

MIT-ADT UNIVERSITY
MIT School of Bioengineering Sciences & Research

2nd International Conference on Recent Trends in Bioengineering (ICRTB 2019)

Saturday, 16th Feb 2019



MIT School of
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& Research**
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About ICRTB 2019

ICRTB 2019 is the largest technical event in Bioengineering in India to foster interdisciplinary exchange and learning. Its goal is to bring together engineers, medical experts, researchers and practising clinicians, individuals working in academia, industry and government agencies.

Conference theme areas

- Biotechnology
- Drug Design
- Biomedical Device & Diagnostics
- Medical Image Processing
- Smart Sensors
- Regenerative Medicine
- Machine Learning & Artificial Intelligence
- Computational Biology
- Brain Research
- Rehabilitation Robotics
- Assistive Devices
- Nano Biotechnology
- Robotics
- Bioremediation

2nd International Conference on
Recent Trends in Bioengineering
(ICRTB-2019)

Editors

Prof. Vinayak Ghaisas

Dr. Renu Vyas



MIT School of Bioengineering Sciences and Research
MIT, Art, Design and Technology University, Pune-412201, India



**Dedicated to
In loving memory of**



Dr. B. D. Kulkarni

(5 May 1949 - 13 Jan 2019)

Shanti Swarup Bhatnagar Awardee
Distinguished Scientist,
CSIR-National Chemical Laboratory, Pune
Dean, AcSIR, Engineering Sciences



Forward: Kiran Mazumdar-Shaw



Dear young audience,

I am happy to know that MIT School of Bioengineering Sciences and Research is organizing an International Conference on recent trends in Bioengineering (ICRTB 2019) , a unique event that brings together academia, research and industry under a single platform to deliberate on innovations in the fields of biotechnology, bioinformatics and biomedical sciences, a concept which is envisioned in the institute's charter itself.

As we are poised to enter into the 21st century , the sustainable solutions for all the problems in India are expected to come from biology. It could be the area of waste treatment, biodegradable plastics, newer vaccines, precision medicine, stem cell therapy, nano drug delivery etc. I urge the young generation to develop biotechnological processes and bring about the much needed revolution in India to put it on a global map.

I wish the organizers tremendous success and good luck to all delegates from India and abroad.

*Kiran Mazumdar-Shaw
CMD, Biocon*

Messages



Hon. Prof. Dr. Vishwanath Karad

*I am greatly delighted to learn that MIT School of Bioengineering Sciences and Research (MITBIO) is organizing an **International Conference on Recent trends in Bioengineering (IRCTB 2019)** its second annual flagship event. I am of the strong conviction that intersection of biology and engineering will usher in a golden era of health care in India. I firmly believe that the deliberations at the conference will encourage youngsters to apply the knowledge gained for the benefit of the society.*

I wish the organizers tremendous success and blessings to all delegates,

A handwritten signature in black ink, appearing to read 'Vishwanath D. Karad'.

Prof. (Dr.) Vishwanath D. Karad
Founder President, MIT Group of Institutions
President, MIT- ADT University



Hon. Dr. Suresh Ghaisas

I am extremely proud to learn that the MIT School of Bioengineering Sciences & Research is organizing its second annual flagship event ICRTB 2019 that will bring together eminent policy makers, researchers, and academicians on a single platform. The rapid growth of the Bioengineering field is required due to the tremendous applications it has to offer to the medical and clinical research community. This conference is therefore a right step in that direction.

My heartfelt sincere wishes to the convenors for the success of this event and blessings to delegates.

A handwritten signature in purple ink, which appears to read 'S Ghaisas', enclosed within a decorative, hand-drawn oval border.

Dr. Suresh Ghaisas
President and Trustee
MIT Group of Institutions



Dr. Mangesh Karad

Dear Delegates

On behalf of MIT, it gives me immense pleasure to announce the second annual flagship event of MIT School of Bioengineering Sciences & Research. I am of the strong opinion that the International Conference on Recent Trends in Bioengineering (ICRTB 2019) will provide a unique multidisciplinary forum to propose sustainable solutions to the society. The conference deliberations will generate innovative ideas for research and entrepreneurship. I extend my warm welcome to the delegates for the event and also to our enchanting green campus. My compliments to the Bioengineering institute for diligently striving toward the success of this mega event.

Hon. Dr. Mangesh Karad
Executive President
MIT-ADT University



Dr. Sunil Rai

I am extremely delighted and proud that one of the premier institutes of this university viz. MIT School of Bioengineering Sciences & Research(MITBIO) a constituent unit of this university is hosting its second annual flagship event International Conference on Recent Trends in Bioengineering(ICRTB 2019). This conference garners interest and deserves appreciation since it strives hard to bring together eminent professionals from research, academia, industry and startups to deliberate on problem solving using Bioengineering approaches. The first conference was a huge success and I am sure this event will even surpass it. I extend my full support and best wishes to organizers and welcome all delegates from India and abroad.

A handwritten signature in black ink, appearing to be 'SR' or similar, written on a light background.

Dr. Sunil Rai

Vice Chancellor, MIT-ADT University, Pune



Prof. Vinayak Ghaisas

It is our proud privilege to host the second International Conference on Recent Trends in Bioengineering (ICRTB 2019). This is a humble step towards fulfilling our vision of advancing health, agriculture and environment through Bioengineering. The primary purpose of the conference is to serve as platform to exchange ideas and built upon the reservoir of technical knowledge and traditional wisdom of the society. Our institute is striving hard to impart training to students that is in sync with the industry requirements and empower them with problem solving skills. A lacuna in our educational system is financial literacy and we are trying to circumvent that by introducing economics for engineers courses. Further the institute provides them with opportunities & ecosystem to incubate new ideas and launch new enterprises. I am confident that with this approach across institutes India will become the hub of Bioengineering entrepreneurs.

I am sure all the delegates of the conference will be stimulated by the eminent talks and will engage in networking with other like - minded professionals.

Welcome and Best Wishes.

A handwritten signature in black ink, appearing to read 'Ghaisas', with a long horizontal line extending to the right.

Prof. Vinayak Ghaisas
Founder Director & Convenor
MIT School Of Bioengineering Sciences & Research



Dr. Renu Vyas

It is rightly said that 21st century belongs to Biology and we are at a juncture where everyday exciting developments are taking place. The theme of this conference is to highlight those novel and innovative research areas in bioengineering. The interdisciplinary nature of the subject provides an excellent opportunity for professionals to break barriers across disciplines and propose unique solutions. The conference will have three parallel tracks for biotechnology, bioinformatics and biomedical engineering presentations.

MIT School of Bioengineering Sciences & Research is an exclusively student centric institute. Since inception we have been striving hard to inculcate the right training, orientation and groom the students to have a healthy research aptitude and an engineer's problem solving approach. I am of the strong conviction that the conference will empower the young research scholars and students with knowledge for ideas that will lead to development of new applications and solutions. Another theme of the conference is the creation of start up culture in this domain and the relevant industry verticals have shown significant interest and will participate in the conference.

This conference is dedicated to my mentor Dr B.D. Kulkarni, distinguished scientist and a gem of a person whose life was an inspiration to many.

A warm welcome to the dignitaries and guests from government, industry and research and most of all the delegates.

A handwritten signature of Dr. Renu Vyas in blue ink, written in a cursive style.

Dr. Renu Vyas

Head of the School & Convener

MIT School of Bioengineering Sciences and Research

Keynote Speakers



Dr Pramod Chaudhary
Executive Chairman, Praj Industries, Pune

Pramod Chaudhary, is Executive Chairman of Praj Industries Ltd. Praj Group is global provider of end-to-end Technology and Engineering solutions for Bio-Energy, Bio-Chemical and Bio-Pharma industry, with strong backing of world-class state-of-the-art R&D Center called, Praj Matrix. As a first generation techno-entrepreneur, he founded Praj in 1983. He dreamt and developed Praj into a world-class engineering company specialized in Agri-processing opportunities.

With strong belief in principle of triple bottom-line, his business model is inherently scalable, replicable and sustainable. Praj fostered the emergence of advanced technologies in certain Bio-Energy and allied space. As India's biggest Biofuel Technology company, Praj has in excess of 750 footprints in over 75 countries, across five continents.

Under his visionary leadership, Praj has successfully developed the technology for conversion of Cellulosic Biomass to 2nd Generation Renewable Fuels, BioGas and Chemicals. Praj is the only Indian Corporate to launch India's first-of-its-kind Integrated Bio-refinery Demo and now executing three commercial plants for Indian OMCs. Globally, Praj is one of the handful of companies to achieve this feat. Praj is setting up first of its kind integrated demo plant of Compressed Bio Gas (CBG) - renewable transportation fuel, in the country.

Deeply passionate about Bio-economy and Environment, Pramod is committed to develop clean and green technologies. As a champion of the powerful premise that 'Innovation and Entrepreneurship can change the world for better', he has been a tireless crusader in propagating spirit of entrepreneurship and intrapreneurship.

Pramod is a 'Distinguished Alumnus of IIT Bombay (1971)' and an alumnus of Harvard Business School (AMP 1995).

SYNOPSIS

Industrial Biotechnology and Bioengineering are emerging verticals gaining more attention and importance, while offering many opportunities in Biology space. It also is the dawn of the age of interdisciplinary science and research where boundaries merge to build cohesive solutions. While being at the forefront, in Praj, pioneering programs build on foundation of Biology, Chemistry and Engineering have led to sustainable solutions in the form of Biofuels – both liquid and gaseous, Bio-refinery, Renewable Chemicals – all giving rise to “Bioeconomy”. Over last 20 years, Praj has contributed to Bioenergy sector in many ways by helping decarbonisation agenda to fight climate change across the globe.

Bioenergy is a unique sector where renewable energy is created from natural biological sources through modern technology. The inexhaustible source of bioenergy has tremendous potential to decrease carbon footprint, reduce greenhouse emissions, positively impact global warming and climate change to improve the environment. This is achieved through the use of bioenergy feedstock's like biomass to fulfil energy challenges in the form of biofuels and biochemical. Future bioengineers well versed in both disciplines would definitely contribute higher value to these advanced technology development trends in the industry. This conference on recent trends is therefore the most appropriate platform for exchange of sustainable growth ideas of the future industry.

Technology Tuning to Serve Combatants



Dr. Upendra Kumar Singh

Director, DEBEL,

Defence Research and Development Organization (DRDO), Govt. of India

The Arm forces continue to be interested in increasing the “tooth-to-tail” ratio, that is, increasing combat effectiveness and reducing logistics support requirements. The extreme environmental conditions pose daunting challenges to the armed forces whose personnel need to be fit, capable and active for operations demanded by the situations beyond their control.

Convergence of multiple technologies has aided to the cause of development of devices which caters for need of society in general and military in specific. Robotics, new Technology Fueled devices, Medicine and Smart drugs, Cloud computing, Big data & the Internet of Things, Medical Virtual Reality, Neural technology and Brain Tools, and Nano-Biotechnology has enabled researcher to design and develop many medical tools, apparatus and devices which can help in improving the healthcare, diagnostic, therapeutic and other areas of medical care. It has also enabled medical practitioner for apt decision-making, provide healthcare to last-mile areas through telemedicine, visualise complex and inaccessible parts of body through virtual reality and augmented reality, correlate the operating field with prior imaging as well as anatomical information, train fresh surgeon through simulated environment, use big data and artificial intelligence to analyse and take most appropriate decisions.

Bio-Engineering technology has provided tool to design, develop and manufacture devices to support combatant on multiple platform, whether it is G-Suit and flying clothing for crew of fighter aircraft, submarine escape systems for submariner, telemedicine for ships sailing in high-sea or NBC individual protective suits for first responders on the border. The competency, vitality and performance of combatant have increased considerably due to use of new technology even in adverse field conditions of high altitude with extreme cold weather, mountainous and desert regions with bone-chilling cold and torturous high temperature, most strenuous g-pull by pilot of fighter aircraft, managing ships and submarine engine room with enervate heat even in high-sea state. Wearable devices for monitoring vital physiological parameters of each soldier by local command, electronic medical record (EMR) of each personnel, real-time retrieval of records when needed,

record-keeping of innate cognitive capabilities to deploy right person for right job in most demanding situations are few benefits which are derived from new dimensions which the conglomeration of technologies have spurred to the military researcher.

With continued vigour and collaborative approach among academia, private and public institutions, researcher will explore and expand to find pragmatic solutions to audacious challenges faced by combatants by tuning the existing and futuristic technologies.

A brief overview on robotic surgeries: the way ahead



Dr. Shailesh Puntambekar
Medical Director, Galaxy Hospital

With advancement of science and technology at the current pace, robotic surgeries have created a stir in the field of surgical research! They have revolutionised various complex urological, gynaecological, cardiothoracic and general surgery procedures. Out of the various advantages, the major ones are 3D visualisation, intuitive movement, improved dexterity, increased precision due to human like wrist movements, less trauma on the body, minimal scarring and faster recovery time. The disadvantages of the procedure are high cost of equipment and their maintenance, scarcity of hospitals offering such facility, need for specially trained surgeons & surgical team and a difficult learning curve. But if these obstacles are overcome, robotic surgeries would redefine health in every sphere and context. We aim to do so and contribute to the field of science and let research live and grow!

Plenary speakers



Dr Yogesh Sauche

Scientist G, National Centre for Cell Science, Pune

Dr Yogesh Sauche Research experience of 36 years in the field of Cell and Molecular Biology of microorganisms, Microbial Diversity & Taxonomy, Human health & microbiome. More than 350 publications in reputed journals of relevant area; Reviewed publications in International journals like FEMS Ecology, International Journal of Systematic and Evolutionary Microbiology, Microbial Ecology and others; Several national and international collaborations; more than 25 successful grant applications from various funding agencies; More than twenty students awarded PhD from University of Pune and Eight are currently registered; Twenty years of post-graduate teaching experience and five years teaching experience for M.Sc. students. Invited to contribute chapter in Bergey's Manual of Determinative Bacteriology. Entrusted with responsibility of Establishment of National Centre for Microbial Resource (NCMR).

In vivo imaging in preclinical research



Dr Nishigandha Naik
Director, Haffkine Institute, Mumbai

Imaging is considered as eyes of science. Biomedical imaging allows a noninvasive insight into living organisms and helps to understand anatomy and physiology of the body. Microscopic imaging has a history of 400 years while 'in vivo' imaging has a history of a century. The first microscope was made by Zacharias Janssen in 1595 and the technology is still evolving. 'In vivo' imaging dates back to 1895 when Roentgen discovered the medical utility of x-rays. Within five years chest x-ray images were used to diagnose tuberculosis. In the second half of the 20th century, different types of radiations were exploited to provide images of the structure and function of tissues inside a living subject. Each imaging modality is characterized by differing resolutions on the spatial and temporal scales, and by a different sensitivity for assessing various parameters. Besides its utility in diagnostics and therapeutic monitoring in clinics, it plays a crucial role in drug discovery industry. An overview of major 'in vivo' imaging modalities such as PET, CT, optical imaging systems that are used in pre-clinical research, will be given and future of the field will be discussed.

AI for applications in psychiatry



Justin Dauwels

Associate Professor, NTU Singapore

Deputy Director, ST Engineering – NTU corporate lab

Abstract:

Many tasks in medicine still involve substantial manual work. In many cases there is strong potential for intelligent automation by A.I., leading possibly to a reduction in costs and man-hours, while increasing the quality of clinical service. In this talk, we will consider applications of A.I. in the domain of psychiatry.

Specifically, we will give an overview of our research towards automated behavioral analysis for assessing the negative symptoms of mentally ill patients.

Biography

Dr. Justin Dauwels is an Associate Professor of the School of Electrical and Electronic Engineering at the Nanyang Technological University (NTU) in Singapore. He also serves as Deputy Director of the ST Engineering – NTU corporate lab, which comprises 100+ PhD students, research staff and engineers, developing novel autonomous systems for airport operations and transportation.

His research interests are in data analytics with applications to intelligent transportation systems, autonomous systems, and analysis of human behaviour and physiology. He obtained his PhD degree in electrical engineering at the Swiss Polytechnical Institute of Technology (ETH) in Zurich in December 2005. Moreover, he was a postdoctoral fellow at the RIKEN Brain Science Institute (2006-2007) and a research scientist at the Massachusetts Institute of Technology (2008-2010). He has been a JSPS postdoctoral fellow (2007), a BAEF fellow (2008), a Henri-Benedictus Fellow of the King Baudouin Foundation (2008), and a JSPS invited fellow (2010, 2011).

His research on intelligent transportation systems has been featured by the BBC, Straits Times, Lianhe Zaobao, Channel 5, and numerous technology websites. Besides his academic efforts, the team of Dr. Justin Dauwels also collaborates intensely with local start-ups, SMEs, and agencies, in addition to MNCs, in the field of data-driven transportation, logistics, and medical data analytics.

Engineering cyclic peptides from plant protease inhibitors' reactive centre loops for crop protection



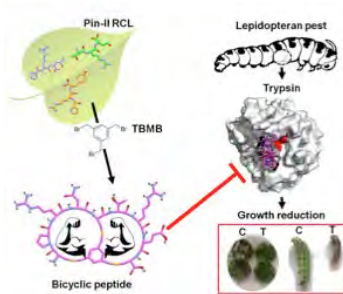
Ashok P. Giri

*Chair, Biochemical Sciences Division,
CSIR-National Chemical Laboratory, Pune 411008, India
E-mail: ap.giri@ncl.res.in*

Discovery, design and development of insect pest control molecules are in demand for sustainable agriculture. Till date several enzyme inhibitor molecules have been explored. However, most of these molecules have limitations such as lack of environmental stability due to large molecular weight, complexity in formulation due to their labile nature. In this direction, we have recently demonstrated the protease inhibition potential of linear tripeptides derived from Pin-II family of plant protease inhibitors. These linear tripeptides are smaller in size and have sequence variation while they are limiting at inhibition potential due to enormous conformational flexibility. Further we build upon our prior art by cyclization of these tripeptides reactive centre loop (RCL) for escalating their potency and stability by providing an optimal conformation to the reactive loop. Thus, we have grafted the RCLs onto the chemical scaffold, tris (bromomethyl) benzene to generate bicyclic peptides. Obtained cyclic peptides showed several advantages over parental molecules.

- Ten-fold enhanced inhibition potency as compared to linear RCL tripeptides
- Insect deterrent activity confirmed by bio-assay on leaves
- Enhanced environmental stability – prolonged stability on leaf surface
- Potential combinations to cope with diverse insect proteases
- Ideal for development of formulations and field application

We demonstrate grafting of selected short peptides on small molecule scaffold can generate potent and stable protease inhibitors. Our results highlight the importance of targeted reactive loop engineering, as opposed to random screening of cyclic peptides. This provides basis to develop next generation bio-inspired cyclic peptides for agriculture or medicinal applications.



Functional Nanomaterials for Cancer Theranostics and Drug Delivery



Prof. Dr. Sangeeta Kale

Professor in Physics and Dean (Academics)

Defence Institute of Advanced Technology, Pune, India

Using nanoforms of inorganic metal oxides (and their complexes with polymeric and biomolecular systems) with fine conjugation strategies, one can explore extremely interesting and promising applications in the area of healthcare: especially for development of smart biosensors, imaging contrast agents, magnetic hyperthermia treatments, wound-healing patches, drug delivery agents, antimicrobial agents and in wide-range of pharmaceutical formulations. This can be achieved via careful materials study to engineer them for establishment of their efficacy in such multiple applications.

In this presentation, few works related to cancer hyperthermia would be elaborated, in which novel magnetic nanoparticles have been harnessed as efficient cancer-hyperthermia-cum-drug-delivery agents. In another effort, mesoporous nanoparticles have been used for sustained drug delivery to cater wound-healing applications. These are either inorganic materials or even sacrificial bio-polymers which work to enhance the medicinal value of the patch, enhancing the drug efficacy. In yet another study, similar polymers have been used for improving the drug-retention properties for ocular drug delivery. The fine conjugation chemistry involved, the drug loading strategies, stimuli-based-release mechanism, and the size-property relationships would be elaborated.

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Kingshuk Poddar

Assistant Director, Kalam Institute of Health Technology

Kingshuk Poddar is the CEO at the Atal Innovation Centre at the Andhra Pradesh MedTech Zone, the only sector specific incubation facility in India dedicated entirely to Health Technologies located within India's largest manufacturing ecosystem. He is a molecular biologist by training and had previously been the Assistant Director at Kalam Institute of Health Technology, the pioneering healthtech policy institute facilitated by the Department of Biotechnology. He has a decade long experience at institutes of eminence like the Lerner Research Institute, Cleveland Clinic; Agency for Science Technology and Research and National University of Singapore.

Invited Speakers

Innovations in ENT Surgery: Endohold, Justtach and Slice !T



Dr. Mubarak Muhamed Khan, Pune, India

Email: ent.khan@gmail.com

Endoscope has revolutionized the surgical domain. In Otolaryngology, endoscopes have been used for sinus surgeries. Ear surgery are traditionally done with the microscope. Since last one decade, endoscope has been extrapolated to the ear. Disadvantage of the endoscopic surgeries is that it is one-handed surgical technique as the non-dominant hand of the surgeon is utilized for holding the endoscope. To overcome the difficulties of single handed endoscopic surgeries, I have developed two endoscopic holders (Endohold and Justtach) which would allow both hands of the surgeon to be free for surgical manipulation and augment advantages of endoscope in ear surgeries. The other innovation is Slice !t which is a multi-utility device used for slicing tragal cartilage in TM reconstruction.

Design Of Khan's Endohold, Justtach And Slice !T:

Endohold is a metallic plate of 70 x 40 x 10 mm in dimensions with a slot measuring 16 x 16mm in diameter mounted onto the microscopic stand after removal of the microscope head.

Justtach, is a Universal attachment to the already existing microscope of any make to convert it into Endoscope Holder.

Slice !T is a modification of the previous existing cartilage slice giving it a multi functional utility device to be used in ENT surgeries. The Multipurpose functions are slicing the precise thickness of the tragal cartilage, measuring dimensions of cartilage grafts, preparation for island cartilage grafts, and for prosthesis length assessment.

