



2nd National Conference
on

UNDERSTANDING THE MECHANISM & CHALLENGES OF COMPLEX DISEASES (UMCCD-2017)

24th - 25th January, 2017



Organised by

Department of Biomedical Sciences
Shaheed Rajguru College of Applied Sciences for Women
Accredited by NAAC with 'A' Grade
(University of Delhi)

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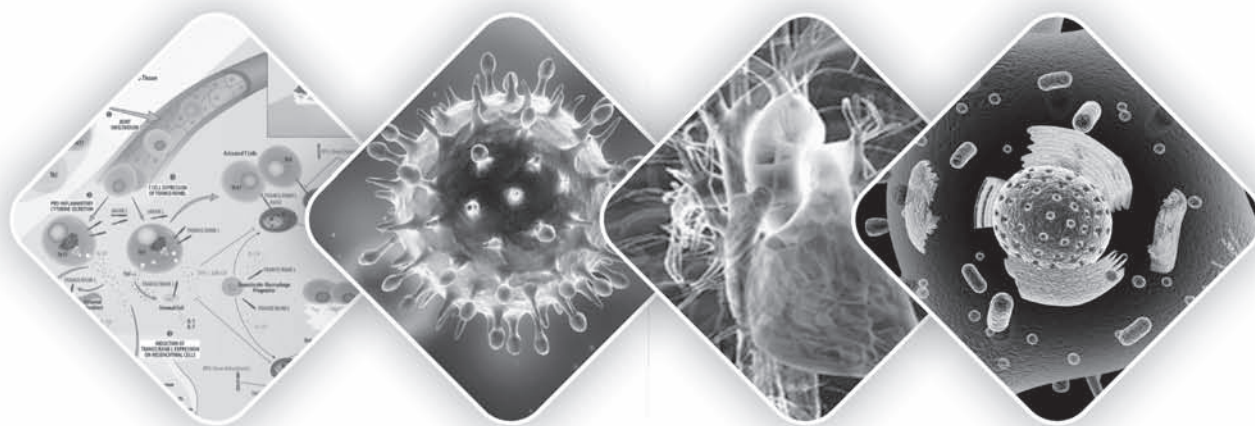


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SRCASW, Delhi



Message from Chairperson

It's a matter of great pride and honor that Department of Biomedical Science, Shaheed Rajguru College of Applied Sciences is hosting the DBT sponsored second National Conference on Understanding the mechanisms and Challenges of Complex Diseases (UMCCD-2017) on 24th-25th January, 2017. This conference is a unique opportunity for students to interact directly with the people from academic and industry world and also to gather information about what is on the frontiers of all time changing technology. Conferences like this play an imperative role in apprising the students to the latest research.

A complex disease is one with features that complicate the detection of the disease's contributing factors. Discovering a contributing factor and characterizing its contribution to a complex disease is a difficult undertaking, because the effect of any single factor may be obscured or confounded by other contributing factors. In this context understanding complex disease is urgent and important because these conditions impose a burden on our country. Life Sciences is at the forefront of research in the 21st century and there is no better way to provide useful insights into research problems than to have the students interact with the scientists who are actually engaged in it. A conference like this would achieve this objective and pave way for many more like this to come.

I am sure that it would be an enriching experience for all. I wish this conference all the success and wish that Department of Biomedical Science would organize more such events in the years to come.

Dr. Payal Mago

Principal

Shaheed Rajguru College of Applied Sciences for Women
University of Delhi

Message from Organising Committee

It is a great pleasure to welcome all of you to Shaheed Rajguru College of Applied Sciences for Women, University of Delhi for the DBT sponsored 2nd National Conference on Understanding the Mechanism and Challenges of Complex Diseases (UMCCD-2017).

We welcome warmly all of our invited speakers who have accepted our invitation to lecture despite busy schedules. We hope that this conference allows students to interact with eminent scientists from all over the country. This conference intends to serve as an interface and amalgamates the disciplines of genetics, molecular biology, biochemistry and therapeutics. It involves various research areas, including Genetic and molecular basis of complex diseases, targeted gene delivery, genetic manipulations and therapeutic applications. We have several interesting sessions which highlight the vast scope of research in life sciences. It is encouraging that we have received abstracts of good quality from students and faculty all over India. One of the aims of such conferences is that researchers from different backgrounds will come together and new collaborations will emerge. Ultimately we need to enthuse, encourage and train our younger colleagues and students who will be the scientists of tomorrow. It is our hope that rapid strides will be made in the understanding the mechanism of these complex diseases and the only way forward is through research. It is our sincere hope that the National Conference on Understanding the Mechanism and Challenges of Complex diseases will serve as a platform towards achieving these goals.

