and Scope**. He emphasized that study of Proteomics and Metabolomics would be impossible without in-depth understanding of Genomics.

He dwelt on the topic of Autosomal recessive inheritance and X-linked recessive inheritance. He also talked about the use of bioinformatics in genetic diagnostics and in clinical genetics. Briefly touching upon topics such as chromosomal mapping and genetic epidemiology, he explained the reasons why MBD marriages should be discouraged.

Prof. Rao talked of the research projects undertaken by his institution concerning Epidomolysis bullosa monogenic disorder, epidemiology of allergic rhinitis, inheritance of blood pressure and associated genetic factors, etc. He listed various premier genetic research centers in our country. He also talked about different diagnostic techniques, gene therapy trails and CRISPR- genome editing technology and highlighted the related ethical issues. He concluded his talk by talking about the scope and research areas in genetics, which can be taken up by the students.

Prof. R Manjunath, Dept. of Biochemistry, Indian Institute of Science, Bangalore introduced the students to the world of Immunology, specifically, the world of antibodies. His chosen topic for the symposium was **The Magic of Antibodies – Their applications in Human Welfare**.

He started off presenting a brief history of Immunology and then went on to explain the different developmental stages in the life of a B-cell, from a progenitor cell to a mature, but naïve B cell. He clarified and differentiated the concepts of affinity and avidity of antibody, by discussing the various classes of antibodies.

He spoke of the distinction between the primary and secondary immune response, and brought out the differences in the specificity, magnitude and the rapidity of the secondary immune response in comparison to the primary. He discussed the properties of antibodies, and their mode of interaction with the antigens. He concisely explained the application of antibodies in RIA; direct, indirect and sandwich ELISAs; Western blotting; immunofluorescence and other diagnostic procedures.