We have been using the endoscope holders and slice it for all the two handed endoscopic ear surgeries since May 2013 till date in Sushrut ENT Hospital, Pune.

Conclusion: Incorporating our innovations into the surgical armamentarium in otolaryngologic surgeries is a new horizon in ENT.

Sheep Temporal Bone As a Teaching Model For Two Handed Endoscopic Stapedectomy With Our Justtach



Dr. Sapna Ramkrishna Parab

MBBS, MS, DNB(ENT)

Ex Prof and Head ENT, MIMER Medical College,

Consultant EntSushrut ENT Hospital

Vice President, Dr Khan's Creations, Talegaon Dabhade, Pune

With the popularity of exclusive transcanal endoscopic ear surgery, the need for a suitable and affordable surgical training model has grown. Fresh human cadaveric specimens are the standard of good surgical training, but the availability of such specimens is not only limited owing to high costs and strict ethical regulations.

Aim: To develop an ex vivo animal model for exclusive endoscopic stapes surgery which is a complex and intricate surgery of middle ear ossicles.

Design: In an experimental study, we studied sheep middle ear anatomy in 12 specimens to assess the similarity with the human middle ear as a model for two handed endoscopic stapedectomy with our developed Endoscope Holder, Justtach. After confirming its suitability, we have developed a surgical training program for the same.

Results: The sheep model is suitable for two handed endoscopic stapedectomy using Justtach.

Conclusion: We describe a novel, exclusively two handed endoscopic approach in an ex vivo animal model for endoscopic stapedectomy. The proposed surgical program will guide the trainee endoscopic ear surgeon for a step by step through the main otologic procedures to enhance his or her surgical skills.

Keywords: Sheep model; middle ear anatomy; two handed endoscopic stapedectomy; endoscope holders.

Evolution of a techno-preneur from an ordinary molecular biologist: a journey seeking same day diagnostic solutions for every day diseases



Dr. Susmita Ghosh, Ph.D.

Co-founder, Director, DiagnoRite Innovative Healthcare

Abstract: Illness among close family members made me feeling the uselessness of my training at Harvard. I found the true utilization of my degree would be when I can make something which can make everyone's life better. So I quitted my job and took up entrepreneurship as a challenge. Gradually formed my own company. We have two platform technologies, both directed towards development of affordable diagnostics for the masses. One platform technology is a novel way of making animal-free, antibody free reagents needed for protein marker based diagnostics. Our product in pipeline based upon this technology is a blood test that detects heart attack at the earliest. Our second platform technology has simplified molecular diagnostics for every day use at any hospital or pathlab, We are developing tests for quickest detection of drug resistance, sepsis and multi-drug resistant TB.

Menace of predatory journals and future of scholarly publishing



Bhavik Sawhney

Associate Editor-Biomedicine, Springer Nature

The past two decades have seen many subtle changes in scholarly publishing. The scholarly publishing process from the initial submission to the final publications has many weak points which are subject to exploitation. Some open-access publishers have taken advantage of these vulnerabilities, profiting by cheating the scholarly authors and the consumers of research, the readers. Predatory publishers hurt the scientists, science, and the communication of science.

I will discuss the deleterious effect of the egregious publishers on scholarly communication and will apprise on their perils and how to preserve the research integrity. In addition, I will shed light on the indicators through which the researchers can identify the predatory journals which act as masquerading scholarly journals.

Also, I will briefly discuss the various sins of the unethical misconduct in scholarly publishing as described by the Committee of Publishing Ethics (COPE) and universal norms to avoid the unintentional unethical behavior.

Further, I will briefly discuss the various transformations in the scientific communication, the use of Artificial Intelligence, sharing negative data and open peer-review process.

Nanotechnology in Bio-Potential Measurements



Dr. H. MuthuRajan

muthurajanemail@gmail.com

Biopotentials represent the activity of the respective organs such as the heart, brain, muscle, eyes, etc. The biopotentials are acquired with the help of specialized electrodes that interface to the organ or the body and transduce low-noise, artifact-free signals. The origins of these biopotentials can be traced to the electric activity at the cellular level. Measurements of these and other electric signals from the body can provide vital clues as to normal or pathological functions of the organs. Biopotentials from organs are diverse. It is apparent that each biopotential source presents its own distinct challenge in terms of electrode interface, amplifier design, pre- or postprocessing, and practical implementation and usage.

Many different forms of electrodes have been developed for different types of biomedical measurements. The gel used along with gel based electrodes may also be associated with itching, allergic reactions and other skin problems in some patients. This method works well for short term monitoring, but subsequently the gel dries causing disruption in the signals. Despite several advances in the signal acquisition technology, the major obstacle which still remains is the transmission of signal at the skin-electrode interface. Dry electrodes or the gel free electrodes is another alternative method being widely explored in the field of healthcare devices.

We have successfully developed packaging for microneedle array based dry electrode for biopotential measurements such as ECG, EEG etc., Biocompatible polymer SU-8 is used to make array of pillars of required dimensions using UV maskless lithography. Height of each pillar is around ~80-110 μm . Thin gold film (~100 nanometer) over the pillars has been deposited to make them conducting. Flexible substrate utilized for contour matching with the body. We have successfully developed the re-usable packaging for the same. We have carried out X-ray Photoelectron Spectroscopy (XPS), Nano indentation to explore the nano mechanical properties (hardness, elasticity, creep, contact stiffness, etc) of gold thin film on biocompatible polymer. The ECG and EEG measurements made using ~ 100 nm thin gold film on biocompatible polymer on flexible substrate with the re-usable packaging developed is presented in this invited talk.

Keywords: Biopotential, Nano indentation, Nano mechanical properties, ECG, EEG

Bioengineering Aspects of Nanotechnology



Dr. Jalindar D. Ambekar (Ph. D.)

Centre for Materials for Electronics Technology (C-MET), Pune

Vigorous expansion of interdisciplinary fields will be the bridges to flourish the basic sciences. Nanotechnology is the one which fostered scientific momentum. Balance between the tremendously growing green nanotechnology, the beautifully architecture nanostructured material and their trustworthy applications for mankind is the forthcoming challenge. The current era is to use this technology to overcome issues, such as water pollution and agricultural engineering. It's critical to monitor and control the water pollution of the surface water and water body. Increasing agriculture productivity along with improved soil quality is the blend of agricultural engineering to fulfill the next gen. We are trying to address our work to explore the solution for the potential challenges in these areas. It is fusion of combined efforts of nanostructured material fabrication, environmental engineering and agricultural engineering etc.

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MIT SCHOOL OF BIOENGINEERING SCIENCES & RESEARCH (MITBIO)

Welcomes you to the

International Conference on Recent Trends in Bioengineering (ICRTB 2019)

On Saturday, February 16th, 2019, 9 a.m. RKM Auditorium
Rajbaug Educational Campus, Loni Kalbhor, Pune, INDIA

PROGRAM SCHEDULE

Inaugural Session: 9.00 a.m. – 10.15 a.m. **(RKM Auditorium)**

8.15 - 9.00 am	Registration, kit distribution, hosting the guests and delegates for breakfast at RKM and plenary speakers at the Raj Kapoor Bungalow
9.00 – 9.05 a.m.	Welcoming the audience by the anchor
9.05 – 9.10 a.m	World peace prayer, Saraswati Pooja and lighting of the lamp by dignitaries
9.10 -9.15a.m	Introduction of dignitaries on dais and conference theme talk by Dr Renu Vyas, convener and Head of School, MITBIO
9.15 -9.20a.m	Introductory talk by Prof Vinayak Ghaisas, Convener, Director and Founder of MITBIO
9.20 -9.25a.m	Welcome address by Dr. Sunil Rai, <i>Vice Chancellor, MIT ADT University</i>



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9.25– 9.30 a.m	Speech by Dr. Mangesh Karad, <i>Executive President, MIT ADT University</i>
9.30 -9.35 a.m.	Dr. Pramod Chaudhari, Executive Chairman, Praj Industries on recent trends in Biotechnology
9.35 – 9.40 a.m.	Dr. Upendra Singh, Director Debel, (DRDO) on recent trends in Bioengineering for affordable Medical Devices
9.40 -9.45a.m	Inspirational talk by Hon Vishwanath Karad sir, founder MAEER MIT group of institutes.
9.45- 9.50 a.m.	Felicitation of all dignitaries and plenary speakers by Hon. Vishwanath Karad and all invited guests by Prof. Vinayak Ghaisas
9.50- 9.55 a.m.	Release of abstract book of conference and CD by all dignitaries on the dais
9.55 – 10.00a.m	Vote of thanks by Dr. Vyas
10.00 - 10.15 a.m.	Group photo with all delegates and dignitaries in the RK auditorium podium followed by tea break

Key Note Talks 10. 15 a.m. – 1.00 p.m.
(RKM Auditorium)

10.15– 10.45a.m	Key note address by Dr. Pramod Chaudhari, Executive Chairman, Praj Industries on the changing scenario of biotechnology with emphasis on Bioeconomy
10.45 – 11.30 p.m.	Key note address by Dr. Upendra Sharma DEBEL, Technology Tuning to Serve Combatants
11.30 – 12. 00 pm	Key note address by Dr. Shailesh Puntambekar, Medical Director, Galaxy CARE Hospitals, titled A brief overview on robotic surgeries: The Way Ahead.
12.00 -12.15 pm	Plenary talk by Dr. Muthurajan, CSI Computech, Mumbai
12.15 – 12.30 pm	Plenary talk by Dr. Sangeetha Kale, DIAT Pune
Inauguration of Biochemical engineering, Tissue Engineering and BSL II labs.	
Signing of MoU with Kalam Institute of Health Technology (KIHT) in the MITBIO conference room	



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Lunch & Poster/Industry Exhibition Session 1.00 pm – 2.00 pm
(Podium outside RKM)

Lunch (VIPs)	Raj Kapoor Bungalow
Lunch(delegates, guests and staff)	Pendal outside the RKM auditorium

Parallel Session Track I (Biomedical): 2.00 p.m. – 6.00 p.m.
(MANET auditorium)

Session chair: Dr. Nishigandha Naik, Director, Haffkines, Mumbai

2.00 – 2.15 pm	Plenary talk by Dr. Prakash Bachani, Head BIS, Govt of India New Delhi.
2.15 – 2.30 pm	Industry talk by Dr Mubarak Khan , CEO Khan Creations
2.30 – 2.45 pm	Invited talk by Dr Kingshuk Poddar, Assistant Director, Kalam Institute of Health Technology, Vizag.
2.45 -3.00 pm	Plenary talk by Dr. Nishigandha Naik, Director Haffkines Mumbai
3.00-3.15 pm	Industry talk by Dr. Sushma Ghosh, CEO, Diagnorite
3.15 -3.30 pm	Tea Break
3.30 -6.00 pm	Oral presentations by delegates



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Parallel Session Track II (Bioinformatics): 2.00 p.m. – 6.00 p.m.
(Design Hall, first floor)

Session chair: Dr. S S Tambe, Professor AcSIR, Ex Chair CEPD, NCL Pune

2.00 – 2.15 pm	Industry talk by Dr VinitJha, Persistent Systems.
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2.45 – 3.00 pm	Talk by Dr Bhavik Sawhney, Assoc. editor, Springer Publications
3.00 -3.15 pm	Talk by Dr Jalinder Ambekar , C-MET, Pune
3.00 – 3.15 pm	Tea Break
3.15 – 6.00 pm	Oral presentations by delegates

Parallel Session Track III (Biotechnology): 2.00 p.m. – 6.00 p.m.
(RKM)

Session chair: Dr. Ashok Giri, Chair, Biochemical Division, NCL Pune

2.00 – 2.15 pm	Plenary talk by Dr Yogesh Souche, Scientist G, NCMR.
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2.45 -3.00 pm	Industry talk by Dr Dalvi, VSI, Pune
3.00 -3.15 pm	Tea Break
3.15 –6.00 pm	Oral presentations by delegates



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Valedictory function 6.00 pm – 6.30 pm
(RKM Auditorium)

Time	Event
6.00 pm	High Tea
6.30 pm	Prize distribution for best poster, best oral presentation at the hands of Vice Chancellor, Dr Sunil Rai and Dr. Prahlad Wangikar, Director, PRADO Pune.

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Bioinformatics (BI)

Oral presentations

Homology modeling active site predictive of VP24 protein involved in Ebola Virus

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Ebola is a single stranded RNA virus which has a filamentous structure and belongs to family of RNA virus called Filoviridae and genus *Ebolavirus*. Ebola virus causes severe hemorrhagic fever and is therefore a fatal disease in humans and non-human primates. Ebola viral protein (VP24) is a secondary matrix protein which has various roles in virulence of virus. VP24 interferes with the interferon signaling pathway by binding to karyopherin- α and blocking the Signal Transducers and Activators of Transcription (STAT-1) signaling pathway. In the present study we analyze protein sequence and predicted the 3 dimensional structure of VP24 protein using various bioinformatics tools. And we have also predicted the active/binding sites for the protein. These sites can be further use for the drug designing purpose for VP24 protein. It is thus involved in packaging of virus and in turn plays an important role in virulence. Since VP24 is present on the surface of viral envelope that has an affinity for plasma membrane. This protein is also essential for the replication of other proteins of virus as was suggested by Mateo *et al* and because of these reasons VP24 protein was selected for this study In this study Three dimensional structure predicted and validated by Swiss model and Ramachandran plot respectively. Our work suggests that VP24 protein can acts as target for the inhibition of Ebola virus. The further study of VP24 protein used in the molecular docking and structure based drug designing to inhibit in Ebola virus.

Simplified Protein Structure Prediction Using Parallel Genetic Algorithms

Gurpreet Singh

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Protein structure prediction is a problem to optimize the protein structure from a given sequence of amino acids. The HP model is widely used for simplified protein structure optimization. Although the model is quite simple, the problem is NP-complete and requires enhanced optimization algorithms. Therefore, in order to search an efficient optimization procedure for HP model-based simplified protein structure prediction, we have investigated two types of parallel genetic algorithms. The two parallel algorithms are based on island and grid models. The average energies and the average time of calculations of both the algorithms are compared for ten benchmark sequences. Both the algorithms have also been analyzed for the convergence of benchmark sequences to the reported minimized energies. The overall analysis shows that the island model based parallel genetic algorithm outperformed the grid model.

Keywords: -Protein structure prediction, Optimization, HP model, Genetic algorithm

Nipah virus L protein overall structural and functional characterization

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Nipah virus (NiV) allied to the family of Paramyxoviridae genus Henipavirus being identified in 1999. During an eruption of febrile illness namely encephalitis among people in countries like Malaysia, Singapore, Bangladesh and India. The name emanated from Sungia Nipah, a village in Malaysian peninsula. Transmission of Nipah virus to human may occur after direct contact with the infected bats, infected pigs or from other NiV infected people. Nipah virus is a enveloped RNA virus consisting of six different polypeptides such as Nucleocapsid protein(N), Phosphoprotein(P), receptor binding glycoprotein(G), Matrix protein(M), Fusion protein(F) and RNA dependent RNA polymerase L protein. L protein is known for its catalytic function in RNA polymerization, It transcript the viral mRNAs and their capping. It is also involved in RNA processing and viral RNA replication. The Paramyxoviridae L protein is the least-characterized protein of the replicative complex and is also the biggest protein encoded by the viral genome (2244amino acids). The main objective of this study is to identify the three dimensional structure of L protein useful for development of new drugs to fight against the disease. The structural and functional characteristics of this protein was done through tools such as ProtParam- a tool for computation of various physical and chemical parameters for a given protein. Followed by CELLO- a tool used for predicting localization of protein then predicting secondary structure through a tool SOPMA. Followed by homology modeling of protein through I-TASSER server. Analysis and checking of stereochemical quality of protein structure by PROCHECK. The information obtained through the above analysis could be used to design a drug against Nipah virus.

Overview of machine learning methods in ADHD prediction

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Most of the children, in their young age seem to be overactive and a few may have even difficulty in paying attention. In a few cases, these problems become uncontrollable and may persist till teenage, which affect their social and personal traits. Attention Deficit Hyperactivity Disorder (ADHD) is one such neurodevelopmental disorder which shows the symptoms of inattentiveness, hyperactivity/impulsivity in children between the age of 2 to 17. Usually, this disorder is identified when one starts schooling. Although the actual cause is not identified, prenatal exposure to toxic environment is considered as the main reason resulting this disorder. The treatment involves various neuro-developmental activities along with administration of neuro-stimulant drugs. ADHD is identified by various rating scales and using MRI patterns. Neurobureau, a data sharing initiative, had collected the structural and functional MRI data along with various rating scales from different research institutes, preprocessed and made available for the research activities. For accurate prediction of this disorder, various machine learning models are applied on the diagnosing parameters. Majority of machine learning studies are based on creating classification models, out of which SVM and ANN proved to give most accurate way of diagnosis. Not many studies were reported on regression models on ADHD prediction. So, one of our work was based on creating a Genetic Programming (GP) based model for ADHD and compared its accuracy with other classification models. As an evolutionary algorithm, GP provided better predictive model with good CC values, specificity and sensitivity. This chapter gives an overview of various machine learning models used in identifying ADHD. It also helps the researchers in this field in understanding various techniques of prediction of this disorder, which will further help in providing better treatment for the children who are suffering from similar neurodevelopmental disorders.

Keywords: Attention Deficit Hyperactivity Disorder, Genetic Programming, Machine Learning, predictive model.

Big Data Analytics for Handling NGS Data & its Applications in Identifying Cancer Mutations

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With the evolution of Next generation sequencing (NGS) technology, huge amount of complex data is generated in computational analysis and day by day the size of data is expanding enormously. In the variant analysis computational pipeline of NGS, a number of different files are generated like bam, sam, vcf and all files that are in size of gigabytes only. Around 100 gigabytes of data is generated for the sequencing of a single whole genome. So, the researchers are facing challenges in handling, storing and organizing this vast and complex NGS data. To overcome these challenges, big data analytics techniques are evolving that facilitate working on such large and complex datasets. For storing, processing and analysing these data, big data analytics framework is being employed that consists of different components like Hadoop, NoSQL databases and Massively parallel processing (MPP). Implementation of this framework will enhance time required for identifying cancer mutations via alignment of sequences reads with the reference genome, as in mutation analysis, sequence alignment is a major step that has become a major bottleneck due to explosive growth of genomic databases. Traditional sequence alignment tools surrender before huge amount of sequence data. Hadoop is designed for solving problems involving massive amount of data and computation. The Hadoop framework implements distributed storage and a parallel programming algorithm known as Mapreduce. The chapter will focus firstly on highlighting the challenges in computational analysis of NGS data. It will further define into implementation of Hadoop framework for reducing processing time for sequence alignment. The reader will also be made aware of illustrative examples of use of big data analytics in mutation identification of various cancers. The knowledge provided will accelerate the translation of NGS in routine health care and personalized medicine protocols.

Keywords: Next generation sequencing, Hadoop, NoSQL, Massively parallel processing, cancer mutations

Ultrashort microwave – pumped real time thermocoustic breast tumour imaging system

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Breast cancer is the most frequent type of disease among women in India and abroad. Breast cancer increases mortality in India especially in women, as it is considered the second – largest form of the disease that lends to death. This situation is largely the result of improvements in early detection and treatment.

The proposed system shown is a frame work for efficient and automatic breast cancer detection. We have proposed a new region growth segmentation algorithm for mammogram image segmentation to detect breast cancer. The wiener filter filters the noise in pictures very efficiently. The region segmentation methods are time-consuming, although they detect the tumour very precisely. These are noise removal (WIENER filtering), enhancement (CLAHE), seed selection, seed growth segmentation, breast mass detection, the method was tested on CT images. Using SOM, depending on the type of clustering, one can find that energy and entropy are oppositely related. Information Measure related to correlation differs for benign and malignant. The SOM with KNN clustering method is accurate at 93%, Specific at 80%, and Sensitive at 90% which are high compared to the achievable Classification

Computational modeling and docking studies of *Teratodon nigrovirdis* and *Salmo salar* Tyrosinase Protein with Natural Compounds

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Colouration and colour patterns are most distinct phenotypic traits in majority of the living organism including fishes. Color and its patterns are the main influencing factors in consumers' buying decisions. Color traits are formed by four main types of pigments stored in interacting chromatophores. Melanin are the sole pigment cells responsible for the coloration. Tyrosinase is a characteristics enzyme in melanin biosynthesis. Modulation of tyrosinase is of significance in ornamental fish industry, food fishes as well as in humans. By modulating the tyrosinase activity, it is possible to alter the body pigmentation and will help to develop improved strain varieties, treatment of hyper pigmentation disorder. The green spotted puffer fish (*Teratodon nigrovirdis*), an ornamental fish and Atlantic salmon (*Salmo salar*), an important aquaculture species were selected because of their commercial importance. The present study was aimed to characterize the tyrosinase enzyme of green spotted puffer fish (*Teratodon nigrovirdis*) and Atlantic salmon (*Salmo salar*) and to identify the natural compounds as putative modulators of tyrosinase. 3D models of tyrosinase protein were predicted by adopting the comparative homology modeling program with the help of Chimera 1.1.3 and Swiss-model, and predicted structure was validated by energy minimization method using Saves Server including Procheck, Verify 3D and Errat tools. The physicochemical properties revealed that the fish tyrosinase protein is hydrophobic in nature, acidic, having high extinction coefficient, unstable, thermolabile for a range of temperature. The functional properties identified that *T.nigrovirdis* and *S. salar* tyrosinase protein sequence had transmembrane-segment and random coils dominated the secondary structure followed by alpha helix, extended strands and beta turns. The results obtained from Saves server showed that the models predicted by Swiss-model were more reliable compared to models developed by other tools. Structure-based virtual screening method helped to identify tyrosinase modulators. Three compounds out of

13000 from ZINC database were identified as putative modulators of fish tyrosinase having binding energy -8.7Kcal/mol to -8.2 Kcal/mol. Among which, 3-Methyl-2-phenylquinoline-4-carboxylic acid, 2-(4-chlorobenzyl)-5-(3-nitrophenyl)-2H-1,2,3,4-tetraazole and Kaempferol were considered as potential putative modulators as they had low binding energy and had acceptable properties for standardized drugs. Further these compounds can be tested in-vivo for their efficacy and usefulness in altering the color pattern of the fishes.