We express our profound gratitude to our sponsors and to the University of Delhi for supporting our efforts. We welcome you to this conference and hope that it will be a pleasant experience for all of you.

Organising Committee

UMCCD-2017



National Conference on Understanding the Mechanism and Challenges of Complex Diseases

(UMCCD-2017)

24th-25th January, 2017

T e c h n i c a l P r o g r a m m e

24th January, 2017

09:00 am to 10:00 am

Registration

10:00 am to 11:30 am

Inauguration

Keynote Address by Professor Dr. Seyed Ehtesham Hasnain,
Vice Chancellor, Jamia Hamdard University,
Professor & Head, Jamia Hamdard — Institute of Molecular
Medicine,
Invited Professor, IIT Delhi

11:30 am to 12:00 pm

High Tea

Session I

12:00 pm to 01:30 pm

Understanding the Mechanism of Complex Diseases-I

Prof. K. Natrajan, Director, Dr. B. R. Ambedkar Center for
Biomedical Research, University of Delhi, Delhi

Dr. Anurag Agrawal, Scientist, CSIR — Institute of Genomics and
Integrative Biology, Mall Road, Delhi

02:00 pm to 03:00 pm

Lunch and Scientific Poster Display/Exhibition

Session II

03:00 pm to 04:30 pm

**Scientific Paper Presentations (Young Scientists) and Panel
Discussion**

25th January, 2017

10:15 am to 11:15 am **Plenary Lecture by Prof. Chinmay K. Mukhopadhyay,**
Special Centre for Molecular Medicine,
Jawaharlal Nehru University, Delhi

11:15 am to 11:45 am **High Tea**

Session III

11:45 am to 02:00 pm **Understanding the Mechanism/Challenges of Complex Diseases-II**

Dr. Bishwajit Kundu, Associate Professor, School of Biological Sciences, IIT Delhi

Dr. Sivaram Mylavarapu, Associate Professor, Regional Centre for Biotechnology

Scientific Paper Presentations (Young Scientists) and Panel Discussion

02:00 pm to 02:30 pm **Lunch and Scientific Poster display/exhibition**

Session IV

02:30 pm to 04:00 pm **Challenges & Pharmacological Interventions in Complex Diseases**

Dr. Devesh Bhardwaj, Associate Vice President, Mankind Research Centre, Mankind Pharma Limited

Prof. Kanury V. S. Rao, THSTI — National Chair & Head, Drug Discovery Research Centre

04:00 pm to 05:00 pm **Valedictory Function and Certificate Distribution**





National Conference on Understanding the Mechanism and Challenges of Complex Diseases

(UMCCD-2017)

24th-25th January, 2017

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Mycobacterium Tuberculosis, the TB Bacteriums, is able to achieve “More from Less for More” to fool the Human Post

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Abstract : Mycobacterium tuberculosis (*M.tb*) is the deadliest bacterial pathogen known to humanity causing the disease TB. Despite the fact that TB is completely curable, if diagnosed timely and treated properly, one person dies every 15-20 seconds. *M.tb* has evolved during evolution over millions of years into a very slim and trim genomic and functional architecture. Not only it has shed much of its genome, but has balanced this genome deficit by resorting to very intelligent survival strategies such as gene cooption, moon lighting and molecular mimicry involving intrinsically disordered proteins. My presentation will give specific examples of how *M.tb* is able to achieve “more from less for more” for its survival and pathogenesis. I will also try to give a flavor of efforts in our group combining computational, functional genomics, molecular epidemiology, infection biology and clinical approaches including drug repurposing to understand the extraordinarily clever “disruptive innovation” strategies adopted by this bacterium.