Keywords: *Teratodon nigrovirdis*, *Salmo salar*, Tyrosinase, Chromatophores Bioinformatics, Homology modeling, Virtual screening

Computational Analysis of Whole Exome Sequence Data to identify Ovarian Cancer Mutations

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Whole exome sequencing (WES) has been proved to be a potential method in the detection of disease causing mutations. Whole genome sequencing (WGS), whole exome sequencing and transcriptome sequencing are the main implementations of Next generation sequencing (NGS). Among these, WES is preferred as great number of disease causing mutations are found to be located in the exome part of a gene, that constitutes only 1% to 2% of the concerned gene. Thus it reduces time and cost of sequencing and analysis as compared to WGS. Ovarian cancer is detected at advanced stage because most of the possible disease causing mutations have not been identified using traditional sequencing technology like sanger sequencing. The present work is focussed on identification of ovarian cancer mutations by analysing 4 whole exome sequence reads of ovarian cancer patients with metastasis. This is the first time we are reporting novel mutations in ovarian cancer causing genes. The identified mutations have role in serving as potential biomarkers of ovarian cancer and have benefits in clinical diagnostics.

Keywords: Whole exome sequencing, Next generation sequencing, ovarian cancer, mutations, biomarkers, clinical diagnostics

BioJava in Bioinformatics tool development & its Application

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Bioinformatics & computational biology is one of the important research area in today's IT world. Information technology is playing vital role to explore biology in data mining & data analytics tool. High level open source programming languages like Java when incorporated with bioinformatics tool, explores the functionality of BioJava by persisting security, scalability & portability. It is open source, makes application distributed & gives enhancement facility. BioJava uses Java language to provide framework for implementing applications in Bioinformatics by introducing various modules which work independently to provide tools for comparison of protein structure, protein sequence alignment, parsing for standard file format, analysis on protein modification as well as disordered regions. This chapter also explains in brief about BioJava & significance of Java programming language in developing various tools and its applications in Bioinformatics. The knowledge gained will motivate students & researches alike to evaluate most common API's used in Bioinformatics tool for application development with several illustrative examples, & step by step tutorial.

Keywords: Bioinformatics, Open source, BioJava

Identifying Novel Anti-Cancer Drug for Ovarian Cancer by Integrated Text Mining and Cancer Omics Data

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Ovarian cancer is one of the most common cancers and has a high mortality rate due to insidious symptoms, lack of robust diagnostics & drug resistance. In order to understand the molecular mechanism underlying any disease, knowledge about the interacting proteins in the disease pathway is essential. In the present work, we investigate existing literature data for information discoveries in order to identify new potential biomarker for ovarian cancer. A database was generated by text mining of 1,08,875 abstracts for ovarian cancer literature from the PubMed database. A gene protein-drug network pathway was generated based on the data base to perform large-scale text analysis of abstract in order to generated new hypothesis about cancer biomarkers. The genes with the maximum interaction could be considered as biomarkers. This study will also help in identify new anti-cancer drug candidates. To conclude a network-based approach provided a better insight underlying gene-gene interaction mechanisms and a developed connection model across different types of cancer will be useful in identifying potential diagnostics markers and novel therapeutic targets.

Keywords: Cancer biomarker, Cancer omics, Text mining, Ovarian Cancer.

Thyroid Nodule Classification in Ultrasound Images by Deep Learning Method

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Over the past two decades detection of thyroid nodules (TNs) has significantly increased. As the majority of these nodules are benign or behave indolently, accurate determination of whether thyroid nodules are benign or malignant could reduce patient risk and reduce the significant costs of medical health care with fine needle analysis (FNA) biopsy and/or surgery. We proposed to develop a complete thyroid ultrasound image classification system based on a fine-tuned GoogLeNet model using deep learning approach to extract features from thyroid ultrasound images. The process of doing so included generating a morebalanced thyroid nodule ultrasound image database, pre-processing the images for better image quality and fine tuning GoogLeNet with the augmented image samples. By using two methods to effectively improve the performance of fine-tuning an existing deep convolutional neural network: (1) pre-processing the image samples to normalize the texture scales and remove artifacts and (2) the image samples can be augmented.

Keywords: Ultrasonography, thyroid nodules, deep convolutional neural network, finetuning.

Development of a Genetic Programming Based Model for Prediction of Attention Deficit Hyperactivity Disorder

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Recent developments in machine learning have made significant impact in the detection and diagnosis of various diseases. Attention Deficit Hyperactivity Disorder (ADHD) is a neuro-developmental disorder, which is noticed in children of school age. It is difficult to detect by scientific methods and is mostly identified by their behavioural changes. In this study, Genetic Programming (GP) based approach was used for the improved diagnosis of the ADHD. A dataset of 332 ADHD patients was analysed using binary QSAR, Support Vector Machine (SVM) and Artificial Neural Network (ANN) but yielded prediction accuracies of 90.006%, 95.48%, 96.67% respectively. Using GP approach, a predictive model was constructed with better prediction accuracies compared to other related works. A high correlation co-efficient (CC) of 0.98, a low root mean square error (RMSE) value of 2.353 and a mean absolute percentage error (MAPE) value of 1.25 were obtained from GP model. The model was validated using leave-one out (LOO) five-fold cross-validation method. Thus, improved accuracy can be obtained using GP method compared to linear methods in ADHD disease classification and this improved model can be effectively used in the disease diagnosis.

Keywords: Artificial neural network, attention deficit hyperactivity disorder, genetic programming, machine learning, support vector machine.

Polyunsaturated fatty acids alleviate bone marrow impairment of radiation injury

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Exposure to ionizing radiations (IR) such as X-rays and Gamma rays as the result of nuclear accidents or terrorist attacks is a significant threat and a major medical concern. Among various tissues and organs, bone marrow is one the most radiosensitive tissue in the body. IR-induced hematopoietic failure is primary cause of death after exposure to a moderate or high dose of total body irradiation (TBI). n-3 and n-6 polyunsaturated fatty acids are essential fatty acids (PUFAs) classified as nutraceuticals and have numerous known health benefits. Unlike other drugs or synthetic molecules, Omega 3 and omega6 fatty acids(n-6 and n-3 PUFA) are natural compounds that are safe. Antioxidant nature of PUFAs has been shown to protect the stem cell pool and also there are reports in literature that PUFAs modulate apoptotic and oxidative pathways. Administration of specific PUFA metabolites could enhance stem cell recovery from radiation injury, suggesting a potential application for PUFA metabolites as an adjunctive to radiotherapy for recovery and enhancing hematopoiesis.

Keywords: Radiation Injury, Haematopoiesis, Bone marrow failure, Polyunsaturated fatty acids, Recovery

Modeling of protein complexes involved in signaling pathway for NSCLC

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Emergence of High-throughput technology has made it possible to monitor biomolecules such as proteins, metabolites, DNA/RNA transcripts with high speed and accuracy. Pathway modelling is an important approach to study diverse biological pathways like metabolic, disease and signaling pathways that help us in investigating protein metabolomics, signal transduction and gene regulation processes occurring at the cellular level. It is possible to investigate the complex biological systems with the help of pathway modelling. Most of the reactions in the signaling pathway are enzyme catalyzed protein activation reactions that are commonly referred to as “signaling cascade”. The aim of this chapter is to discuss various mathematical, computational modelling and networking approaches for the pathway modelling in the field of cancer in general and NSCLC in particular. This chapter also discusses a molecular dynamics approach for studying Non-Small Cell Lung Cancer (NSCLC) signaling pathway based on protein-protein interactions involved in these signaling pathways.

Keywords: Non-Small Cell Lung Cancer, Signaling Pathways, Molecular Dynamics Simulations, Pathway Modeling, Cancer Biology

Applications of deep learning in drug discovery

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Armed with advances in computational resources and high data throughput, artificial intelligence techniques have achieved remarkable success in diverse application areas in past decade. In recent years the field of pharmaceutical drug discovery has seen upsurge of deep learning applications that go beyond bioactivity predictive models and aid in various facets of drug discovery process. One of the biggest strengths of deep neural networks is their ability learn from complex nonlinear data without explicit need for handpicking the features. This paper aims to provide an overview of deep learning methods and their applications in the drug design field. The paper begins by introducing concepts of artificial neural network and deep learning. Advances in deep neural architecture are discussed with examples of Recurrent Neural Network (RNNs), Generative adversarial networks (GANs) and Convolutionary Neural Networks (CNNs). Application examples of these architectures such as RNN based variational auto-encoders for *de novo* molecular design, natural language processing; use of adversarial network in GANs for obtaining valid molecular designs and bioactivity prediction; and image-based profiling of bioassays using CNNs are reviewed to bring out variety of drug design challenges being addressed using deep learning techniques.

Keywords: deep learning; drug discovery, virtual screening; RNNs; GANs; CNNs

Biomedical Engineering (BM)

Oral presentations

Removal of Noise in ECG Signal Using Improvised Adaptive Algorithm

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Statistics suggest that on a global level, Cardio vascular disease (CVD) accounts for 31% of all deaths. The estimated cost of CVD will be \$1,044 billion by 2030. These CVD will be easily identified by using ECG signal. An electrocardiogram, or ECG, is a graphical record delivered by an electrocardiograph which records the electrical action of the heart over a period of time. The signal is acquired by measuring electrical potentials between different locations of the body. The calculation of heart rate is very easy and simple with modern ECG machines. The denoising of ECG signal is a main concern to get the absolute results for better and corrective diagnosis of heart problems. The thresholding techniques are used for denoising of ECG signals with the help of Wavelet Transform.

Keywords: component; formatting; style; styling; insert (key words)

Smart glove: hand gesture recognition system for speech impaired people using Indian sign language

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As per Census 2011, in India, out of the 121.08 Cr population, about 2.68 Cr persons are 'disabled' (hearing and speech impaired) which is 2.21% of the total population. The Census 2011 revealed that, in India, 19 % of the disabled person have disability in hearing and 7% of the disabled persons are speech impaired. Communication is a difficult task between the normal population and the disabled (hearing and speech impaired) as sign language is the only medium to communicate between them. It also requires the normal population to learn the Indian sign language (ISL) as ISL is the sign language used in India. To overcome this language barrier, there is a need to design devices which can convert their hand gestures into voice which a normal person can understand. The main objective of the project was to design and develop a Smart Glove System that can continuously recognize sign language gestures and translate them into spoken words. Smart Glove, consists of flex sensors attached to all fingers and an accelerometer. These sensors sense the movement of hands and fingers used in hand gesture. It also consists of a speech synthesizer circuit which converts these movements of hand into real time speech output and a display which gives the interpretation in English language for the corresponding gesture. This device provides cost-effective and efficient mode of communication for speech impaired and normal people. New gestures can be added to the existing gesture library. This gives the system the flexibility to meet the high degree of variation among sign languages, and also the need to do some customized gestures as per requirement.

Investigating Various Emotions by Analyzing Human Brain Signals (EEG Signals)

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Human brain is very complex part of our body. Human emotions are related to the brain. Now a day's lot of research is going on in e-healthcare systems. With the help of bio-sensors we can capture brain signals, which are used to discover human emotional and mental state. As emotions are playing very important role in making decisions and other mental tasks. Such e-healthcare systems are really required to improve overall human's life. As researchers are showing lots of interest in establishing emotional interaction between Brain and Computer (BCI) and for this recognition of emotional state is basic requirement.

In this research, the emotions and the EEG signal patterns are studied. The aim of this research is to study how brain signal changes for different emotions. Also emotion is important indicator of mental instability. The objective of this paper is to find out how these emotions are helpful to solve emotional disorders like depression, anxiety and emotional instability.

Keywords: EEG, Emotion, Psychological disorders, Feature extraction, Classification

Heart Rate Variability Analysis in lung cancer patients to study the effect of treatment

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Lung cancer mortality is increasing nowadays. The objective of the study was to analyze the improvement in performance status (PS) of lung cancer using heart rate variability (HRV) measures after the treatment. The electrocardiogram (ECG) of 104 consecutive lung cancer subjects and 30 healthy controls was recorded for five minutes. The RR intervals plot were extracted from ECG using Acknowledge 4.0 software, which was fed to Kubios HRV 2.1, Finland for HRV analysis. R Statistical Software v.3.3.2, 64 bit was utilized for statistical analysis. The HRV measures increased after the treatment. Considering gender as confounder, it was found that male subjects had higher values than females and it increased after the treatment. Control males had lower values of all HRV measures than control females. Increased HRV measures after the treatment brings parasympathetic dominance and improvisation in the quality of PS of patients.

Keywords: autonomic nervous system, ECOG, heart rate variability, lung cancer, smoking, tobacco

Flat Foot Detection Using Podoscope

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Flat foot or Pesplanus (or fallen arches) is a postural and structural deformity where the foot arch collapses and the sole of the foot coming into complete or near-complete contact with ground. Flat feet can increase the likelihood of pain developing in the hips, knees, and ankles. Flat foot can be detected using different methods such as optical technology and sensor based technology. In optical technology, initially the image of the foot is scanned using conventional U.V scanners or high resolution cameras. After acquiring the image, the foot angle is measured as an essential part to assert the foot as flat, therefore becoming a tedious and costly method. The other method to detect flat foot is using the piezo electric crystals. These crystals take the pressure readings and depending upon those readings, the degree of flat foot is known. These crystals are costlier and have short lifespan. The technique proposed, will take advantage of both direct pressure readings and no high resolution images. The prototype will consist of a pressure sensitive sheet (Velostat) from which readings will be obtained in the form of voltages. The image will be constructed based on these readings and will be further analysed to detect and declare foot as flat foot. Thus, this technique would be economic, it will provide effective & accurate results and it can also be used for continuous monitoring. For continuous monitoring, insoles made up of velostat can be implemented in the shoes.

Application of positive air pressure: A possible method for treating OSA

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Obstructive Sleep Apnea (OSA) is the most common type of sleep apnea and which is caused by complete or partial obstructions of the upper airway. This can be treated by applying a continuous mild pressure which would keep the airways open. Continuous Positive Airway Pressure (CPAP) therapy on the structural and functional characteristics of the right heart in patients with obstructive sleep apnea (OSA). When CPAP is used, the titration is performed according to usual manual standardized procedure, which includes CPAP monitoring. With reference to the Continuous positive airway pressure (CPAP) we have designed and developed a device which supplies positive pressure to the patient suffering from OSA. The obtained results display variations in pressure and flow of the air breathed by the subject. The sleep pattern of the patient can be easily depicted from graphical representation of the data obtained.

Keywords: Osa, polysomnography, cpap, titration

Design of Portable Automotive Restraint and External Counter Pulsation System for Deep Vein Thrombosis and Leg Cramping

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The main objective of our paper is to design an Automotive Restraint system to solve the Biological problems such as D EEP VEIN THROMBOSIS, LEG CRAMPING while driving for long distance journey. The right foot is constantly feeding signals to the accelerator either depressing it more or letting off the pressure, for split seconds of time. And every so often pivoting the ball of the foot on the heel to press the brake: The heel of the foot constantly rest on the floor, while the rest of the foot is angled up to press against the accelerator pedal and it last up to long hours or depending on driving hours. So the Ankle joint, ball of the feet, heel and toes are always under stress. This leads to pain in both foot and thigh portion: Pain in the heel, Pain in toes/ball of the foot, Pain in just above the ankle, Muscle strain. Minimize the muscle fatigue and stress we are proposing External Counter Pulsation. In this propose method pneumatic cuffs are automatically wrap around person legs and inflation and deflation of cuff about 200 to 250 mmHg keep the muscle active, improve the blood circulation and prevents the said problems. We are also proposing the use of heat up to 37°C in pulsatile form to stop the pain of ankle and thigh. A sheath of bed in which heat is generated as per requirement and it is fully based on Artificial intelligence

Methods to Reduce the Stress Shielding Effect for Orthopedic Implants: A Review

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Orthopedic implant problems are considerably increasing posing pressure to healthcare systems. Metallic implants have a significant mismatch with bone mechanical properties and create stress concentration at the fracture fixation plate, which results in stress shielding. This study reviewed on stress shielding, which impedes load transmission at the fracture site leads to non-union, delayed healing, refracture of bone and construct failure. This study started with a brief discussion on metallic implant and detailed discussion on stress shielding phenomenon. It also reviewed currently use of several composite implant materials and its design in order to reduce the current problem. This review will therefore highlight recent advancements in reducing stress shielding effect with different materials and methods. As the review ended, fiber reinforced composite implant have recently attracted significant attention because they can provide solution to aforementioned problems.

Keywords: Stress Shielding Effect, Bone, Refracture, Implant

Analysis of forward head posture

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Proper posture is believed to be the state of musculoskeletal balance that involves a minimal amount of stress and strain on the body. Although proper posture is desired, many people do not exhibit good posture. The focus of the paper is mainly on the cervical segment of the spine, where one of the most frequently noted abnormal postures, in and out of the clinical setting, is the Forward Head Posture (FHP). FHP implies that the head is in an anterior position in relation to the theoretical plumb line which is perpendicular to the body's center of gravity. This altered posture decreases musculature efficiency and extra muscular action is required to maintain a balanced position of the head and neck. This increases the weight and tension exerted at the base of the cervical spine. This paper analyses the problem of FHP by means of a survey via Google Forms and a neck joint simulation in OpenSim. In doing so, various conclusions regarding the severity of neck pain in the youth, its duration or periodicity, whether the pain is work related or medically diagnosed and the range of neck pain in the pain scale can be drawn. Also, the simulation in OpenSim (using GUI and Python) was used to obtain the craniovertebral angle or the range of motion of the neck and to assess the muscles involved in flexion-extension of neck. Based on these results, it was concluded that the neck pain is surely a matter of concern among the technology users because of the hours spent using technological devices and postures people portray while using the said devices, which proves that indeed there is need of a preventive measure to ensure a healthy living.

Co-Relation of Physiological Signals and Therapy for Diagnostic Purpose of Periodic Limb Movement Disorder (PLMD)

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Periodic limb movement disorder (PLMD) is involuntary lower limb movement during sleep commonly referred as kicking during the alpha state of (8 to 12 Hz) brain of Rapid Eye Movement (REM) sleep at night. Originally, generation of PLMD is from spine and due to iron impairment. Duration of flexion is more than 0.5 to 90 seconds, reoccurring in four or more sequences with an interval of 50 to 90 seconds between two events. Presently, diagnosis of PLMD is done at polysomnography centre also known as sleep study laboratory where patients must sleep with multiple sensors attached to the body, for two-night study and by the end of study they will get the polysomnography reports mentioning about the disorders suffered by them throughout the night. However, these laboratories are limited up to diagnosis level only. So, our major motive in this proposed method is to provide real time monitoring and therapy to PLMD patients. Initially, alpha wave (20-200uV) is fetched using electroencephalogram (EEG) filter from occipital and frontal lobe of cerebral cortex. Electromyogram (EMG) is obtained from lower one third portion of lower limbs as it is the most mobile part during kicking. Combination of both these signals is then compared with the known standard sleeping frequency. Whenever there is abnormal spike of 8uV in EMG signal, it is re-polarized using electrical stimulation. Our motive is to repolarize the spike and bring it back to the baseline. Our proposed deliberation is to control the kicking during sleep.

Design & development of health monitoring wearable kit with predictive live tracking android application for soldiers

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I have proposed an idea to “Design and Development of Health Monitoring Wearable kit with Predictive Live Tracking Android Application for Soldiers” which focuses on providing the soldiers an assurance and continuous monitoring of their health status in real time through Internet of Things (IoT). In this research, we are using a prediction algorithm and live position tracking for continuous monitoring. The continuous monitoring include various physical parameters like electrocardiograph (ECG) , temperature and it also update the current health status of each soldiers using a web server and android application. A doctor or monitoring team can continuously monitor the soldier’s condition on his smart phone or PC using an Android application. An encrypted data transcription is possible using wireless technology where the heart rate waveform and temperature can be obtained on the application for real time. The soldier’s history will be stored on the web server and doctor can access the information whenever needed from anywhere and need not physically present. Physiological values beyond the normal values initiate immediate. The physiological parameters and the location of the soldier will be continuously displayed on a personal webpage which can be accessed using individual username and password. Sudden abnormal variations in the values will be immediately alerted to the control room to take immediate recovery measures.

Keywords: Internet of Things (IoT), live position tracking, ECG, android application.

Current assistive devices for the paraplegic

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Paraplegia, sometimes called partial paralysis, as stated by Ida Bromley in the 'Tetraplegia and Paraplegia guide book', is a form of paralysis in which motor and sensory function of the lower extremities is substantially impeded. It is a form of spinal cord injury classified often as disability. It is almost always the result of damage to the brain, spinal cord, traumatic injuries or in some cases due to congenital conditions.

When these injuries occur, signals cannot travel to and from the lower regions of the body, and the body is prevented from sending signals back up the spinal cord to the brain. Thus, paraplegics not only struggle with normal day-to-day movements below the waist but also experience an extensive loss of sensation.

The WHO recognizes this injury as a major musculoskeletal condition that presents a serious disease burden. In India, according to a report of the International Conference (Spinal Injuries Management, New Delhi, 1995) the incidence of spinal injury was estimated at about 15,000 new cases per year with a backlog of ten years, with the numbers only rising ever since.

Spinal cord injuries not only cause physical but also a psychological consequence on the patient, his family and the society. The costs involved for treatment, management and recovery from the disease are also high. Such struggles of patients can be reduced by integrating new technological and medical devices in the daily functioning of the affected people.

Sadly, the awareness and understanding of the disease and the subsequent devices and techniques that assist in the normal functioning of a paraplegic patient is limited to physicians and allied health professionals. The general masses consider a wheelchair to be the only option when picturing a paraplegic are shockingly unaware about the wide variety of the treatment techniques and devices available today.

This paper gives the review of the various Paraplegic treatment techniques/devices that are available. Some innovative designs of the devices are also discussed.

Robotic Arm Control Using Myoelectric Signal and Speech Recognition with Remote Panel in LabVIEW

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To create an affordable robotic arm using LabVIEW by means of EMG signal and speech recognition. The scope of our project is to control a robotic arm in the remote environment which enables us to operate it from a distant place by connecting it with the main server. The Remote Panel in LabVIEW enables us to control the Arm by connecting its module to one system and controlling from another system. The EMG signals are trained with real time surface myoelectric signals which are decoded and implemented to the embedded system of the robotic arm. Speech recognition is also used along with this in case of EMG electrode failure using voice recognition Bluetooth module where the human voice is acquired using an android application. The robotic arm which is connected with the remote PC with LabVIEW is controlled using these signals. The Arm can be used widely in hospitals for treating patients with communicable diseases, removing human medical wastes etc. The Arm can also be used in laboratories and industries in places where the surrounding is difficult for humans to work.

Keywords: Remote panel, LabVIEW, EMG, Speech.

Biotechnology (BT)

Oral presentations

Polyphenols: Extraction and its Health benefits

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The growing public awareness of nutrition and health care research substantiates the potential of phytochemicals such as polyphenols and dietary fiber. There is a need to identify newer sources of natural nutritional materials with the desirable functional characteristics. Fruit peel waste is a novel source of polyphenols and dietary fibers. The use of waste for production of various crucial bioactive components is an important steps toward sustainable development. Polyphenols are secondary metabolites of plants and are generally involved in defense against ultraviolet radiation or aggression by pathogens. It has been reported that polyphenols exhibits health benefits such as antioxidant, anticancer, anti-atherosclerosis, anti-inflammatory, anti-influenza and prebiotic activities. This work presents different extraction processes of polyphenols from waste fruit peels and their selective separation

Keyword: Extraction, Polyphenol, Fruit Peel Waste, Dilute separation

Teratogenic effect of nanoparticles at sublethal concentration in *Drosophila melanogaster*

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Nanoparticles are used for a variety of purposes; however, risk associated with nanomaterial exposure at sublethal concentration is not clear, especially in whole organisms. Fruit flies are commonly used as a model organism for many biological processes including toxicity testing. However, there are no reports on the influence of nanoparticles on *Drosophila* development at sublethal concentration. In the present study we explored the developmental toxicity of titanium dioxide (TiO₂), silica oxide (SiO₂), aluminum dioxide (Al₂O₃) and zinc oxide (ZnO) nanoparticles at sublethal concentration. The results obtained in the present study indicate that all the nanoparticles tested had a negative effect on development, female fecundity as well as leads to mutations in F1 generation of *Drosophila*. The nanoparticle causes growth defects, anomalies in body size and malformations such as wing deformation, elongated and pointed abdomen, depigmentation of abdomen and wing, reduced eye size etc. TiO₂ and SiO₂ do not have dramatic effect on pupal formation and number of adult emerging from pupa, however leads to deformities in 50% of the population. In case of Al₂O₃ NPs, it seems to repress pupal formation along with reduction in number of adult emerging from the pupa while the deformities are less pronounced. Interestingly, ZnO NPs treatment leads to faster development, however all of the adults shows deformities. Thus zinc oxide nanoparticles lead to highest mutant flies' ratio followed by silica oxide nanoparticles and titanium oxide nanoparticles. The frequency of mutant flies was minimum in flies exposed to aluminium oxide nanoparticles. The data presents a comparative study of nanotoxicity at sub lethal concentrations at which no obvious cytotoxic effect or oxidative stress is manifested could still to teratogenic effect on *Drosophila*. This research work will assist in attaining a clear and comprehensive picture of the potential risk of nanomaterial exposure to health, and demonstrate the advantages of using *Drosophila* in nanotoxicological investigations.

Keywords: Metal oxide Nanoparticles, *Drosophila melanogaster*, Mutations, Teratogenic effect

Function of isolated microbial consortium in PBR for treatment of agrochemical effluent: growth kinetics, process modeling and toxicity

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The purpose of this research was to evaluate the potential of novel isolated bacterial consortium BFNT immobilized on inert sorbent of over burnt porous brick packed column in a continuous flow removal of toxic bifenthrin (BFN) from synthetic and agrochemical effluents. The present research is one of the very few growth dynamics studies showing the substrate accumulation rate ($A_s = 0.92$) of the consortium, also the specific growth rate which was observed to be 0.185 h^{-1} . The kinetic growth parameter modeling showed best fitting of the experimental data in Logistic function ($R_2 = 0.95$) as compared to others. The BFN biosorption performance was analyzed under optimum process conditions of 200 mg L^{-1} BFN influent concentration, feed flow rate of 2.5 mL min^{-1} and 20 cm bed height. The column operational data concerning the breakthrough time, volume as well as saturation time and volume closely fitted the bed depth service time model ($R_2 > 0.96$) as compared to others. Analytical studies of SEM, FTIR and XRD revealed the BFN treatment mechanism by combined bioaccumulation and bio-sorption process. Induction of intracellular dehydrogenase (115%) and dioxygenase (132%) in addition to extracellular laccase (453%) signifies the essential role of the consortium BFNT in the treatment process. The column could be successfully applied for 5 cycles of biosorption and regeneration studies for BFN treatment. The column could significantly treat different toxicants from real effluent and therefore this strategy can be effectively applied for commercial application. One of the important observations is the toxicity analysis of the real effluent and aqueous solution of BFN after the PBR treatment which indicated the environmental friendly behavior of the new technique.

Keywords: Bifenthrin; Packed bed column; Immobilized consortium; Accumulation rate; Sorption modeling; Biosorption-desorption; Toxicity

Medicinal Properties of Fruit waste

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In these days, more focus is made for improving immune system and curing diseases by using food and food related products. In these contexts, fruits are being extensively used to treat and prevent diseases. After utilization of fruits, huge amount of waste is generated during pre and post harvesting process. This produced waste is generally discarded as waste in the dump yards which is hazardous to the environment. However, recent studies has confirmed that fruit peels waste (FPW) can be a valuable source of bioactive compounds, due to the presence of steroids, phenolics, tannins, flavonoids, triterpenoids, glycosides, carotenoids, ellagitannins, anthocyanins, vitamin C and essential oil. These compounds can add value to the FPW if extracted efficiently. Several economically valuable products having superior medicinal, nutritional, and antioxidant properties can be obtained from FPWs by various processes like drying, size reduction, fermentation, solvent extraction, and many more. The bioactive compounds in the FPW shows its varied uses in the treatment of wounds, acne, diarrhea, gastroenteritis and rotavirus enteritis, allergies, malaria, coughs, degenerative muscular diseases, bacterial/fungal infections, cancer, cardiovascular disorder, diabetes, liver diseases, dental plaque, inflammatory ailments including rheumatism, menstrual pain, etc. The paper reviews the antioxidant, antiatherogenic, antimicrobial, antiallergenic, anti-inflammatory, antithrombotic, cardioprotective and vasodilatory properties and of some commonly used FPW (banana, pomegranate, papaya, guava, apple, etc.). This will helps to obtain the maximum health benefits and maximize the industrial profits.

Keywords: Fruit peel waste, bioactive compounds, antioxidants, medicinal properties, health benefits.

Production and purification of decolorizing agent laccase from *Trametes versicolor* using agro-industrial waste under Solid state fermentation

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Fungal laccases are of particular interest with regard to potential industrial applications, because of their capability to oxidize a wide range of toxic and environmentally problematic substrates. Enzymatic oxidation is a potential substitute to chemical methods, since enzymes are very specific and efficient in catalysis and are ecologically sustainable. Laccase has many commercial applications which include dye decolorization, bioremediation, paper and pulp industry, bio-bleaching, food processing industry and pharmaceutical industry. In the present study, *Trametes versicolor* NCIM 1086 was explored for the production of laccase using palm fiber as substrate under solid state fermentation and also partial purification and decolorization of the dyes with enzyme was done. Thirteen agro-industrial residues were screened for laccase production. Mannitol and peptone are the best carbon and nitrogen supplements respectively. Enzyme was partially purified with ammonium sulphate precipitation and dialysed. Decolorization studies were carried out on 4 synthetic dyes namely malachite green, congo red, methylene blue and methyl orange. Laccase was effective on all four dyes, showing more than 50% decolorization.

Revealing latest innovations in Technological Microbiology

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Since its very inception microbiology together with genetic engineering has enabled researchers in production of antibiotics, bioactive molecules, cheap and effective drugs and vaccines, drug delivery, expression of eukaryotic proteins, biofuels, biofertilisers etc. Yet, many of the most promising and critical application of microbes remain uncharted and less recognized. The rapidly growing evidences on their recent and novel applications demand a detailed review of literature. The core tenet of this review is to highlight non contemporary utilisation of bacteria in various field. This paper summarizes and provides a broad overview on the research status of “Technological Microbiology” in areas such as green electronics, living devices, robotics, construction engineering and developing algorithms. This review is an effort towards documenting advancing microbial application such as (1) Bioink: 3D printing of bacteria to make living devices and living materials. (2) Bioelectronic: Electrically conductive pili and self-assembling nanowires used in implantable bioelectronics, degradable photovoltaics, self-powering and self-repairing devices etc. (3) Robotics: Bacteria-inspired nanorobots and microrobots are engaged in clearing occlusion and kidney stone, endoscopy, lab-on-a-chip applications. (4) Construction Biotechnology: microbe-based cement is known to have self-healing, corrosion inhibition, self-powering and self-repairing properties. (5) Bio-inspired algorithms: bacteria behavioural patterns has inspired several algorithms capable of detecting fault in complex structure, prioritise sensitive sensors, acts as metaheuristics for addressing the optimization problems etc. A few examples are described to lay the perspectives of considerable interdisciplinary efforts devoted in identifying unique application of microbes to a completely different level of complexity, breadth, and practical applications.

Keywords: Technological Microbiology, Bioink, Bioelectronics, Robotics, Construction biotechnology, Bio-algorithms.

Bioconversion of tannins into and anti-bacterial drug trimethoprim from cashew waste

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India has a long tradition of using drugs obtaining from plants in the Ayurvedic system of medicine. Medicinal plants are a potent supply of many secondary metabolites like alkaloids, glycosides, steroids, flavanoids, tannins, trepenoids and synthetic resin compounds.

Introduction of Trimethoprim has resulted during a potent bacterial agent in combination with sulphonamide and sulphamethoxazole used for treatment of commonly acquired infections , particularly of urinary and respiratory tract. Conventionally the drug Trimethoprim was produced from synthetic Gallic acid however, this method has generated a lot of environmental and process issues, therefore a completely unique method of production of drug Trimethoprim was developed which uses Gallic acid obtained from natural sources, this method has proved to be effective in reducing problems related to environmental pollution and process problems. The present work describes the bio-conversion of the Gallic acid from cashew testa waste into an anti-bacterial drug Trimethoprim by submerged fermentation using partially purified immobilized enzyme of *Aspergillus niger*.

Epigenetic toxicity of nanoparticles

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Nanoparticles (NP) are being used in an increasingly wide range of fields which leads to increased human exposure. Accumulating evidence clearly shows that exposure to nanoparticles leads to cell toxicity, immunotoxicity, genotoxicity, nongenotoxic carcinogenicity, reproductive toxicity. However, there is a dearth of information on adverse effects of these NPs on the epigenome. Rapidly growing evidence has linked sublethal exposure to NP with epigenetic variations, including changes in DNA methylation, histone modifications, and miRNAs, which may lead to reprogramming of broad spectrum of gene expression. Being the most sensitive and first retort, epigenetic modifications are extensively studied and used as potential biomarkers in several disease conditions. The early NP exposure biomarker may go unnoticed by traditional toxicity assays, but epigenetics variations being more sensitive can be used as fingerprint for nanotoxicity and provide guidance for creating safe nanomaterials. This review collates the literature on “Nanoepigenetic toxicity” and its contribution to both genotoxicity and cytotoxicity experienced by cell. It is interesting to note that even at concentrations and conditions under which NP are harmless to cells, they can affect the epigenetic profiles of cells, which in subsequent cell generation can alter cell metabolism. Lastly, identification of key factors and establishing reliable screening tests to predict toxicity that improve our understanding of NM-induced epigenetic toxicity are discussed.

Keywords: Nanotoxicity, Epigenetics, Biomarker, DNA methylation, Histone modification.

Reducing bone implant rejection: An investigative study on utilisation and application of collagen extracted from *Rohu* skin as Nanoscale coating material

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One of the major reasons for graft/ implant rejection is its low adhesion to osteocells resulting in poor osseointegration. Surface roughness plays an important role in affecting the binding characteristics of cells on implant surfaces. Since nanoscale surfaces provide better cell adhesive properties, this has created a huge demand for orthopaedic implants which match the unique nanometer topography of the bone. Collagen constitute a family of triple helical proteins present in the extra cellular matrix that initiate synthesis of bone by acting as a nucleation centre for hydroxyapatite (HA), the mineral part of bone. The present research aims at extracting collagen from the huge amount of fish waste generated in India and use the same in biomimetic synthesis of Nanoscale hydroxyapatite crystals. Collagen was extracted from *Rohu* skin waste through acid/salt treatment and dialysed to remove the salt; 35.80% of collagen was obtained. The purified collagen was characterized through electrophoretic, spectral and elution profile. It displayed a band at 125 kDa in SDS PAGE, high absorbance at 220nm and a polyproline-II secondary structure. It eluted within void volume from a 1.8×13cm sephadex G100 calibrated column and at 31% NaCl concentration from a 1.8×6.5cm CM sepharose column. The collagen was suspended in bone nucleating solution at 37°C for a period of 31 days for biomimetic growth of HA crystals. The obtained crystals were characterised through FT-IR studies, confirming the presence of collagen amide bands, PO_4 , CO_3^{2-} and OH. XRD analysis of crystals exhibited characteristic planes of HA at 212, 213, 222 and 232. The size of crystals was found to be in the nanometer range from Atomic Force Microscopy. This study substantiates the utilisation of biomimetically grown HA as Nanoscale coating material in the bone growth. Despite many advances in materials, techniques and implant design, implant failure is a major concern among the specialists; however our study in bone growth from collagen does provide an alternate solution in implant surgery.

Plant gums: a cost-effective and eco-friendly biomaterial for green nanotechnology

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Advances in green chemistry have focused on exploring bio-materials available in nature for the synthesis of nanomaterials with improved environmental quality and reduced health hazards. The plant gums, a non-starch polysaccharide derived from plants, can mentor as “green” reducing as well as capping agents for synthesis of highly stable metal colloidal nanoparticles. Plant gums are cost-effective, eco-friendly, non-toxic, biodegradable and abundantly available in nature. By employing plant gums for reduction and stabilization of nanoparticle, water can be used as solvent as well as this method being devoid of chemical usage helps to overcome the harmful effects posed by toxic organic solvents. The hydroxyl groups of polysaccharides and hemiacetal reducing ends of branched chains act as a reaction center for the reduction of metal ions to nanoparticles. Plant gums provide a bio-template for the synthesis of various metal oxide nanoparticles with improved optical, chemical and magnetic properties. Plant gum assisted nanoparticles being biocompatible and biopolymer derived, have pharmaceutical, cosmetic and domestic applications. The present review summarizes the trends in the development of plant gums derived nanostructured materials and their applications in the environmental remediation, chemical sensing, pharmaceuticals, and biotechnology.

Keywords: plant gums, green synthesis, metal nanoparticles, metal oxides

Screening and Characterization of Isolated Microbial Strains from Forest regions for Enzymes of Industrial Importance and Secondary Metabolites as Drug Molecules

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The extravagant biodiversity of Western Ghats is an unexplored plethora of novel microbial masses that could be used for research in industrial and medical development. These microbes can be used for production of enzymes of industrial importance and secondary metabolites that serve as antimicrobial agents or for development of drug molecules essential to day. In this study, microbial strains were isolated from the forest regions of the Western Ghats by enrichment method and purified by repeated streak plate method and preserved on slants. Screening for different enzymes like Amylase, Lipase, Pectinase, Protease, Chitinase, Xylanase, Cellulase, Asparaginase, Glutaminase and Laccase was done using standard methods using dyes. Most of the screened isolates showed positive results for almost all the enzymes; however Protease and Pectinase showed maximum zone of clearance of 10 mm. Partial purification was done by Ammonium-Sulphate Precipitation (80% saturation), followed by dialysis. These isolates were characterized for their Gram's nature where most of them were Gram's negative in nature, motility test was done by hanging drop technique and most of the isolates were motile. Further, strains showing prominent enzyme production were tested for antimicrobial activity using Agar-Well Diffusion method for activity against pathogenic strains like *Bacillus subtilis*, *Bacillus cereus*, *Micrococcus luteus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Zymomonas mobilis* where they showed maximum antibacterial activity against *Micrococcus luteus* with a zone of clearance measuring 18 mm. Based on the results of antimicrobial studies, secondary metabolites which can be developed into drug molecules were isolated. Growth curve was studied and optimization with respect to temperature and pH was done to obtain optimal growth. Optimization studies for enzyme production were also carried out. Enzymes like amylase, pectinase, protease, etc. find innumerable applications in industries. Amylase is used in brewing beers, bread-making, syrup preparations, etc. It also has medical applications in the use of Pancreatic Enzyme Replacement Therapy. Proteases are used in detergents, in bread improving, to control blood clotting, pathogenic protein degradation, etc. Pectinase is used for extraction of juices. These enzymes also are used in the production of pharmaceuticals and are vital in the field of bioengineering and medical biotechnology.

Standardization of protocol for isolation of genomic DNA from groundnut

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The aim of this study was to establish a new and handy protocol for DNA isolation from Groundnut (*Arachis hypogaeae* L.) to get high quality DNA that is suitable for amplification with molecular markers. The plumule of groundnut seed was used as sample for DNA isolation. 200 µg of groundnut plumule was stored at -20°C till DNA isolation. DNA isolation was carried out within 2 days after collection of sample to avoid degradation. Crushing of plumule was done by using phasel. DNA was isolated by rapid DNA extraction method by the following protocol of Doyle and Doyle (1990) with little modifications. In this protocol Phenol: Chloroform: Isoamyl Alcohol (25:24:1) is used for removal of phenolic compounds from cell debris. PCIA treatment was given two times instead of once as given in protocol. The quality and quantity of DNA was ascertained through agarose gel electrophoresis. It was observed that good quality with sufficient quantity of DNA isolation is possible through rapid DNA extraction method. In spectrophotometric reading it was observed that in most of the samples the DNA yield ranged from 250-300 ng/microgram. Due to phenolic treatment DNA was free from polysaccharides. The DNA amplification was occurred without additional treatment of RNase and proteinaseK.

Keywords: Molecular Marker, DNA isolation, Phenolic compounds, Gel electrophoresis, RNase, Polysaccharides.

Effects of Pomegranate juice and their polyphenols in Tauopathy

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Tau, microtubule-associated protein (MAP) under pathological conditions, forms neurofibrillary tangles (NFTs) leading to the development of numerous neurodegenerative diseases. Tau, promotes microtubule assembly and regulates its stability. The protein is natively unfolded, however, when irregularly modified, Tau accumulates, becoming insoluble and leading to the formation of NFTs and changes in Tau conformation resulting in decreased binding to microtubules. Indian medicine, medicinal plants has been using natural product to treat neurodegenerative disorders. Many approaches have been applied to reverse the Alzheimer's related pathology, which include use of natural and synthetic compounds. Several studies have been reported that the role Pomogranate polyphenol in various diseases like cardiovascular accidents, diabetic, skeletal muscle, myopathies and neurodegenerative disease. The present interest would be to study the ethanolic extract of Pomogranate polyphenol in Tau aggregation, dissolving the preformed fibrils and role in neuronal cells. This study would help us to understand the neuroprotective properties of *Punica granatum* in Alzheimer' disease.

Keywords: Tau, Alzheimer', Microtubule associated protein, neurofibrillary tangles, neurodegenerative

Food Nutrition Analysis kit

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The food we consume provides our body with the vital nutrition that we require. Nutrition is of mainly two types, Macronutrients and Micronutrients. The three main types of Macronutrients are the Carbohydrate, Protein and Fats. Though with the recent ongoing food adulteration pandemic either due to addition of an inferior quality material or by extraction of a material, the nutritive value of food is hampered. A simple example of which is the adulteration of milk with water, etc. Though much information isn't available to the general population as to how the purity or the nutritive value of a food stuff can be determined, a simple test kit for the qualitative analysis of it could prove as a useful tool. It comprises of 3 individual strips for each of the major macromolecule. The protein detection strip is made of 5% CuSO_4 and shows a colour change from Blue to Violet when the sample is placed onto it along with given NaOH solution to develop alkaline conditions. Carbohydrate detection strips contain Benedict's reagent and therefore on placing the sample drop and heating mildly for 5-10 seconds, shows a colour change from Blue to Yellow/Orange/Red, depending on the concentration of sugar present. The fat detection strips are paraffin coated. The sample can be blotted onto the marked centre of these strips and then stained with a given non-toxic lysochrome dye, to check the quality of the fats or lipids present. They however do not need a controlled environment and thus can be of help for minimizing food adulteration and nutritive detection in common households.

Keywords: Food, Nutrition, Adulteration, Qualitative analysis, Macronutrients, Test kit.