How do you solve a Problem like Tuberculosis : The Immortals of the Lung

Shashank Gupta, Arti Selvakumar, Cecil Antony, Deepika Sharma and Krishnamurthy Natarajan
Dr. B. R. Ambedkar Centre for Biomedical Research, University of Delhi, Delhi, India

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Dr. B. R. Ambedkar Centre for Biomedical Research
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Abstract : Understanding complex diseases many a times requires out of the box, radical and sometimes irrational approaches combined with conventional approaches. Tuberculosis caused by *Mycobacterium tuberculosis* (*M. tb*) results in mortality and morbidity on a global scale. BCG, the only available vaccine against *M. tb* is effective only during childhood and fails to protect the adult population. Similarly, the increasing evolution of drug resistance to almost all drugs further compounds the problem. This has inspired scientists to tweak their line of thinking and devise strategies that could result in developing better vaccines and therapeutic regimes. This of course requires a thorough understanding of host-pathogen interactive biology. Over the last several years our lab has been constantly working on understanding the nuances of host-pathogen interactions to identify possible mechanisms that the pathogen uses for immune evasion. One such mechanism is remodeling the calcium dynamics of the infected cell that appreciably determines *M. tb* survival. We identified Voltage Gated Calcium Channels (VGCC) to play a critical negative role in regulating immune responses to pathogens. Inhibiting the VGCC increased calcium influx that upregulated expression of genes favoring protective responses in infected macrophages and effectively enhanced killing of intracellular *M. tb*. Importantly, compared to healthy controls, PBMCs of tuberculosis patients expressed higher levels of VGCC, which were significantly reduced following chemotherapy. Further, blocking VGCC in vivo in virulent *M. tb* infected mice significantly reduced bacterial loads. More crucially, supplementing anti-TB drugs with calcium channel blocker S-amlodipine, prescribed to treat hypertensive patients, significantly reduces Multiple Drug Resistant (MDR) *M. tb* infection in mice and guinea pigs. Attenuation was marked with significant improvements in the pathology of infected organs. S-amlodipine promoted phagosome-lysosome fusion and initiated apoptosis and autophagy in infected macrophages. Our results indicate that S-amlodipine betters the ability of anti-TB drugs to attenuate drug sensitive or MDR *M. tb* infections and its inclusion could serve as an adjunct therapy to combat drug resistant Tuberculosis infection. We are currently working towards furthering our knowledge on the calcium homeostasis in other infections.



Syndromes, Phenotypes and Endotypes : Delving Deeper into Asthma

Anurag Agrawal
CSIR, IGIB



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Abstract : Research in complex diseases like asthma is critically dependent on what we mean by asthma. Is asthma a single disease or a syndrome containing many distinct diseases? If there is no single asthma, then how do we untangle the various threads? These are important questions that lack a single answer, but the key steps towards systematic pathobiological understanding will be discussed, with illustrations from primary research being conducted in our lab.



Leishmania donovani — The Master of Mining Iron

Chinmay K. Mukhopadhyay
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Jawaharlal Nehru University
New Delhi



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Abstract : Iron is essential for survival of all the organisms. It plays crucial role in determining host-pathogen interaction because of its exquisite role in energy metabolism and electron transfer reaction. During infection iron becomes central of the battle field between host and invading pathogens as strategic acquisition of iron by pathogen or sequestration by host can block other's growth. For successful invasion the pathogen has to block host iron sequestering mechanisms for its own growth and survival. Our study reveals the strategies adopted by *Leishmania donovani*, the etiologic agent of Kala-azar, to manipulate iron homeostasis in host macrophages.



Insights of Amyloid Interaction Network and Designing Structure-based Anti-amyloidogenic Biomolecules

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Abstract : A variety of chronic disorders arises owing to structural perturbation-associated malfunctioning of native proteins. Despite large scientific advances in technology and biology, counter measures to protein misfolding and their self-assembly to form aggregated states still remains unsolved. This generates necessity for identification and optimization of structure-based entities which could effectively combat protein aggregation complexities. For the past decade, we have been extensively working on identification of small molecules and small-molecular chaperons which could faithfully prevent misfolding induced aggregation of amyloidogenic proteins and thus reduce associated cytotoxicities. In this direction, we have come up with various leads: receptor-based identification of small planar molecules as emetin, chelerythrine etc. and a small molecular chaperon from N-terminal domain of L- asparaginase of *Pyrococcusfurius*(NPfA). Our studies have conclusively proven these planar molecules as generic modulators of aggregation pathway of different proteins viz. Gelsolin, Insulin Amyloid Polypeptide, PrP etc. On the other hand, NPfA has also been shown to possess anti-aggregatory effects against A β (1-42) and Poly-Q aggregation. Both molecules share same pharmacological actions but with distinct underlying molecular mechanisms.



Motoring through Cell Division

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Laboratory of Cellular Dynamics
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Abstract : The intracellular molecular motor cytoplasmic dynein performs multiple essential roles in the cell, including intracellular vesicle transport, Golgi complex organization and a host of mitotic functions. The various functions of dynein are achieved by transporting diverse cellular cargo to the desired intracellular destinations in a precisely regulated manner, by travelling along the microtubule cytoskeleton towards the source of the microtubules. The oppositely oriented kinesin motors ferry cargo towards the growing ends of microtubules. In order to be able to carry a large variety of cargoes, kinesins have evolved to about 45 varieties in eukaryotes. However, the dyneins have remained much more constant through evolution, evolving only to three major subtypes, while still retaining a similar cargo binding diversity as the kinesins. The mitotic functions of dynein include regulation of proper mitotic spindle assembly, spindle positioning and orientation in the cell and mitotic checkpoint regulation. During this talk, I will share our recent mechanistic insights into the biochemical and functional evolution of two Light Intermediate Chain subunits of dynein in regulating unique facets of mitotic progression through differential binding to selective cargo.



Overcrowding of Biosimilars Space — A Case for Biosuperiors

Dr. Devesh Bhardwaj

Associate Vice President

Mankind Research Center

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Abstract : Biologics are one of the fastest growing class of drugs globally. Seven out of ten top selling drugs are biologics. New drug pipeline globally has increasing number of biologics. However, due to enormous costs of these drugs, payers as well as patients are looking upto the 'generic' versions of the biologics, the so called biosimilars. Most of the innovator biotechnology as well as the big pharma companies are actively entering in to this space making it very crowded. This talk will explore the drivers and brakes of developing biosuperiors and biobettters.



Exploiting Systems-based Approaches for Drug Target Discovery

Kanury V.S. Rao
THSTI — National Chair & Head
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Abstract : A common approach to drug development is to first identify a biological target protein that is specific to a given disease, and then either design or discover small organic molecules that modulate its function. Drug discovery research, therefore, requires a separate skill set where an understanding of cellular and biochemical mechanisms needs to be integrated with knowledge of chemistry/medicinal chemistry and pharmacology. We now recognize, however, that the approach of one-target-one-drug is severely limited because it does not take into account the complexity of biological mechanisms and processes. The recent explosions in technologies for interrogating cell and tissue behavior have revealed that cellular pathways do not function in isolation. Rather, they form intricately connected networks that exhibit complex and non-linear behavior. Network complexity has in fact been engineered into all living systems through evolutionary processes, and resolving disease-specific perturbations in the network architecture presents one of the most daunting challenges of the day. The complexity is further compounded by the fact that biological systems are dynamic in nature wherein the individual functional modules of a cell assemble to form a fully periodic machine. Consequently, resolution of the perturbed modules in a disease, and the subsequent delineation of potential drug targets, requires analysis across the scales of both space and time. Addressing this issue is not a trivial task but requires development of new approaches, and even new perspectives, for analyzing dynamical features of complex system behavior. This can only be achieved through an integrative approach that synthesizes a wide variety of disciplines such as biology, physics, mathematics, engineering, computer sciences, chemistry and pharmacology among many others. Our own efforts in this are will be discussed.



Oral Abstracts

Pharmacological Characterization of Benzylpiperidine Derivatives in the Management of Alzheimer's Disease Associated Pathogenesis

Poonam Meena¹, Apra Manral¹, Vishal Nemaish², Vikas Saini¹,
Fouzia Siraj³, Pratibha Mehta Luthra², Manisha Tiwari¹
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2. *Neuropharmaceutical Chemistry Laboratory, Dr. B. R. Ambedkar Centre for Biomedical Research, University of Delhi, Delhi-110007, India*
3. *Department of Histopathology, National Institute of Pathology, Indian Council of Medical Research, Delhi-110029, India*