Enzyme technology prospectus & their Biomedical Applications

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Enzymes are natural catalysts & protein molecules functioning as specialized catalysts for chemical reactions. They are produced by living organisms to increase the rate of a diverse set of chemical reactions required for life. They are involved in all processes essential for life such as DNA replication and transcription, protein synthesis, metabolism and signal transduction, etc. And their ability to perform very specific chemical transformations has made them increasingly useful in industrial processes. Enzyme technology uses enzyme as a biocatalyst to manufacture new products in bulk in order to meet needs such as food, fine chemicals, pharmaceuticals, biofuels and biopolymers. The most common types of industrial enzymes are proteases, amylases, lipase, cellulases and xylanases. Enzymes are applied in various fields, including technical use, animal nutrition, cosmetics, medication, and as tools for research and development. Enzymes are now increasingly being used in medical application such as therapeutics, drug delivery, diagnostic, new drug development, bioanalysis and biosensors. Examples of some biomedical enzymes are cytochrome oxidase, creatine kinase, streptokinase, urokinase, trypsin, chymotrypsin & serratopeptidase. Industrial biological catalysis through enzymes has experienced rapid growth in recent years due to their ability to operate at mild conditions, and exceptional chiral and positional specificity, things that traditional chemical processes lack. New advancements in “white biotechnology”, mainly in protein engineering have offered imperative techniques for the effective development of new enzymes using directed evolution. Directed evolution is a term used to describe the entire range of molecular biology techniques that allow natural evolutionary processes to be mimicked in the laboratory. The present paper aims to provide a review on industrial enzymes, highlighting on recent scientific advances, current applications in biomedical industrial sectors and global market.

Keywords: Enzyme technology, industrial enzymes, biomedical enzymes, directed evolution, white biotechnology

Development of soil physical characters analysis kit

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Soil is a complex mixture of minerals, water, air, organic matter and countless organisms that helps in decaying remains of once living things. It is capable of supporting plant life and vital to life on earth. It has various roles in agriculture, construction, nutrient recycling, and many other aspects. There is a great need to test the soil to evaluate its composition characteristics, functioning, etc. And depending on that to conclude where should the specific type of soil be used. Also it helps to determine whether soil needs amendment or more measures to make it suitable for growing plants or crops or any other use. Physical properties play an important role in determining soil's suitability for agricultural, environmental and engineering uses. The supporting capability; movement, retention and availability of water and nutrients to plants; ease in penetration of roots, and flow of heat and air are directly associated with physical properties of the soil. Physical properties also influence the chemical and biological properties. The physical properties of a soil depend on the amount, size, shape, arrangement and mineral composition of its particles. These properties also depend on organic matter content and pore spaces. Important physical properties of soils: 1. Soil texture, 2. Soil structure, 3. Surface area, 4. Soil density, 5. Soil porosity, 6. Soil color, 7. Soil consistence. The ASM soil testing kit deals with the evaluation of physical characters of soil by means of various methods. It basically provides all the materials for on field soil testing and hence determines the uses of soil. This kit can be effectively used by the researchers in laboratory analysis, by the surveyors, in land management programs and also by farmers for routine check of soil quality in their land.

Keywords: Soil, physical properties, analysis, soil testing kit

Screening of Extracellular biomolecules from microbial culture

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Extracellular biomolecules are an important bacterial trait, regardless of the trophic strategy. Extracellular enzymes have enormous potential applications in industries and widely used in variety of industries such as pharmaceuticals, chemical production, biofuels, food and beverages products. Therefore, there has been much research aimed at obtaining new microorganisms producing extracellular enzymes with higher efficiency. 11 bacterial strains were obtained from the water sample collected from Unkal Lake, Hubli. strains were primarily screened to assess their extracellular amylase, gelatinase, L-aparaginase, L-glutaminase production potential through inoculation on plates containing medium supplemented with starch, gelatin, L-asparagine, L-glutamine as substrates which have applications in various biotechnological process.

Assessment of novel substrate *Zizipus Oenoplia* for fruit wine production

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In this study the potential of tropical fruit *Zizipus oenopilia* was assessed for the production of fermented fruit juice. *Z. oenoplia* possess significant antioxidant activity, which has greater utility as therapeutic agent in preventing oxidative stress related degenerative diseases. This study successfully investigates the use of alternate source as a substitute for wine production viz., found to be more cost effective both operationally and economically. Also comparative study was done with various levels of sugar concentration. This followed the anaerobic fermentation to produce wine for an approximate duration of 10 days with numerous samples. The prepared wine was kept in glass bottles at lower temperature of 2°C and analyzed by GC-MS technique. The results resolved alcohol concentration of 4.34%, 8.72%, and 18.55% in sample 1, sample 2, and sample 3 respectively. In addition, some trace elements were also found during the analysis.

Keywords: *Ziziphus oenoplia*., Antioxidant, Therapeutic, Degenerative, Anaerobic, Fermentation, GC-MS.

Electrochemical detection of Pathogens

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Water borne, Hospital borne and water borne pathogens are serious threats worldwide. Pathogens are harmful to human beings. Detection of pathogen at earlier stage is important for on time diagnosis of disease. It becomes lethal after certain period of time. Current techniques available for the detection are PCR, ELISA, immunological assays. Conventional techniques are time consuming which takes three to four days. Biosensors are the tools used currently in various fields such as clinical diagnostics, food analysis, bioprocess and environmental monitoring. Biosensors are of different types. Optical biosensors, Electrochemical biosensors are the types of biosensors currently used widely. Biosensor should possess properties such as sensitivity, portability and point-of-care utility. The integration of nanotechnology with biomedicine and diagnostics has advantages in the field of diagnosis and channelized the path for better treatment and prognosis. With the use of properties of nanoprobe and nano-transducer mediators such as surface, electronic and electrocatalytic properties can lead to improved platform for detection strategies. The progress in the field of biosensors for detection of pathogens would make significant contributions to advanced medical technology.

Key words: Biosensors, Electrochemical, nano-transducer

Prediction of potential phytochemical anti-cancerous compounds against Leucine Zipper Transcription Regulator-1 (LZTR1) through In silico analysis

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Ovarian and endometrium cancers are the fifth most common diagnosed cancers in India. As per 2020 statistics, it may lead to third most common diagnosed cancers in India. Overexpression or mutation of Leucine Zipper-like Transcription Regulator1 (LZTR1) leads to various cancer such as schwannomas, melanoma, prostate cancer and endometrial cancer. LZTR1 protein is a member of BTB-Kelch superfamily which is involved in DNA-binding transcription factor activity. The sequence of LZTR1 (Q8N653) comprises of 840 amino acids whose structure is yet to be determined. In this study, we predicted the tertiary structure of LZTR1 using fold recognition or threading method through I-TASSER server and predicted potential phytochemical anti-cancerous inhibitors from NPACT database against LZTR1 protein by virtual screening through PyRx software. Phytochemical compounds such as Dinoxin B (NPACT00510), Luxenhalcone (NPACT00730) and Paclitaxel (NPACT00839) shown better interactions against LZTR1 protein with the binding affinity of -9.4 kcal/mol.

Key words: LZTR1, Ovarian cancer, Endometrial cancer, NPACT, I-TASSER, PyRx

Mycobacterial TlyA (Rv1694) plays an important role in survival of bacterium and its S4 domain is functionally responsible for its rRNA methyl transferase activity

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The *Mycobacterium tuberculosis* (Mtb), the causative agent of human tuberculosis disease, manifests its survival and virulence by modulating many pathways within it and within the host. Among many studies, its intracellular survival ability has received large attention in order to achieve therapeutics that can limit the virulent damage done by the bacterium. Apart from the numerous virulence proteins of Mtb studied extensively, the proteins helping it in its *in vivo* survival play a significant role in the pathogenesis of Mtb. Mycobacterial TlyA, is one such protein, having moon-lighting functions: a functional hemolysin and SAM dependent rRNA methylase, which is categorized in non-essential category. In our work on MtbTlyA, we had explored its functions via deletion mutagenesis. Deletion of 49 and 89 amino acids from N-terminal increases hemolytic activity 2-3 fold and survival. It also does not affect the activity of its membrane presentation however, Δ N49 and Δ N89 are defective in functional rRNA activity of TlyA, hence resistance to capreomycin. Model bacteria harbouring TlyA secrete the protein in micro-vesicles (MVs, secreted in the medium) and Cterminal plays an important part for transporting TlyA via MVs. *In vivo* experimentation suggests that TlyA is expressed *in-vivo* in H37Ra and hence its immunization led to decrease in interstitial inflammation and helps in clearing of bacteria. TlyA can be a key molecule that facilitate the intracellular survival of Mycobacteria, especially during initial stages of infection.

Keywords : Mycobacterial TlyA, *Mycobacterium smegmatis*, H37ra, hemolysin, rRNA methyl transferase.

Bovine Serum Albumin as a nanocarrier for the efficient delivery of model anticancer drug Berberine: Preparation, Characterization and *In vitro* studies.

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Cancer is a major global health catastrophe threatening the health of millions worldwide. Breast cancer is the most common cancer in women and leading cause of cancer death. Chemotherapy is a major therapeutic approach for the treatment of the breast cancer. Lack of selectivity and multidrug resistance are two major setbacks of chemotherapy. Berberine, a bioactive extract from plants of the genus *Berberis*, has shown multiple activities including anti-inflammatory, antioxidant, anti-diabetic, antihypertensive, antidepressant, antidiarrheal, anti-microbial, neuroprotective, hepatoprotective, hypolipidemic and anti-cancer property. Its low bioavailability, slight absorption and poor aqueous solubility limits its applications. To overcome these limitations we have used protein based nanoparticles as a smart therapeutic approach for drug delivery. In this study, we have demonstrated that BSA (Bovine Serum Albumin) nanoparticles are promising drug carriers for effective Berberine delivery that can mediate efficient anticancer activity against breast cancer cells. Berberine loaded BSA nanoparticles were synthesized by desolvation method and then purified by centrifugation. Nanoparticles were characterized by DLS, SEM and FTIR. The average particle size of nanoparticles was found to be 166 nm and the SEM images reveal that nanoparticles were spherical in shape. The drug entrapment efficiency of prepared nanoparticles was found to be 85.65 % with a drug loading capacity of 7.78 %. The overall data of FTIR spectrum confirms the interaction between protein nanoparticles and drug. After successful synthesis and characterization of Berberine loaded BSA nanoparticles we demonstrated the anticancer activity by *in vitro* studies.

Keywords: Cancer, Bovine Serum Albumin, Nanoparticles, Drug, Biocompatible

Application of *Trichoderma* and *Bacillus* during initial berry developmental stages inhibits epiphytic colonization of grape berries by *Cladosporium* spp., a post-harvest pathogen

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Cladosporium spp. is slow growing and extensively sporulating fungus which is initially present as an epiphyte on grapevines but assumes pathogenic status at late berry developmental stages and is reported as a post-harvest pathogen, especially in grapes stored at low temperature. *Trichoderma* spp. and *Bacillus* spp. are two biocontrol agents recommended for control of powdery mildew disease in grapes. A study was conducted to check the effect of these biocontrol agents on presence of *Cladosporium* on grape berry surface. A field study was planned in an experimental vineyard at ICAR-National Research Centre for Grapes, Pune. The treatments included vines sprayed with only *Trichoderma asperelloides* or *Bacillus amyloliquifaciens*, or alternate application of *Trichoderma asperelloides* and *Bacillus amyloliquifaciens*. Vines sprayed with sulphur were maintained as control. Sprays were given every eight to ten days starting immediately after pruning. Berries at 7-8mm size were harvested and checked for presence of *Cladosporium* spp. by spread plate technique on potato dextrose agar media. No *Cladosporium* colonies were recovered from berries harvested from *T. asperelloides* and *B. amyloliquifaciens* treated vines, indicating that the biocontrol agents, alone or in combination, significantly effected establishment of *Cladosporium* on grape berry surface. Conversely, *Cladosporium* colonies were recovered in substantial numbers from the surface of berries treated with sulphur. *In vitro* antagonism study by dual culture assay showed that *T. asperelloides* and *B. amyloliquifaciens* inhibited the radial growth of *Cladosporium* spp. and overgrew the colonies. The fungicide sensitivity assay showed that only hexaconazole fungicide significantly inhibited radial growth of *Cladosporium*, while the fungus was insensitive to sulphur and chitosan which are recommended for powdery mildew control as well as to mancozeb which is recommended for downy mildew control in initial growth stages. As triazole fungicides are usually not recommended in viticulture due to residue problems and development of resistance of pathogens to these fungicides, application of *T. asperelloides* and *B. amyloliquifaciens* for simultaneous control of powdery mildew and *Cladosporium* spp. in vineyards will be beneficial. It would reduce the risk of post-harvest decay of grapes berries and would increase the shelf life of this perishable fruit.

Key words: Grape berries, epiphytic colonization, berry developmental stages, *T. asperelloides*, *B. amyloliquifaciens*

Production of ethanol using green coconut husk

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Now a day's large amount of carbon source fuel is required to produce energy. Due to depletion of fossil fuels in very large amount it has led to develop alternative renewable source of energy bio-ethanol. This bio-ethanol is produced by the fermentation of lingo-cellulosic material. Green coconut husk contain this lingo-cellulosic material which can be used for production of ethanol using solid state fermentation and submerged fermentation. The cellulosic sample was collected from local market and pre treatment was done using acid hydrolysis. Benedict's test for reducing sugar was carried out and after that fermentation of sample was done. After fermentation, distillation process was carried out to separate out the liquid fraction. The change in color was observed and it was measured using calorimetric method.

Keywords: Bio-ethanol, Green coconut husk, Solid state fermentation

Key Words: Solid state fermentation, ethanol, coconut husk, energy, fuels

Nutrimetabolomic Profiling of a Potential Grape Variety by Multi-Mass Spectrometric Approach

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The new frontiers in food research reflect the role of non-nutritive components of the diet in promoting human health. The search for the bioactive principle in food has hence gained significant attention of the researchers over the past few years. Lipids, fatty acids, sterols, vitamin isomers, and polyphenols present a wide range of phytochemicals which are obtained through consumption of raw food and their processed derivatives. The aim of the present work is to provide an overview of the strategic applications of a range of advanced mass spectrometric (MS) approaches to facilitate screening and identification of such compounds in the seed and oil of selected varieties of grapes. The MS strategies comprised applications of high resolution Q-ToF-MS and Orbitrap-MS in full scan as well as MS/MS modes. The targeted LC-MS/MS analysis was also carried out as a complementary approach with the applications of multiple reaction monitoring as well as product ion spectra based identifications. The GC-MS analysis, on the other hand, involved full scan, selected ion monitoring, and MS/MS acquisitions, targeting relatively less polar metabolites. In all cases, screening was substantiated by high throughput data analysis with the help of in-house and publicly available molecular databases for targeted as well as non-targeted screening. Characterization of the studied matrices offered a unique profile of phytochemicals in terms of flavonoids, phenolic acids, stilbenes, terpenes, lignins, anthocyanins (acylated and nonacylated), etc. Analysis of grape seeds revealed the following trend of fatty acids: PUFA (polyunsaturated fatty acid) > SFA (saturated fatty acid) > MUFA (monounsaturated fatty acid) of the total fatty acid content. Among the isomers of vitamin E, gamma tocotrienol, alpha tocopherol and alpha tocotrienol were the major ones in grape seeds and oil, which are proven to have a role in cancer prevention and radiation protection. Triglycerides, phospholipids and bound fatty acids were detected in the lipid category which have a range of useful properties, such as anti-oxidant activity, aroma, flavour and nutritional properties. The lipids were also identified by corresponding

approaches such as neutral loss scan and precursor ion scan. Knowledge of these bioactive constituents is expected to form an essential foundation for further examination and utilisation of the investigated matrices as functional foods, and sources of nutraceutical products. Certain further applications have been demonstrated in establishing polyphenol profile of pomegranate, and specialty vegetables, including purple radish, black carrot, phalsa etc.

Keywords: Phytochemical, Characterisation, High resolution mass spectrometric analysis, Nutraceutical, Functional food.

Bioinformatics (BI)

Poster presentations

Structural and Expressional Characterization of RNA Dependent RNA Polymerase (L-Protein) Involved in Pathogenesis of Chandipura Virus

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Chandipura Virus (CHPV) is a member of genus vesiculovirus of rhabdoviridae family. CHPV is a human or vertebrate pathogenic virus. The virus is associated with the encephalitic illness (inflammation of the brain) which results in spasmodic case and deaths in children were also observed during the year 2014 and 2016. The vector for chandipura virus is female phlebotomine sandfly. Chandipura virus is a enveloped RNA virus whose viral genome code for five different polypeptides which are Nucleocapsid protein(N), Phosphoprotein(P), Glycoprotein(G), Matrix protein(M), and Large protein(L). These proteins are coded in five monocistronic mRNAs. The viral RNA dependent RNA polymerase is composed of two protein; N protein and L protein. L protein is known for its catalytic function in RNA polymerization, It transcript the viral mRNAs and their capping. It is also involved in RNA processing and viral RNA replication. On the molecular level L protein acts as A TP binder, Methyltransferase and Nucleotidyltransferase. The main objective of this study was to extract the three dimensional structure of L protein due to its importance in pathogenesis which helps in understanding the functions of the protein and development of the new drugs and vaccines to fight against disease. The online bioinformatics tools were used in order to extract the structure. At the initial stage vast information about the L protein was screened in order to collect relevant data. This paper address the use of various bioinformatics tools like blast, emboss, clustalw, phylip, genemark and pratt, ligand database, igemdock with other databases such as GenBank, Uniprot and PDB were used in order to characterize the protein structurally and functionally. Further, identification of conserved domain, 2D structure and 3D structures were also carried out. Ramachandran plot of L protein was also plotted with additional studies about the active site of the protein. This information could be used in future to design drug against the chandipura virus which has caused sporadic events.

Keywords: Chandipura Virus, L protein, three dimensional structure, and Bioinformatics tools.

Structural and Functional Characterisation of Decorin Binding Protein B involved in Pathogenesis of Lyme Diseases caused by *Borrelia burgdorferi*

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Borrelia burgdorferi is a bacterial species of spirochete class of the genus *Borrelia*. The bacterium can survive even if the host has an intact immune system. It also can disseminate early in the course of the disease to remote areas, be anaerobic, hide in niches, be intracellular and express multidrug resistance. It can cover itself with the host's material, make antigenic changes, manipulate the host's immune system, and change into inactive cysteine. It colonizes multiple tissues and is capable of attachment to diverse cell types. It is one of the organisms believed to be causing Lyme disease until 2016. Lyme disease is an infectious disease transmitted to humans through a bite from an infected black-legged or deer tick. Presently some cases of Lyme disease have been reported in North Eastern India. The saliva of the tick contains proteins that are anesthetic, vasodilating, immunomodulating and preventing coagulation. This increases the infectivity. Other insects such as stick and sting can also be carriers of the spirochete. Few important proteins present in the organism are lipoproteins (decorin binding protein A and B (dbpA and dbpB) which bind to decorin, a proteoglycan which decorates collagen fibers. Decorin and glycosaminoglycans both are important building blocks of proteoglycans which are abundantly found in extra cellular matrix of mammals. These proteins potentially influence infections. Outer surface protein E (ospE) is another protein which undergoes large antigenic variations during antibody attacks. It is also observed that the presence of either only DbpA or DbpB does not reduce the virulence but absence of both reduces the virulence. Lysines in the C-terminus of dbpB are vital to dbpB's ability to bind GAGs whereas C-terminal tail for DBPA only plays a minor role in facilitating GAG bindings. This paper address the use of various bioinformatics tools to characterize decorin binding proteins in terms of structural and functional aspects. Bioinformatics tools like clustalw, EMBOSS, Procheck, Protparam and drug designing tools are used to find the suitable drug candidate in order to control pathogenesis.

Structural and Functional Characterisation of DnaK protein involved in Pathogenesis of tularaemia diseases caused by *Francisellatularensis*

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Francisella tularensis is highly infectious gram negative coccobacillus bacterium, causative agent of tularaemia. *F. tularensis* bacteria is present in two different strains they are *F. tularensis* subsp. *tularensis*, also called as Type A strains and *F. tularensis* subsp. *holarctica*, also called as Type B strains. Both strains of bacteria are highly infectious to humans. The present study focuses on the identification of proteins produced by *F. tularensis* bacteria and identification active site for drug designing. From different studies it was found that the outer membrane of *F. tularensis* produces different proteins like acid phosphatase AcpA, a beta-lactamase, and hypothetical protein FTT_0484, catalase-peroxidase KatG, chaperones DnaK, GroEL, and GroES, superoxide dismutase SodB, and bacterioferritin Bfr. Our studies focus on DnaK protein, which is most important protein in *F. Tularensis* for multiplication. The protein helps in initiation of DNA replication of phage lambda and also involved in chromosomal DNA replication. The protein DnaK is used as query protein to understand alignment of nucleotide sequence. Identification of conserved domain was done by comparing nucleotide sequence of *F. tularensis* with nucleotide sequence of *Escherichia coli*, secondary and tertiary structure of the protein DnaK were identified by using different software tools. Physical and chemical properties of the protein were determined. Identification of the active site was done to design particular drug.

Structural and Functional Characterisation of MbollA methyltransferase involved in Pathogenesis of Bovine keratoconjunctivitis caused by *Moraxella bovis*”

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Drug design often referred to as rational drug design or simply rational design, is the inventive process of finding new medications based on the knowledge of a biological target (an organism). Our biological target of interest is a *Moraxella bovis*. *Moraxella bovis* is a Gram-negative, aerobic, oxidase-positive diplococcus implicated in infectious Bovine kerato conjunctivitis, an eye disease of cattle, also colloquially known as pinkeye or New forest eye. *Moraxella bovis* is the only organism for which Koch's postulates have been fulfilled with respect to the IBK (infectious bovine kerato conjunctivitis). Infectious bovine kerato conjunctivitis (IBK) is the most common ocular disease of cattle and is seen worldwide. Seven different serogroups of *M. bovis* are currently recognized and it produces various proteins. By using PDB (protein database) and structure visualization we found out which proteins are produced by *Moraxella bovis*. This paper concentrate on MbollA methyltransferase protein produced by *Moraxella bovis*, This paper address the use of various bioinformatics tools like blast, emboss, clustalw, phylyp, genemark and pratt, ligand database, igemdock with other databases such as GenBank, Uniprot and PDB were used in order to characterize the protein structurally and functionally. Further, identification of conserved domain, 2D structure and 3D structures were also carried out. Ramachandran plot of MbollA methyltransferase was also plotted with additional studies about the active site of the protein. This information could be used in future to design drug against the *Moraxella bovis*.

Characterization of Tumor Protein Involved in the Pathogenesis of *Mycobacterium tuberculosis*, with respect to Structural and Functional aspects, and In-silico Drug Designing

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Mycobacterium tuberculosis, a species of pathogenic bacteria is a class of Actinobacteria which belongs to the Mycobacteriaceae family. It is the causative agent of Tuberculosis (TB) in humans, a respiratory disease which mainly infects the lungs. The disease first evolved in the African continent and various strains of this species were later spread across the world. At present, the BCG vaccine has restricted control over the disease. Still, the spread of this disease is not very controllable as it is spread through the airborne water droplets expelled from an infected patient. The prevalence in the disease is due to the lack of effective diagnostic methods. This organism produces a number of different proteins like Lipoprotein (LppX), β -RNA polymerase (rpoB), Rv1288 (Hypothetical protein), Tumor protein (Tp53), etc. The protein selected in this particular study is Tumor protein. This protein is the main tumor causing agent of tuberculosis, even then it is not distinctly explored and looked into and thus does not have a considerable amount of data on its structural and functional characters. Characterization of the protein was done using various online tools. BLAST was used to compare the amino acid sequences of the particular protein, Pairwise Alignment of similar sequences was done using EMBOSS Needle and EMBOSS Water. Further, ClustalW was used for multiple sequence alignment of the protein sequences. PHYlip was used to infer the evolutionary tree. Further Identification of Conserved Domain, 2D and 3D structure was carried out. The In-Silico drug designing for this protein was done by the exploitation various online tools. Tp35, being a tumor causing protein, further research on this protein is substantially important to find out suitable drug candidate to control Tp35 protein.

Structural and Expressional Characterization of (P-Protein) Involved in Pathogenesis of Chandipura Virus

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Chandipura Virus (CHPV), a member of Rhabdoviridae, is responsible for an explosive outbreak in rural areas of India as it causes a fatal illness which presently lacks therapeutic option. It affects mostly children and is characterized by influenza-like illness and neurologic dysfunctions. It is transmitted by vectors such as mosquitoes, ticks and sand flies. Chandipura virus upon entering the neurons triggers cellular stress factors and release of reactive oxygen species (ROS). The stress granules produced in response to cellular stress have been implicated in viral replication and ROS generation, which stimulates neuronal death. In 2003, 329 people died in outbreak in Andhra Pradesh and Maharashtra. In 2009, the virus infected 52 people and claimed 15 lives. In 2010, a total of 50 people contracted the virus and 16 died. A majority of the infected patients were below 14 years of age. Between 2009 and 2011, 110 tested positive, and 11 died in 2011. An outbreak in Gujarat in Kheda District, Vadodara District, and Panchmahal District had killed 17 people in 2010. The sporadic cases appeared in Gujarat in 2014 and 2016. One girl died in Ahmedabad in 2016. The viral genome of chandipura virus codes for five polypeptides, namely, Nucleocapsid protein N, Phosphoprotein P, Matrix protein M, Glycoprotein G and Large protein L in five monocistronic mRNAs. The N protein and the P protein of nonsegmented negative-strand (NNS) RNA viruses interact with each other to accomplish two crucial events necessary for the viral replication cycle. The protein selected for our work was Phosphoprotein as it is involved in both transcription and replication of the viral life cycle. As the 3-Dimensional structure of this protein in the particular organism is unknown. This paper address the use of various bioinformatics tools like blast, emboss, clustalw, phyip, genemark and pratt, ligand database, igemdock with other databases such as GenBank, Uniprot and PDB were used in order to characterize the protein structurally and functionally. Further, identification of conserved domain, 2D structure and 3D structures were also carried out. Ramachandran plot of P protein was also plotted with additional studies about the active site of the protein. This information could be used in future to design drug against the chandipura virus which has caused sporadic events.

Structural and functional Characterization of Phosphoprotein(p) Involved in Pathogenesis of Nipah Virus

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Nipah virus belongs to paramyxoviridial family and henipavirus genus. Nipah virus is a highly pathogenic paramyxovirus that first emerged in Malaysia and Singapore in 1999, Re-emerged in Bangladesh and India. The primary mode of head division of the disease was from pig to human. Niv causes rapid acute encephalitis with a high mortality rate. The primary mode of head division of the disease was from pig to human. Niv causes rapid acute encephalitis with a high mortality rate. The primary clinical features were fever, headache, dizziness, vomiting and reduced levels of consciousness. This study focuses on the structural and functional characterization of protein involved in pathogenesis and drug designing of Nipah virus.. Nipah virus comprises of a gene, negative sense single stranded RNA (ssRNA) genome, which encodes for Nucleoprotein (N), Phosphoprotein (P), the interferon antagonists (W) and (V), the Viral Cprotein, a Matrix protein (M), viral fusion (F), Glycoprotein (G) and large Polymerase (L). The main objective of this study was to extract the three dimensional structure and its conserved domains of P protein which enables us to study the function of the protein to help in the development of new drugs against this disease. This paper address the use of various bioinformatics tools like blast, emboss, clustalw, phylip, genemark and pratt, ligand database, igemdock with other databases such as GenBank, Uniprot and PDB were used in order to characterize the protein structurally and functionally. Further, identification of conserved domain, 2D structure and 3D structures were also carried out. Ramachandran plot of P protein was also plotted with additional studies about the active site of the protein. This information could be used in future to design drug against the Nipah virus.

Computational and docking studies of Chromone derivatives as selective Src family tyrosine kinase inhibitors

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Src family kinases (SFKs) are a family of tyrosine kinases that play a critical role in signal transduction. *In-silico* studies such as virtual screening and molecular modeling have proven to be useful in identifying potential kinase inhibitors. In the present work, a library of chromone compounds was synthesized and was prioritized to obtain a lead chromone compound (MMK014) with desired *in-silico* properties. Docking studies were performed to analyze the binding mode of MMK014 chromone compound against 8 target SFK proteins. The best intermolecular interaction was obtained for Yes protein (-7.61 kcal/mol) and cSrc protein (-6.5 kcal/mol). Further molecular dynamics and simulation based studies revealed that leucine, valine, lysine and aspartate residues were key intermolecular interactions. It is envisaged that the molecular modeling studies will serve as guidelines for developing a better anti-SFK drug in near future.

Drug repurposing approach to identify novel inhibitors for targeting DNA gyrase in *Mycobacterium tuberculosis*: Insights from Biophysical and Biochemical Studies

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Drug repurposing has gained momentum globally and become an alternative avenue for identifying new drugs against tuberculosis (TB). TB can be cured with the use of currently available anti-tubercular drugs, emergence of drug resistant strains of *Mycobacterium tuberculosis* H37Rv (*Mtb*) and the huge death toll globally, together necessitate urgently newer and effective drugs for TB. To address this problem, we have employed drug repurposing approach to screen FDA-approved drugs by virtual screening and binding free energy calculations to identify novel inhibitors against *Mtb* target enzyme, DNA gyrase. Screening of compounds was done against the active site of *Mtb* DNA gyrase, the region of ATP binding (N-terminal domain) pocket on gyrase B subunit. Here, we identified total of four compounds (Drug97, Drug45, Drug77, Drug38) tightly binds to ATPase binding pocket of gyrase B (*MtbGyrB*). These compounds were simulated using GROMACS; the results generated were subjected to molecular mechanics-Poisson Boltzmann surface area (MM-PBSA) calculation. Docked results shows binding energy for drugs (Drug97, Drug45, Drug77, Drug38) as -9.94, -9.93, -9.69 and -8.87 kcal/mol. MM-PBSA predicted the binding free energy of the drug97, drug45, drug77 and drug38 to be -1123.18, -1025.211, -1016.250 and -339.745 kcal/mol, respectively. These four compounds showed equilibrium dissociation constant, *K_D* values of 2.1-53.0 μ M. Among them, drug97 shows *K_D* values of 2.1 $\pm$ 0.17 μ M. Our results suggests that the screened compounds binds to the ATPase domain of gyrase B subunit and inhibits gyrase catalytic cycle. This finding indicates all the identified compounds represents potential scaffolds for further optimization of novel antibacterial agents that can act on drug-resistant strains.

Key words: DNA gyrase, Tuberculosis, Molecular docking, Drug Repurposing, Gromacs.

In silico* identification of drug targets involved in drug efflux system of *Staphylococcus aureus

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Methicillin-resistant *Staphylococcus aureus* (MRSA) is a versatile pathogen capable of causing a wide variety of diseases both in human and animals such as bacteremia, skin infection, endocarditis, osteomyelitis, toxic shock syndrome, meningitis, sepsis, pneumonia, etc making antibiotics less effective. *S. aureus* being a multidrug-resistant due to the efflux pump mechanism has given rise to a tremendous pressure on clinical researchers to cure the worldwide healthcare problem. Membrane transporters in them are capable of extruding drugs & other related compounds. Therefore, entire genome of *S. aureus* MRSA252 containing 2746 genes was evaluated for identification of proteins involved in drug efflux system. 19 genes were responsible for drug efflux mechanism was confirmed via bioinformatics approach. Screening of comprehensive antibiotic resistance database (CARD) revealed 19 antibiotic resistant genes responsible for drug efflux mechanism. Out of 19 genes, *parC* and *gyrA* having highest antibiotic resistant scores showed resistance to many antibiotics of fluoroquinolone derivatives like gatifloxacin, grepafloxacin, pefloxacin, nalidixic acid etc and *ErmA* gene showed resistance to antibiotics like vancomycin, daptomycin, erythromycin, clindamycin, etc.. Therefore the three significant genes like *parC*, *gyrA* and *ErmA* can be considered as a potential drug target to design new inhibitor against multidrug-resistant *S. aureus*. Inhibition of drug efflux pumps in *S. aureus* is current status of potentializing existing antibiotics.

Key words: Antibiotics, efflux system, multidrug-resistant, *Staphylococcus aureus*.

In silico characterization of Dopachrome Tautomerase (DCT) of Molly-fish and identification of its putative modulators

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The body colouration is an important economic trait in ornamental fisheries. Molly fishes are the common ornamental fishes with an array of black and white colouration. Several genes through their products affect the formation of the body colour and its pattern. DCT protein is a product of the DCT gene and is present in the majority of fish species including Molly. DCT plays a pivotal role in the final phase of melanogenesis. In the present study, a bioinformatics approach was adopted to explore the properties and structure of the DCT protein of Molly fish, and the putative modulators of the protein were identified. The DCT protein contains 523 amino acids and had 58693.41 Dalton molecular weight. The theoretical PI value of DCT was 6.20, and it was found to be hydrophobic. The aliphatic Index value infers DCT may be thermolabile for a wide range of temperature. The predicted secondary structure revealed the abundance of the random coils followed by the alpha helix, extended strand, and beta-turn. The transmembrane region was found in the range of 466 to 488 amino acid residue by TMHMM server. The 3D structure of the DCT was predicted through homology, and the predicted model was validated using PROCHECK server. The results showed that more than 87% amino acid residues were in the most favored region in the Ramachandran plot. Two active site regions were identified by CastP server. The first active site was identified at the range of 92-108, 219-230 and 433-447 amino acid residues and the second active site were identified at a range of 341-366 amino acid residues. Five natural compounds out of 180313 were found to be binding to the active site with the lowest binding energy and had acceptable Lipinski's and ADMET values. These compounds may further be tested in vivo as the modulators of the DCT protein and can be useful in altering the colour pattern of the fishes.

Differential Expression Profiling of Breast Cancer using Next Generation Sequencing(NGS)

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Next-generation sequencing technology, often abbreviated as, NGS is a high-throughput sequencing method that sequences millions of base pairs of DNA or RNA in comparatively very less amount of time. The NGS technology has a broad range of applications such as De novo Sequencing, DNA/RNA-Protein Interactions, Metagenomics, Methylation Sequencing, Targeted Resequencing and Transcriptome Sequencing, etc. Apart from sequencing genomic data at a very high speed, it is also cost effective with high resolution and accurate data analyses. NGS also has a great influence in the field of medicine that helps in diagnosis and treatment of diseases like cancer. One of the implementations of NGS is RNA-Sequencing or RNA-Seq that determines the quantity as well as the sequences of RNA in a biological sample. RNA-Seq is used to analyze gene expression patterns of transcriptome that are encoded within our RNA. Some of the applications of RNA-Seq are Differential Expression Profiling, Gene fusion, Alternative splicing, RNA editing, Allele-specific expression analysis, etc. In the present study, differential expression profiling of breast cancer patients using RNA-Seq analysis was carried out. The sample data collected for control is RNA-Seq of mRNA contents of normal individual 1 and for treated is RNA-Seq of mRNA contents of IDC patient 2. The differentially expressed genes from these samples were predicted using computational pipeline of RNA-Seq analysis that will help in breast cancer diagnosis.

Keywords: Next generation sequencing, RNA-Sequencing, breast cancer, Differential Expression Profiling

Use of Constraint Based Modelling Approach to Identify Synthetic Lethal Sets in Multiple Drug Resistance Organisms (MDROs)

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Mycobacterium tuberculosis, *Staphylococcus aureus* and *Klebsiella pneumoniae* are highly pathogenic Multiple Drug Resistance Organisms (MDROs) which prove fatal for a large proportion of the population every year. Multiple Drug Resistance Organisms (MDROs) are a major threat as they have developed resistance to multiple types of antibiotics. Discovery of novel drug targets in MDROs is an active area of research and involves a lot of challenges. Synthetic lethal gene sets are sets of genes which when knocked out simultaneously stop the growth of an organism. This study involves an *in silico* approach towards the critical reactions and synthetic lethal gene sets of these organisms using a constraint based modelling approach- Flux Balance Analysis(FBA). The OptFlux software and CONstraint-Based Reconstruction and Analysis(COBRA) toolbox were chosen to identify the critical reactions and genes. Fast-SL, an algorithm that assists in the prediction of synthetic lethal gene sets in a genome-scale metabolic model was further used. Identification of synthetic lethal sets can help in gaining new insights about critical regulatory mechanisms in these organisms. Such analysis can also aid in identification of novel drug targets and design of combinatorial drug therapy strategies.

Keywords: Multiple Drug Resistance Organisms(MDROs), Synthetic lethal gene sets, *in silico*, Flux Balance Analysis (FBA), OptFlux, Constraint-Based Reconstruction and Analysis (COBRA), Fast-SL

Insilico docking studies of cry and cyt toxins against dipteran mosquito species

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Mosquitoes are major pests in human health, spreading deadly infections around the world. Million of deaths are reported each year all around the world because of these vectors. For a long time, attempts to manage chemical insecticides such as D DT, malathion, or pyrethroids have been used worldwide since the 1940s. Insecticides are often toxic to non-target organisms and contribute to environmental contamination. *Bacillus thuringiensis* (Bt) δ -endotoxins have been used successfully as a bioinsecticide for controlling Lepidopteran, coleopteran and dipteran insect species. However, over a few years, mosquito larvae have evolved tolerance against Bt δ -endotoxins, rendering them ineffective for mosquito control. In this study, an effort has been made towards the development of biopesticides that target mosquitoes of three main target mosquito species, *Aedes aegypti*, *Culex pipiens* and *Anopheles gambiae*.

The central idea is to test CRY and CYT toxins which have a good affinity towards the two main receptors (Aminopeptidases and Cadherins) in the midgut of the three stated mosquito species. A molecular docking study has been conducted using 8 different Cry proteins and 4 different Cyt toxins, which may or may not work synergistically. The protein with the best docking score will be selected to form a recombinant protein in *Escherichia coli* first and then later on in a host which is already present in the microbiota of the three mosquito species. A successful transformation can lead to revealing a broad-spectrum mosquito larvicidal protein for use in biological control of mosquitoes.

Keywords: Cry toxins, CYT toxins, delta endotoxins, *Bacillus thuringiensis*, mosquitocide, larvacide, molecular docking

Large scale molecular dynamics simulations for PPIs complexes

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Protein–protein interactions (PPIs) are the physical contacts of high specificity established between two or more protein molecules as a result of biochemical events. PPIs are essential interactions that help to understand the biochemistry of a cell, cell development, and responses to stimuli. Many biological processes involve the formation of protein-protein complexes hence are important within the cellular network. PPIs are thus sought after as important targets for drug discovery and can be linked to diseases and certain cellular conditions. Molecular Dynamics simulations have been previously used to study functional and conformational properties of interface regions based on single protein complex but no large scale molecular dynamics work has been carried out. This research aims at understanding the distance and energy landscape variation within protein complexes belonging to different class.

Keywords: Protein-protein interactions, Molecular Dynamics simulations, energy landscape variations

Structural and Functional Characterisation of Glycoprotein involved in Pathogenesis of Nipah virus.

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Nipah virus (NiV) is an emerging, highly pathogenic, zoonotic virus of *Paramyxoviridae* family. It causes a range of illness from asymptomatic infection to acute respiratory illness and fatal encephalitis in human beings. Human transmission occurs by close contact with infected bats, infected pigs or from other NiV infected patients. The natural host of the virus is Fruit bat. Nipah virus comprises of a gene, negative sense single stranded RNA (ssRNA) genome, which encodes for Nucleoprotein (N), Phosphoprotein (P), the interferon antagonists (W) and (V), the Viral Cprotein, a Matrix protein (M), viral fusion (F) , Glycoprotein (G) and large Polymerase (L). Nipah virus enters the target cells via direct viral-cell membrane fusion mediated by two membrane glycoproteins: the attachment protein G and the fusion protein F. The main objective of this study was to extract the three dimensional structure and its conserved domains of G and M protein which enables us to study the function of the protein to help in the development of new drugs against this disease. Online Bioinformatics tools like blast, EMBOSS, ClustalW, Phylip, genemark , pratt were used in order to characterise the protein structurally and functionally . This study tellsus that the host attachment is achieved by the viral G protein that binds the host cell receptor ephrin B2 and B3 .In the future this NiV-G/ephrin interaction can be effectively targeted to disrupt viral entry and provide foundation for structure based antiviral drugdesign.

Keywords: Nipah Virus, G protein, Three dimensional structure, and Bioinformatics tools.

How Data Mining is Contributing to Cancer Research?

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Purpose: Cancer is the leading cause of deaths in India and worldwide, having doubled its rate of taking lives since 1990. According to a 2018 report by WHO's IARC, 18.1 million new cases of cancer has been registered with 9.6 million cancer deaths in 2018. A simple search of "breast cancer" produces more than 2.5 million search results. With this plethora of scientific publications available and other data like pathological lab reports, clinical data, data mining gives us the tool to assist cancer research. **Methodology and Results:** In this research, we try to give an overview of the data mining techniques and use-cases related to cancer research where these methodologies are being applied. Our research takes into consideration, literature on cancer research over the past 10 years and summarizes the applications where data mining techniques can be put into implementation.

We start our journey by looking into text mining and its tools such as NER, Regular Expressions, Information retrieval and Information extraction which can be used to structure, unstructured patient data from electronic health records. Next, we look into how data mining techniques such as classification, clustering and association rule mining which can be used to predict cancer staging, reduce the number of unnecessary biopsies, mine cancer literature to know about biomarkers and hence, help in early detection of cancer. Finally, we discuss about how data mining is used in nutrigenomics which is a recent research topic that deals with finding the direct consequences of using bioactive compounds derived from day to day food like broccoli on gene expressions. We also look into the available state-of-the-art products which are using the power of data mining to get more insights on cancer research. **Conclusions:** Data mining over the years has proved itself to be instrumental in cancer diagnosis, predictions and opening up new paradigms in cancer research. Knowing about what all things have been done and what is the current trend in the domain, gives us a direction to continue our research work and help contribute efficiently.

Screening and Strain Improvement of Auxin producing Bacteria

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Auxins are a class of plant hormones having a cardinal role in coordination of growth and play a major role in the development of plants. Auxin producing bacteria offers an alternative and attractive way to replace chemical fertilizer, pesticides and supplements. Auxin levels produced by bacteria are comparatively low, so the main objective of this study was to enhance auxin production in bacteria using UV directed strain improvement. Bacterial strains *B. subtilis*, *M. luteus*, *S. aureus*, *S. marcescens*, *P. vulgaris*, *P. aeruginosa*, *A. fecalis*, *E. coli* were selected by Salkowski reagent as auxin producers. Strain improvement of isolates was carried out by exposure to UV for various time intervals. Auxin concentration was estimated in wild type and mutants obtained. Along with experimental approach for strain improvement, *in silico* studies were also performed to identify rational mutations for site-directed mutagenesis. Experimentally characterized 3D structure of enzyme tryptophan-2-monooxygenase (TMO) from auxin bio-synthesis pathway of *Pseudomonas savastanoi* was used for this purpose. TMO catalyses the conversion of tryptophan to indole-3-acetamide which later produces indole-3-acetic acid (IAA) i.e. Auxin. Computationally we explored single and double site mutations for the amino acids involved in active site interactions of this protein. The mutations in TMO leading to higher affinity for the substrate molecule can potentially cause increase in enzyme activity and thereby higher production of auxin. Efficacious mutations identified using such approach can be validated using experimental site-directed mutagenesis. Better strain of bacteria obtained using such approaches can be used as bio-fertilizers to stimulate faster and better growth of a plant.

Keywords: Bio-fertilizer, Auxin, Auxin assay, random UV mutation, site-directed mutagenesis.

Biomedical Engineering (BM)

Poster presentations

Bio-integrated electronics for healthcare applications

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Bio-integrated electronics (BIE) has the potential to revolutionize the healthcare diagnostics and treatments far beyond the current ambulatory clinical technologies. These BIE devices are designed to conform closely to the irregular shape of the human skin and provides the opportunity of monitoring even while performing daily routine activities and are imperceptible to the user. Here we report the development of a BIE device for monitoring physiological mechano-acoustic signals. A highly sensitive accelerometer along with all the necessary components is embedded into the flexible packaging capable of being easily adhering to the skin. Programmable bluetooth chip incorporated into the device allows the data to be processed remotely through a mobile phone. The device thus fabricated has been used for monitoring stroke patients for their talking capability, respiration rate and swallowing ability. The compactness, durability and remote accessibility make this device a ground-breaking development in the field of healthcare. We also report a flexible and wireless implantable device for stimulating the ion-sensitive channels in the brain of genetically modified mouse. The device combines subdermal magnetic coil antennas connected to microscale, injectable light-emitting diodes (LEDs), with ability to operate at wavelengths ranging from UV to blue, green-yellow, and red. This device has been used for understanding and controlling the brain functions in a highly targeted and controlled fashion. Flexible, wireless and fully implantable optoelectronic technology reported here have broad applicability to study the structural and functional relationships in the brain which can play an important role in the healing of neurological diseases.

Assessment of Gd₂O₃ nanoparticles as exogenous imaging contrast agent for swept source optical coherence tomography: an in vitro study

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Owing to the need for rapid technological advancements in the field of healthcare, researchers all over the world are working towards the development of advanced bio-imaging techniques rather than just focussing on therapy alone. This quest has also encouraged researchers to divert their resources in improving the imaging efficacy of the already existing bio-imaging modalities like magnetic resonance imaging (MRI), positron emission tomography (PET), optical coherence tomography (OCT) etc. OCT, a non-invasive imaging modality which exploits reflection of light waves for tissue imaging, greatly suffers from limited contrast and restricted penetration ability. Subsequently, to enhance the OCT image contrast, herein we present gadolinium oxide (Gd₂O₃) as a potential exogenous contrast agent for three-dimensional non-invasive depth-resolved imaging of animal (chicken breast) tissue using a swept source OCT system with centre wavelength at 1064 nm. OCT imaging of chicken tissue (*in vitro*) was performed both with and without the application of Gd₂O₃ nanoparticles (NPs). The effect of Gd₂O₃ NPs on chicken breast tissue was studied at different time exposures. Post analysis, a substantial increase in contrast was observed with time. Furthermore, Gd₂O₃ magnetic NPs being a well-established MRI contrast agent, holds tremendous potential for *in vivo* OCT applications and magnetomotive OCT studies, and is beyond the scope of this work.

Keywords: swept-source optical coherence tomography, gadolinium oxide, imaging, non-invasive, contrast agent.

Multi-control electric wheelchair

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A wheelchair is widely used by the people who have trouble to walk around. The electric wheelchairs are a great alternative for disabled people who can no longer use manual wheelchairs. The use of these wheelchairs can be for long term or short term (post-operative rehabilitation). The patients who are permanently disabled or paralyzed depend on these wheelchairs for majority of their life period. These electric wheelchairs provide them mobility and independence to ambulate to some extent. Most of these wheelchairs are controlled by joystick, but for the patients who suffer from quadriplegia/spinal cord injury this functionality is not enough. Quadriplegia is a paralysis in which the functionality of the four limbs are lost. A micro-controller based multi-control, low-cost electric wheelchair has been designed and programmed, which would be used by the patients suffering from various physical disabilities.

Keywords: Electric wheelchair, multi-control, joystick, voice-module, DC hub motors.

Wireless brain-computer interface for paraplegic patients

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Brain Computer Interface (BCI) technology has the potential to bring about the most significant change in the history of the human race. BCI is a partnership between humans and machines. Generally, BCI is a communication tool that translates brain activities into action or commands for computerized devices. The research community has initially developed BCIs with biomedical applications in mind, leading to the generation of assistive devices. They have facilitated restoring the movement ability for the physically challenged or locked-in users and replacing lost motor functionality. The field of BCI research and development has since focused primarily on neuroprosthetics applications that aim at restoring damaged hearing, sight and movement. The ultimate purpose of a direct brain computer interface (BCI) is to allow an individual with severe motor disabilities to have effective control over devices. A BCI system detects the presence of specific patterns in a person's ongoing brain activity that relates to the person's intention to initiate control. The present work is based on extracting signals of the brain using non-invasive methods or simply interfacing brain and computer. To capture the signals, Neurosky Mindwave device is used. The captured signals can then be used to control external devices like wheelchairs or robots without using any physical means, which means through the brain signal control system.

Adjustable Clubfoot Corrective Splint

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Clubfoot (congenital *talipes equinovarus*) describes a range of foot abnormalities in which the baby's foot is twisted inwards and downwards. The prevalence rate of clubfoot is about 1 in 1000 newborns in developed countries whereas in developing countries like India it is 1 in 500. Many patients remain untreated due to lack of awareness and this leads to lifelong deformity. Clubfoot can be treated by manipulation of feet and bracing at early age. The current method used to treat clubfoot is Ponseti method in which manipulation of feet is done by cutting the Achilles tendon and then it is followed by casting of the feet. As casts are heavy, extend till thigh and may cause problems such as skin infection and irritation, a scalable 3D model of splint was designed to replace the cast. These splints can also be used post tenotomy to prevent relapse. They provide adjustment in 3 planes to facilitate dorsiflexion, abduction and eversion. These braces can be used for individual legs separately to allow their free movement and do not require a connecting bar. Preliminary results have been patented and recent design improvements will be presented during the poster.

Keywords: Clubfoot, Ponseti, Achilles, Dorsiflexion, Abduction, Eversion, Splint, Congenital talipes equinovarus.

Laser-based guidance system for training in suturing in minimally invasive surgery

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Laparoscopic Instruments are special surgical tools that allow the surgeons to move, cut and stitch organs during minimally invasive surgery. In this paper, the development of a guidance system for suturing procedure in laparoscopic surgical training is presented. With this system, the expectation is to facilitate the training process at the first stages of training in laparoscopic surgery and to contribute to an objective evaluation of surgical skills. Normally, the needle is grasped with the needle driver at a right angle to the needle, approximately half-way to two-thirds of the way back from the tip. In special situations, you may want to grip the needle a little closer to the tip, and sometimes you will want to angle the needle a small amount. To achieve this, two laser modules are incorporated on the needle driver prototype where one laser module is mounted on the instrument and the other laser module is attached away from the instrument in such a way that the distance between the second laser and the needle driver's tip is in the range of 8mm to 19mm in accordance with the common port sizes. The procedure shows that the two laser beams make a right angle only when the needle tip is perpendicular to the tissue.

Keywords: Laparoscopy; Laser-based system; Training; Needle driver; Suturing

Assistive device for oestochondroma

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Oestochondroma is a non-cancerous overgrowth of cartilage or bone occurring at the distal end near the growth plate, which results in shifting of the body weight leading to secondary damages in the spine and patella. The objective of the study is to develop an assistive device which can eliminate the secondary damages. Titanium alloy would be used because of its cost efficiency, durability & light weight. As a result we would be able to counter balance the shifted weight with the help of charging and discharging of electromagnets. Along with this, a strap of pressure cuff is used to provide support around the talus and alleviate the patient from pain. Circuit completes and current is allowed to pass when foot comes in contact with the capacitive plates. Two load cells are connected on either sides, if the weight recorded on each of the sides isn't equal, then current passes to the electromagnets, causing change in the angle of alleviation and hence counter balancing the shifted weight. Now the current is deviated to the pressure cuff which provides support around the affected area.

Keywords: Oestochondroma, Titanium, Electromagnets, Capacitive plates, load cells, Counter-balance.

Biotechnology(BT)

Poster presentations

Development of Biogenic Carbon Dots for Anti-bacterial Application

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The major concern is the persistent failure of prevailing antibiotics because of the development of antibiotic resistance, which results in huge loss of capital as well as lives. The convergence between ethno-botanical sciences and nanotechnology have the potential to develop an attractive alternative with anti-microbial properties, improved bioavailability and lesser toxicity. In this regard, use of herbal bioactives for developing next generation antimicrobials is gaining impetus recently. In the present study, carbon quantum dots (CQDs) prepared from curcumin, which happens to be the principal curcuminoid of *Curcuma Longa* (or Cumin) has been selected for developing the potent antimicrobials. The nanomaterials synthesized were characterized using UV-visible spectroscopy, fluorescence spectroscopy and SEM. Further, the efficacy of the CQDs was tested for antimicrobial activity on various bacterial strains. The results obtained indicated strong antimicrobial property of the developed CQDs. These next generation antimicrobials could be of prime importance to the medical field.

Formulation and in-vitro assessment of antioxidant activity in snack bar

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The intake of antioxidants primes to a decrease in oxidative stress which leads to cancer, cardiovascular disease and pre-mature ageing. Phytochemicals from plant are more effective in reducing the free radical formation and act as a natural antioxidant. Vitamin A, C, E and phenolic compounds are partners in defence and have a synergistic relationship working together so that their combined effect is greater than the sum of their individual actions. The attempts were made in present investigation to formulate the natural antioxidant rich snack bar blends and assess the in-vitro antioxidant activity of blends. The control snack bar formulation was developed with oats, rice flakes and amaranth. Three blend formulations rich in natural antioxidants were developed with plant food ingredients rich in vitamin A, C, E and polyphenols. The DPPH method was standardized for sample extraction and estimation of in-vitro antioxidant activity with ascorbic acid as standard. The blend with higher % inhibition activity was selected for sensory evaluation at 20, 40 and 60% incorporation levels. The blend formulation containing red kidney beans, carrot powder, apple pomace powder, almond powder (60:15:15:10) was found to contain highest % inhibition activity compared to other two formulations. The soxhlet extraction method was preferred compared to overnight stirring method with ethanol as solvent medium. Ascorbic acid was used as a positive control. The sensory evaluation results with antioxidant rich blend incorporation indicated more preference for 40% incorporation level in snack bar. The antioxidant rich snack bar blend formulation was developed with natural plant food ingredients. The synergistic effect of vitamin A, C, E and polyphenols in antioxidant rich blend resulted in increased % inhibition compared to control snack bar. The nutrient and antioxidant rich bar prepared with enhanced antioxidant activity can be a healthy choice to satisfy short term hunger in mid-morning or mid-evening.

Purification and Degumming Activity of *Antheraea mylitta* Cocoonase

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Cocoonase is a proteolytic enzyme produced by silk moths during adult development and used for softening the end of the cocoon to permit exit of the adult moth. It is deposited on the surface of the galeae (mouthparts) as a partially crystalline deposit. Cocoonase is a prime enzyme for silk degumming process. Cocoonase enzyme can be directly used by the silk industry to soften the cocoon for easy reeling of silk without altering the very organic nature of Tasar silk. Cocoonase is the un-utilized crucial by-product of Tasar silk industry. An enzymatic method of degumming is efficient and eco-friendly than the chemical method. Protein purification is the most crucial step that determine its activity. For purification, cocoonase protein precipitation was performed by different methods like Acetone precipitation, ethanol precipitation, TCA precipitation, and Chloroform-methanol precipitation methods. The SDS-PAGE analysis of freshly collected cocoonase showed molecular weight 25-26 kDa. The present study aimed to purify *Antheraea mylitta* cocoonase for the silk degumming process by treating cocoon sheath with NaOH and purified cocoonase enzyme. Prospective utilization of *Antheraea mylitta* cocoonase and its molecular harmony to utilize this by-product in cocoon cooking is being explored. Obtained detailed findings will be presented.

Twist1 overexpression induces genome instability in colorectal cancer cells

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Twist1 is a basic helix-loop-helix transcription factor, and an important regulator of Epithelial to Mesenchymal Transitions (EMT). EMT is essential for development, but is also involved in cancer progression. Here, we examined the effect of overexpressing Twist1 on genome instability in two independent colorectal cancer cell lines (i) diploid DLD1 and (ii) aneuploid SW480 cells. These cells showed a significant increase in both mitotic and nuclear aberrations, accompanied by chromosomal instabilities (CIN). Furthermore, whole chromosomal gains and losses were detected in both cell lines upon Twist1 overexpression. In addition, levels of proteins (Bub1, BubR1) that regulate chromosomal ploidy - were also deregulated upon Twist1 overexpression, further underscoring a role for Twist1 in inducing chromosomal instability in cancer cells. Overexpression of Twist1 also enhanced the numbers of γ H2AX foci (a marker of DNA double strand breaks) in cells treated with Cisplatin. Taken together, these studies implicate Twist1 in inducing chromosomal and genomic instability during Epithelial to Mesenchymal Transitions (EMT) in colorectal cancer cells.

Azo dye degradation by bacteria isolated from mangrove area.

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A variety of synthetic dyes released by the textile industry pose a threat to environmental safety. Azo dyes account for the majority of all dyestuffs produced because they are extensively used in the textile, paper, food, leather, cosmetics and pharmaceutical industries. Existing effluent treatment procedures are unable to detoxify and remove azo dyes completely. Bacterial decolourization and degradation of azo dyes under certain environmental conditions are inexpensive, eco-friendly and can be applied to wide range of such dyes. The aim of this study was to isolate and identify bacterial strain capable of decolourising/degrading azo dyes. In this work 20 bacteria isolated from mangrove area were screened for their ability to degrade dye. UV Spectroscopy analysis was used to explore dye degradation capacity. Out of 20 bacteria, 6 bacteria were able to degrade malachite green. These potential dye degrading bacteria were characterised and as per molecular identification 3 bacteria out of 6 were identified as *Alishwanella agri*, *Shigella dysenteriae* and *Bacillus licheniformis*. Phytotoxicity studies indicates bacterial treatment also detoxify the dye. The degraded dye was less phytotoxic as compared to dye solution. Thus, this study concluded that the isolated bacterium has high potential for the degradation/ decolourization of azo dye as well to reduce its toxicity upto a significant level.

Keywords: Azo dyes, mangrove, decolorization, degradation, phytotoxicity.

Antioxidant and anticancer activity of green synthesized silver nanoparticles from kiwi fruit (*Actinidia deliciosa*)

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Nanomedicine utilizes biocompatible nanomaterials for diagnostic and therapeutic purposes. The present study was to describe a green approach to prepare new antioxidant silver nanosystems using Kiwi fruit (*Actinidia deliciosa*) as promising tools for biomedical applications. The potential ability of the Kiwi fruit for the bioreduction of Ag⁺ to Ag⁰ was investigated by UV-VIS, HR-TEM, FE-SEM with EDX, XRD, FT-IR and TG-DTA techniques and their antioxidant properties were determined by DPPH method. The toxicity of silver nanoparticles was evaluated using cell viability, nuclear fragmentation, DNA damage and cell cycle. Our results showed that biosynthesized silver nanoparticles possess high radical scavenging activity when compared to aqueous extract and the biosynthesized silver nanoparticles inhibited proliferation of human hepatocellular carcinoma cell line HepG-2 with an IC₅₀ of 22.59 µg/ml in 48 h incubation. These results suggest that silver nanoparticles may exert its antiproliferative effect on HepG2 cell line by suppressing its growth, arresting the cell cycle phases, reducing DNA synthesis and inducing apoptosis.

Keywords: Antioxidant, cytotoxicity, *Actinidia deliciosa*, HepG-2 cells and biosynthesis

Effect of green synthesized inorganic nanoparticles on Dengue fever/Zika virus vector (*Aedes aegypti*) and measures its antioxidant and detoxifying enzymes.

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Nanobiotechnology is promising research area in scientific community. Inorganic metal nanoparticles are attracting a global attention for creating a mark in improving the competency of insecticides and pesticides. Eco-fabricated silver nanoparticles (AgNPs) may better performance over chemical derived insecticides/pesticides because of its small size, active secondary metabolites, greater stability, ecofriendly and water dispersibility nature. Synthesis of AgNPs is confirmed by UV-Vis Spectroscopy (UV-Vis), Transmission electron microscopy (TEM), Energy dispersive X-ray spectroscopy (EDAX), X-ray diffraction spectroscopy analysis (XRD) and Fourier transform infrared spectroscopy (FTIR). The study focuses on effect of AgNPs on *Aedes aegypti* late instar whole larvae by treating AgNPs to LD₅₀ and LD₂₀ dose. Later on by quantifying the activity of antioxidant enzymes and detoxifying enzymes like carboxylesterases (CarE), glutathione S-transferases (GST) and glucosidases (Glu) in the larvae. Activity of superoxide dismutase (SOD), glutathione reductase (GR), catalase (CAT), glutathione peroxidase (GSH-Px) were also altered compare to control and estimating the level of lipid peroxidation (LPO) was done by thiobarbituric acid reactive substances (TBARS). Activity of SOD and CAT were found significantly enhanced whereas activity of GR, GSH-Px enzymes were found to be decreased after the treatment with AgNPs. Thus it gives preliminary indication that NPs stimulate oxidative stress (OS) which may lead to programmed cell death through the accumulation of intracellular reactive oxygen species (ROS) in larvae which may act as effective defense mechanism against biosynthesized AgNPs treatment.

Development of a Novel Ayurvedic Drug Derived from Egg Shell powder

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Ayurvedic system of medicine is one of the most ancient medicinal systems established all over the world since antiquity. Ayurvedic pharmacy which is an integrated part of Ayurvedic medicinal system has introduced and developed a huge number of drugs of plant, animal and mineral origin processing excellent medicinal properties. During recent years, research scientists from India as well as abroad working in the field of biological, pharmaceutical and medical sciences are funding special interest in these traditional Ayurvedic drugs due to several of their merits and advantages. Egg shell *bhasma* derived from Hens egg shell powder is one of such traditional Ayurvedic drug which is the subject of present interest. Egg shell is calcium carbonate based complex polymeric product which is composed of CaCO_3 embedded in proteinous organic matrix. This material is produced by hens through the process of bio mineralization and because of its biological origin egg shell *bhasma* prepared from egg shell powder by following Ayurvedic pharmaceutical procedure possesses excellent medicinal properties. The medicinal potency of egg shell *bhasma* as well as its versatility may be promoted through some modifications in traditional ayurvedic process of *bhasmikarana*. In the present work, an attempt is made to synthesize egg shell *bhasma* through refined process of *bhasmikarana*. Here, different plant extracts providing acidic media ranging from pH 1.0 to 6.0 are used during the trituration of finely divided and purified eggshell powder with selected plant juice and increasing number of calcination cycles from one to five. Detail chemical, analytical and structural investigations of each intermediate product obtained from each step are carried out to examine the effect of repeated process of *bhasmikarana* on the physical, chemical and structural properties of each of the intermediate product. Recent instrumental techniques have been employed for this purpose. Egg shell *bhasma*, synthesized by this modified technique, is found to be superior to the previously reported products. Further investigations for the justification of the novelty of this Ayurvedic drug are in progress.

Key words: Egg Shell Bhasama, Novel Ayurvedic Medicine, Refined Process of synthesis

Development of eco-friendly absorbent for effective removal of iron from aqueous solution

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The presence of iron ions as one of the heavy metals in ground and industrial water becomes toxic at high level and then may cause environmental and human health problems. Many absorbents have been reported for removal of iron ions (Fe^{2+} or Fe^{3+}), such as bacteria chitin, palm fruit bunch and maize cob, Bengal gram husk, tur dal husk, eggshells, ash, sawdust, activated carbon, natural zeolite, bentonite and quartz, and apatite, but the use of lactoferrin is new. The feasibility of lactoferrin immobilised biopolymer beads for adsorptive removal of Fe^{3+} from the aqueous solution was investigated. Experiments were performed as a function of process parameters such as contact time, initial concentration of Fe^{3+} , temperature, number of lactoferrin immobilised beads. Lactoferrin immobilised beads exhibited good performance for the removal of Fe^{3+} from aqueous Fe^{3+} solution.

Keywords: Lactoferrin, Heavy metals, toxicity, iron ions, biopolymer beads, immobilisation.

Development of surface modified paper based chemical sensor using Nanosilver-biopolymer composite

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For many years, in the field of analytical chemistry, there is growth in discovery and use of biosensors for detection of chemical compounds. This has led to a progressive research in nanotechnology and its interactive properties with various chemicals. Thereby, a d e f t synthesis of silver nanoparticles (AgNPs) was achieved using known substance from laboratory in a fast and cost-effective approach. Tools like ultraviolet-visible(UV-vis), Fourier transform infrared (FTIR) spectrophotometers and scanning electron microscopy (SEM) were used to determine optical, functional and morphological characteristics. The synthesized silver nanoparticles were coated on Whatman paper strips and dried in hot air oven. These AgNPs coated filter paper strips was then used as a chemical sensor for detection of hydrogen peroxide (H_2O_2), which resulted in discoloration of the paper based sensor. The analysis of the decolored paper strips was done by an android phone camera and a R GB color reader application (app) to measure color intensity. The sensing characteristic was found in the range of 100mM to 10mM.

Keywords: Paper based sensor, silver nanoparticles, H_2O_2 detection, RGB Analysis

Synthesis and Characterization of Small Molecules for Targeting Mitochondria in Cancer Treatment

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Cancer is characterized by uncontrolled cell growth which affects multiple organs and organ systems. Currently, the major mode used for its treatment is chemotherapy. Despite its widespread use, side effects such as multidrug resistance, relapse and off-target cytotoxicity make it a debatable choice and leave an ever-increasing need for exploring alternative modes of treatment. Mitochondria being central to cellular energetics has been found to play an important role in tumorigenesis. Subsequently, if the mitochondria are damaged, the mechanism providing energy for cancer cell division will be impaired and tumorigenesis will be suppressed. Drugs like chloramphenicol and artesunate, possess anti-mitochondrial potency. According to the previous studies conducted in our laboratory, nanoparticles of size less than 200nm can enter pores in tumour tissues formed post angiogenesis. Hence, we report the synthesis of chloramphenicol-Triphenylphosphine (TPP) conjugate and Artesunate-TPP conjugate. The synthesized small molecules have been characterized using MALDI-TOF, ¹H NMR and ³¹P NMR. These molecules can be loaded to a suitable nanoparticle which will have the ability to carry them to the tumour cells, where positively-charged TPP will further carry chloramphenicol and artesunate to the negatively-charged mitochondrial membrane to induce cytotoxicity.

Keywords: Cancer Therapy, Chemotherapy, Repurposing Drugs, Cancer and Mitochondria.

A real-time paper based colorimetric sensor for the detection of alkaline phosphatase activity

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A paper-based sensor for the detection of alkaline phosphatase (ALP) activity has been developed using surface modified filter paper and α -naphthol-fast blue RR system. The color development on the paper was found to be proportional to the activity of the enzyme in the sample and was calibrated on the basis of their RGB colour component. A standard was developed using RGB values of known enzyme activities and tested on plant extracts for determination of quality and sensitivity. Results obtained from the developed paper-based sensor were validated with a spectrophotometric assay using p-nitrophenyl phosphate as a substrate. The developed paper-based sensor does not require the use of bulky and costly instruments thus can be used for real-time analysis of ALP in clinical samples, and for the screening of ALP in various plant and microbial sources.

Keywords: alkaline phosphatase, paper-based sensor, colourimetric sensor

Importance of *Ayurvedic Bhasmas* derived from metals/non-metals as regenerative medicines.

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The concept of *bhasma* has its origin in Ayurvedic medicinal system especially for the drugs derived from metals as well as non-metals. Nagarjuna is believed to be the father of Ayurvedic *rasashastra* in which the art, science and technology of Ayurvedic *bhasmas* was fully developed. The criteria for identification and confirmation of genuine Ayurvedic *bhasma* were also established and these were used to test authenticity of a *bhasma*. The miraculous and extraordinary medicinal properties of *bhasmas* derived from mercury, gold, silver, copper, iron, tin, lead, zinc as well as diamond, sulphur and selenium were invented due to which these Ayurvedic *bhasmas* occupied prime position in Ayurvedic pharmacy and *bhasma* therapy received tremendous popularity in India. However later on due to continuous invasion from foreign countries, this extremely important art and its knowledge went in dark. It is only after independence and especially since past seventy years, scientists from India as well as abroad are realizing the vital importance and need of this class of Ayurvedic medicines of mineral origin. Consequently attempts are made to rejuvenate this art, science and technology of Ayurvedic *bhasmas* in the light of modern sciences and technology. Our research group is working in this area since past fifty years and we have carried out extensive and intensive research work on metallic as well as non metallic Ayurvedic *bhasmas*. From research point of view the most important and attractive properties of these Ayurvedic *bhasmas* are their a) action on root cause of the disease and ability to destroy the diseases b) capacity to promote and maintain the inherent preventive power of the human body and c) regenerative power and potential to rejuvenate the infected cells. With the help of modern instrumental techniques, recent development in nanotechnology and nanobioscience we have made an attempt to explore the different factors responsible for the extraordinary medicinal properties ascribed to these Ayurvedic *bhasmas*.

Through this communication we would like to present some of the significant results and conclusions in favour of the importance of these *bhasmas* as regenerative medicines.

Keywords: Ayurvedic *bhasmas*, regenerative medicines

Fungal contaminant secretes hydrophobins with surface active properties

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Hydrophobins are a class of small (<20 kDa) cysteine-rich proteins, produced by filamentous fungi, are the most powerful surface active molecules known since they have the ability to convert hydrophilic surfaces to hydrophobic. Hence, these unique proteins have many potential applications in the field of anti-fouling, biomaterials, medical applications, targeted drug delivery, personal care, biosensors, emulsifiers and separation technologies. The present study deals with the extraction, purification and biophysical characterisation of hydrophobins from a fungal contaminant obtained in our lab. The extracted hydrophobins were utilised to synthesize gold nanoparticles as well. On observation of fungal spores under scanning electron microscopy and water contact angle analysis of the fungal mycelium, the presence of hydrophobins on the fungal mycelium were confirmed. Hydrophobins were isolated based on their insolubility in hot Sodium Dodecyl Sulphate and then extracted in cold 98% formic acid by sonication. Extracted hydrophobins were further purified by adsorption on to silica gel by column chromatography. The purified hydrophobins were coated on a glass slide and on observation under scanning electron microscopy, rod like appearance was seen which confirmed that hydrophobins belonged to class II. Purified hydrophobins showed good emulsification effect in the oil-water phase and paper precoated with hydrophobin resisted wetting by water for up to 90 seconds. The hydrophobins could also displace petroleum crude oil on water indicating their surfactant ability. Gold nanoparticles (size 20 nm) were obtained in a one step process by mixing purified hydrophobins and gold chloride solution in a one-step process. These results implement that the purified hydrophobins from fungal contaminant could be exploited for use in various applications such as emulsifiers and targeted drug delivery.

Development of an efficient and retrievable catalyst based on the nanoparticles decorated cellulose fibers for reducing environmental pollutants

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Eichhornia crassipes, or the water hyacinth is an invasive species in India, responsible for the blockage of lakes and rivers and lowering the Dissolved Oxygen content, thus interfering with the natural ecosystem. Its high cellulose content allows for mass extraction of cellulose, and subsequent usage in a variety of applications. In this study, cellulose fibres were extracted from dried Water Hyacinth using the Acid-Base-Bleaching Agent technique. The obtained cellulose fibres were used as a bio-template for the synthesis of Silver Nanoparticles (AgNPs), using heat and pH modulation. AgNPs decorated cellulose fibres, after a pilot experiment were found to be retrievable, reusable catalytic agents. They successfully catalysed the degradation of the environmentally toxic agent p-nitrophenol (PNP). The plain Cellulose fibres and the AgNP decorated Cellulose fibres will be characterised in the future using the analytical techniques XRD, SEM and EDX.

Keywords: Water Hyacinth, Cellulose fibres, AgNPs, retrievable catalysts

Pharmacological and Phytochemical Evaluation of *Nyctanthes arbor-tristis*.

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To study detailed pharmacological characters of the floral petals of *Nyctanthes arbor-tristis* (Oleaceae), along with their physico-chemical parameters, fluorescence analysis and phytochemical screening. The pharmacological characters were determined in terms of macroscopy, microscopy, powder microscopy, physicochemical analysis, fluorescence analysis and preliminary phytochemical investigation of flower of the plant. The microscopic study shows the general characteristic of flower. Phytochemical analysis revealed the presence of various phytochemical groups like alkaloids, glycosides, steroids, phenolic, tannins constituents. It can be concluded that the established pharmacological profile of *Nyctanthes arbor-tristis* flower will be helpful in developing pharmacopoeial standards for correct identification and quality control.

Keywords: *Nyctanthes arbor-tristis*; Phytochemicals, Fluorescence analysis

In silico screening of phyto – constituents for the bone fracture healing property

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In Ethano medicinal uses, a plant named *Phyllanthus reticulatus* was found to be of great importance in curing bone fracture. On this rationale in the current study an approach was made to identify the phyto-constituents of *Phyllanthus reticulatus* reported by earlier researchers by manual literature review and resulted in identification of 19 phytoconstituents. Further, the molecules with more than 85% similar to the phytoconstituents were identified and retrieved using various small molecule databases like ChEmbl and PubChem. Totally 167 molecules were retrieved and classified into two groups on the grounds of structural similarity with known Receptor activator of nuclear factor- κ B(RANKL) inhibitors and Selective Estrogen Receptor Modulator (SERM) in osteoporosis treatment. The pharmacokinetics analysis with special emphasis on ADME/Toxicity for all retrieved molecules has ensured the safety of molecules and encouraged to study their efficacy. The Molecular docking and simulation studies have demonstrated the interaction of phyto-constituents with respective drug targets and suggested oleanolic acid and kaempferol as potent RANKL inhibitor and SER modulator respectively. The obtained results have concluded the mechanism of agonistic and antagonistic action of kaempferol and oleanolic acid respectively in curing osteoporosis in general.

Keywords: Osteoporosis, RANKL, SERM, *Phyllanthus reticulatus*, Phytoconstituents.

Horse gram- A power pack underutilized nutraceutical source

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Horse gram (*Macrotyloma uniflorum* Lam.) is a popular pulse, locally known as Kulith belongs to the family Fabaceae that still remain an under exploited legume crop. Horse gram (*Macrotyloma uniflorum*) is an underutilized pulse crop grown in wide range of adverse climatic conditions. It occupies an important place in human nutrition and has rich source of protein, minerals, and vitamins. Horse gram contains carbohydrate (57.2% w/w), protein (22% w/w), dietary fiber (5.3% w/w), fat (0.50% w/w), calcium (287 mg), phosphorus (311 mg), iron (6.77 mg) and calories (321 kcal) as well as vitamins like thiamine (0.4 mg), riboflavin (0.2 mg) and niacin (1.5 mg) per 100 grams of dry matter. Besides nutritional importance, it has been linked to reduced risk of various diseases due to presence of non-nutritive bioactive substances. These bioactive substances such as phytic acid, tannins, phenolic acid, fiber, enzymatic/proteinase inhibitors have significant metabolic and/or physiological effects, they are now considered as potential antioxidants source having health promoting affects. The phytic acid possesses rich antioxidant, anticarcinogenic and hypoglycaemic activities, therefore, depending upon consumer preferences retaining or elimination of these compounds could be facilitated. The importance of horse gram was well recognized by the folk/alternative/traditional medicine as a potential therapeutic agent to treat kidney stones, urinary diseases, piles, common cold, throat infection, fever etc.

Keywords: Horse gram, Phytic acid, Tannins

Chemically synthesized pure and Sr-doped CuBi_2O_4 for photoelectrochemical application

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Effective photoelectrochemical (PEC) hydrogen (H_2) generation scheme via water splitting requires efficient, stable, non-toxic and relatively earth abundant metal oxide materials. The optimization of parameters in the preparation of electrode materials which can be capable of simultaneously evolving H_2 and O_2 from water with high solar conversion efficiencies (10% or more). This issue has been motivated researchers to pursue tandem-cell device system which utilizes two separate solar light absorbing materials as photocathode and photoanode. Such approaches have demonstrated commercially viable metal oxide materials for efficient conversion from solar-to-hydrogen (STH). The water splitting activity and the photothermal effect of these materials can also have a potent antimicrobial activity. It can be utilized for water purification. The advantage is these materials respond to visible spectrum (λ_{400} – λ_{700}), so it can overcome the requirement of UV light for water purification. This type of tandem structure requires proper matching of the band energy positions with respect to redox–energy level of water and hydrogen and also the generated photo-voltage of the two photoelectrodes is useful for efficient proton reduction and water oxidation. The favorable band edge positions of p- CuBi_2O_4 would make it an effective photocathode in a tandem PEC device for water splitting. Sr doped CBO (CuBi_2O_4) nano-particles were successfully synthesized via a low temperature chemical route and phase confirmed by X-ray diffraction (XRD) patterns. XRD results show that Sr-doped CuBi_2O_4 has been crystallized with a spinel-type structure in tetragonal crystal system. Also, nanostructured thin films of pure CBO were grown on FTO glass substrate via a seed assisted hydrothermal technique. CBO nano-particulate powder appears in a light brown color. We studied these materials for the antimicrobial activity for coliforms and *Staphylococci*. The studies included photothermal effect, Alamar blue assay, testing anti-microbial activity, and spectroscopy. Sr doped CBO showed significant antimicrobial activity compared to the control sets against *E.coli* (O157:H7). Further samples were checked for cytotoxic studies.

Keywords: CBO, photoelectrochemical, water-splitting, photothermal, antimicrobial

Bioplastics made from multifarious nature substrates: A Review

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Bioplastics have been investigated as a favourable substitute to petrobased polymers. Biobased plastics are emphasised for reducing carbondioxide emission, saving fossil fuels and plastic waste reduction. At present bioplastics are most innovative “eco-friendly” materials developed. Utilising different natural substrates instead of petroleum resources in various environments enabled these polymers to be easily admissible than the conventional plastics. The biodegradability of plastics is highly affected by their physical and chemical structures. This review highlights the use of multifarious substrates for bioplastic production and its applications, advantages, types, challenges, biodegradability and energy analysis. It is concluded that use of bioplastics will help in advancement and sustainability, thus making the environment less overwhelmed.

Keywords: Bioplastic, biodegradability, petrobased polymer, environment, sustainability.

Extraction of active potent ingredient from calotropis leaves

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In traditional medicine, several Indian medicinal plants or their extract have been used for many different purposes. Herbal medicine has become an item of global importance both medicinal and economical. Usage of these herbal medicines has increased, their quality, safety and efficacy in industrialized and developing countries. *Calotropis procera* is one of those medicinal plants used for pharmacological purposes. *Calotropis procera* is rich in bioactive substances that determine the medicinal potential of this species. *Calotropis procera* is a species of flowering plant in the family Apocynaceae that is native to North Africa, Tropical Africa, Western Asia, South Asia, and Indochina. The study reveals that leaves of *Calotropis* contains-carbohydrate, alkoids, glycosides, saponins, tannins, flavonoids, steroids and fixed oils and all of these are active compounds. The extraction of plant was made using different solvents such as distilled Water, Ethanol, Methanol, Acetone, Chloroform. Qualitative analysis of plant extracts was done for the presence of active ingredients as mentioned above. Methanol, Ethanol, Distilled water extract obtained from reflux distillation leads to better extraction of active components. The selected extracts were further analysed for Antimitotic and Phytotoxic activity. The extracts showed both Antimitotic as well as Phytotoxic activity which can be used for several pharmacological application.

Keywords- *Calotropis procera*, extraction, reflux distillation, active ingredients, antimitotic activity, phytotoxicity,

Studies on development of curcumin enriched soy base pineapple beverage

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Curcumin, a pleiotropic polyphenol in turmeric is a potential therapeutic agent against non communicable diseases such as neurodegenerative diseases, cardiovascular diseases, diabetes, obesity, allergies, and certain types of cancer. Pineapple is a marvelous tropical fruit having extraordinary juiciness, coruscating flavor and enormous health benefits. Soya milk one of vibrant health food product getting popular among health conscious consumer in developing countries due to its high nutritional value. Functional beverages containing bioactive compound, fruit and soy milk not only suffice hunger, supply nutrient but also promote health and prevent diseases. In present investigation, attempts were made to develop innovative curcumin enriched soy base pineapple beverage. Soy base pineapple beverage was standardized first by blending soymilk with pineapple pulp at different concentration (0%, 10%, 15% , 20% , 25 % , 30%) and evaluated for sensory properties. Soy base beverage with 25% pineapple pulp was organoleptically most acceptable and further selected for curcumin enrichment. Soy base pineapple beverage formulated by incorporating various level of curcumin (0%, 0.025%, 0.05%, 0.075%, 0.1%) was assessed for sensory and physicochemical characteristics. Organoleptic assessment shown 0.050% curcumin enrichment in soy base pineapple beverage is overall acceptable as compared to other levels. Well planned clinical study is required to establish health claim base functional efficacy of curcumin enriched soy functional beverage against non-communicable disease.

Key Words: curcumin, pineapple, soy milk, beverage, sensory

Screening of Chitinase producing bacteria from mangrove soil

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Chitin is second most abundant naturally occurring biopolysaccharide after cellulose. It is primary component of cell wall in fungi; found in exoskeleton of arthropods like crabs, lobsters, shrimps, etc.; also found in insects; in radulae of molluscs and in scales of fishes. As it is abundantly found its increase in accumulation in environment has led to significant hazards. Chitinases are enzymes that break down the 1→4 β-glycoside bond of N-acetyl d-glucosamine in chitin to produce monomers or oligomers and can inhibit fungal growth. Natural biofungicidal microbes like bacteria producing chitinase enzymes can replace chemical fungicides which would reduce negative impact on environment. Here we describe isolation and characterization of chitinase producing bacteria from mangrove soil.

Keywords: Biofungicide, Chitin, Chitinase, Chitin degrading bacteria, Mangrove soil

Synthetic Sensor Based Nanovesicles Provides Glucose Responsive Release of Insulin

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Although previous studies have attempted to create electronic free insulin delivery systems using different glucose sensing mechanism, no successful clinical translation as hitherto been made. Insulin delivery by closed loop system are self regulated administration, where it mimics the function of pancreatic cells which can govern the drug release kinetics in response to the fluctuation in blood glucose levels. Hence, we report a new glucose responsive vesicles (GRVs) formulation which is a self regulated insulin delivery system was constructed by packing insulin, glucose-specific enzymes into hypoxia sensitive polymersome based nanovesicle assembled by a diblock copolymer. The GRVs (average diameter of 200 nm) was loaded with insulin and an enzyme glucose oxidase which are glucose sensing elements which may prove more effective for closed loop insulin release. The hypoxic microenvironment in the hyperglycemia state promotes the reduction of HS-HA which rapidly triggers the dissociation of vesicle and thus there is sustained release of insulin. From In vitro studies by Bradford method, it was found that release of insulin from GRVs was effectively correlated with the external glucose concentration thus facilitating the stabilization of blood glucose levels in the hyperglycemia state (200mg/dl). Different concentrations of glucose were taken which showed HS-HA GRVs could effectively deliver insulin in sustained manner under normoxic condition (physiological environment) whereas the drug release rate remarkably increased under hypoxia condition. Overall, this rapid responsiveness of the formulation which may act as smart sensor might have a potential to trigger the release of insulin under hypoxia condition avoiding both hyperglycemia and hypoglycemia in case of type 1 diabetes.

Early miscarriage screening tool based on mutation detection in Factor V gene in maternal DNA

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Background: Miscarriage is an adverse pregnancy outcome and is multifactorial. Miscarriages are also polygenic and are attributed to mutations in Factor V gene, prothrombin gene and 5,10-methylenetetrahydrofolate reductase gene. Inherited thrombophilia which is caused by $G \rightarrow A$ mutation in the FV gene (Factor V Leiden) has been associated with recurrent pregnancy losses. But, the association of FV gene mutation with a single miscarriage has not been established.

Methodology: Samples were obtained from maternal DNA biobank. Cases were the samples of the women having pregnancy outcome as a miscarriage controls were the samples of the women having pregnancy outcome as live birth. Samples were analyzed by Amplification-refractory mutation system (ARMS) PCR.

Results: The study identified that 55-60% of the women having miscarriage are heterozygous for FVL which was higher than controls (40%). Heterozygosity for the FV gene mutation increased the risk of miscarriage by 4.5 times. Inheritance of A allele was associated with a 3.2 (1.1810 to 9.0689, 0.0226) odds of having miscarriage.

Conclusion: FV mutation was associated with increased odds of miscarriage. Screening women for this mutation will be useful in identifying women at risk of miscarriage. This study could find 55-60% of the population having Factor V gene mutation who have history of single miscarriage using genotyping. After this potential data we are taking this work forward to have a more sensitive and portable screening technique.

Key words: Multifactorial, polygenic, Factor V gene, recurrent pregnancy loss, Factor V Leiden, ARMS PCR.

Biotransformation of Cr (VI) by Rice Husk and its toxicity analysis using *Danio rerio*

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Abstract: Hexavalent Chromium [Cr (VI)] is a heavy metal released into the environment majorly through anthropogenic activities and is known for its carcinogenic activity, posing a severe threat to life and environment. The urgent need of a potential and sustainable technology for remediation of chromium (VI) contaminated waste constructs the foundation of the current research project. The present study focuses on the potential of using agricultural waste like rice husk as a biosorbent for Cr (VI). Effect of pH, biomass dosage, time variation and initial metal concentrations were studied. The adsorption process followed Langmuir Isotherm and maximum uptake capacity ($q_{\max}$) was found to be 304.9 mg/g. Estimation of total chromium via ICP-AES indicated that the Cr (VI) remediation process involves bioreduction of Cr(VI) to Cr(III). Further, the toxicity studies of untreated chromium and bio-remediated chromium samples were conducted using zebrafish (*Danio rerio*) embryos as model systems. The total mortality, percent hatching, heart rate, deformities in tail formation and detachment was evaluated at different time points and showed Cr(VI) to be highly toxic compared to bioremediated samples.

Keywords: Bioremediation, Hexavalent Chromium, Biotransformation, Biosorption, Adsorption isotherms

Bioremediation using *Pseudomonas spp.*

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Being the basic structural unit for the variety of compounds, phenol, is used in multiple industries e.g. oil refinery, pharmaceuticals, paper industry, textile industry, etc. Hence Phenol is found in the effluent of these industries, which if without proper treatment is discarded in the water bodies causing water pollution. Phenol being highly toxic to the man-kind must be degraded to non-toxic substances, as it is a potential carcinogen. This elimination of phenolic compounds is efficiently achieved by the tertiary treatment of these effluents by using *Pseudomonas sp.* It contains hydroxylase enzyme, that is a potential biodegrader of phenolic compounds. Phenol is oxygenated by hydroxylase enzyme present in the microorganism to form catechol. This ring structure is cleaved between two hydroxyl groups, to further yield basic products viz. Carbon dioxide and water. Initially *Pseudomonas* cultures were grown in NB media, with an addition of tolerating amount of phenol in it. The cultures were monitored under different pH and temperature conditions. The degradation rate of phenol were estimated by using various chromatographic and spectroscopic techniques. The results obtained from the HPLC, TLC, UV- spectrophotometry showed the growth rate of the bacteria and the degradation of the phenol compound present were estimated by quantitative analysis. From the obtained results, it is seen that *Pseudomonas* has higher tolerance for phenol. Thus, it is a capable aspirant for bioremediation of phenolic wastewater.

Keywords: bioremediation, *Pseudomonas*, wastewater, phenolic compounds, biodegradation

Bioplastics made from multifarious nature substrates: A Review

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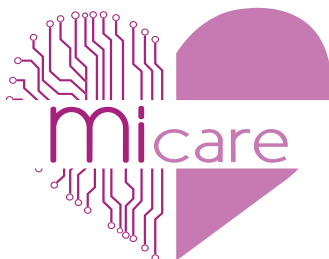
Bioplastics have been investigated as a favourable substitute to petrobased polymers. Biobased plastics are emphasised for reducing carbondioxide emission, saving fossil fuels and plastic waste reduction. At present bioplastics are most innovative “eco-friendly” materials developed. Utilising different natural substrates instead of petroleum resources in various environments enabled these polymers to be easily admissible than the conventional plastics. The biodegradability of plastics is highly affected by their physical and chemical structures. This review highlights the use of multifarious substrates for bioplastic production and its applications, advantages, types, challenges, biodegradability and energy analysis. It is concluded that use of bioplastics will help in advancement and sustainability, thus making the environment less overwhelmed.

Keywords: Bioplastic, biodegradability, petrobased polymer, environment, sustainability.

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