In response to the molecular complexity of AD, the strategy of multi-target directed ligand (MTDL) holds great potential in modulating different targets involved in the neurodegenerative cascade of AD. In this context, there is a need to give impetus for the use of privileged scaffolds in discovering potential multifunctional agents for AD treatment. Recently, we have reported a new series of benzylpiperidine derivatives and our findings revealed that compounds **5k** and **5h**, could provide good templates for further pharmacological development in AD therapy. In the present study, we have further made an attempt to decipher some of the key mechanisms behind the multitargeted potential of most active inhibitors (**5h** and **5k**) and their characterization for anti-Alzheimer effects. The combined interpretation of extensive results from biophysical studies involving CD spectroscopy, ThT fluorescence assay and electron microscopy revealed that **5h** and **5k** could reduce or inhibit β -sheet aggregation and fibril formation, thus proved to be the strong inhibitors of $A\beta_{1-42}$ fibrillogenesis. Molecular docking and dynamics simulations studies indicated that these compounds especially **5h**, was found to be effective in inhibiting the toxic conformation of $A\beta_{42}$. Furthermore, compounds exerted neuroprotective action on SH-SY5Y cells towards $A\beta$ and H_2O_2 -mediated cell death and oxidative injury by inhibiting ROS generation. In addition, compounds **5h** and **5k** showed multifaceted effects in attenuating the progression of scopolamine-induced AD-like pathology via decreasing AChE activity, suppression of $A\beta$ levels and ameliorating oxidative stress. Moreover, the neuroprotective characteristic of these derivatives were well supported by neurochemical basis and histopathological findings. Together, the present findings provides novel insights into disease-modifying potential of benzylpiperidine derivatives in the management of AD.



Pharmacological Evaluation of Novel 1-[4-substituted-piperazin-1-yl]-phenyl]-3-phenyl-urea as Potent Anticonvulsant and Antidepressant Agents

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Background : Earlier, we have identified a number of piperazine derivatives having good anticonvulsant activity *in-vivo* and as a part of our ongoing search for potent anticonvulsant agents, we herein describes the synthesis of an aryl piperazine derivative “1-[4-(4-benzo[1,3]dioxol-5-ylmethyl-piperazin-1-yl)- phenyl]-3-phenyl-urea” (BPPU), and “1-{4-[4-(4-chloro-phenyl)-piperazin-1-yl]-phenyl}-3-phenyl-urea” (CPP). The anticonvulsant and antidepressant activity of BPPU and CPP was checked in various *in-vivo* models.

Methods : Anticonvulsant activity was assessed in the maximal electroshock test (MES) and subcutaneous pentylentetrazole (scPTZ) induced seizure tests. Moreover, plausible mechanistic studies were also performed by using several chemical induced seizure models. The antidepressant activity of BPPU and CPP was checked in the forced swim test (FST) and tail suspension test (TST) in mice. The drug safety profile was studied in sub-acute toxicity rat model at a dose of 100 mg/kg, per oral for 14 days.

Results : BPPU and CPP exhibited excellent protection against seizures induced by MES and scPTZ in mice as well as rats. In Pilocarpine induced model of status epilepticus (SE), BPPU and CPP demonstrated good seizure protection in Wistar rats. BPPU and CPP also successfully inhibited seizures induced by 3-mercaptopropionic acid (3-MPA) and thiosemicarbazide (TSC) in mice, thus suggested that BPPU and CPP might influences GABA-ergic neurotransmission in the brain. Moreover, Both compounds showed good antidepressant activity and did not exhibit any significant *in vivo* toxicity.

Conclusion : Both tested compounds displayed a broad spectrum of anticonvulsant activity in several seizure models along with a satisfactory antidepressant activity. Therefore, BPPU and CPP may be further developed as a potential therapeutic agent for therapy of epileptic disorders.



Animal Models for Biological Screening of Anti-Diabetic Drugs : Clinical and Pathophysiological Significance

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Diabetes mellitus, a metabolic disease with abnormal glucose homeostasis leads to development of micro- and macro-vascular complications which contribute to the morbidity and mortality associated with the disease. According to Lancet, China, India and USA are among the top three countries with a high number of diabetic populations. India had 69.2 million people living with diabetes (8.7%) as per the 2015 data of which it remained undiagnosed in more than 36 million people. Prognosis of the disease occur over many years and interventions used today or prevent progression or complications are both time consuming and resource intensive. To better understand the pathogenesis and potential therapeutic agents, appropriate animal models are needed. Animal models develop diabetes either spontaneously or by using chemical, surgical, genetic or other techniques, and depict many clinical features or related phenotypes of the disease. An ideal animal model for study of diabetes will be able to biologically replicate to a major extent the pathophysiology of diabetes or the model should develop complications of diabetes with an etiology similar to that of the human condition. Till now there is no single animal model that encompasses all of these characteristics. Animal models for Type 1 diabetes include animals spontaneously developing autoimmune diabetes or chemical ablation of pancreatic β -cells and Type 2 diabetes is studied in both obese and non-obese animal models with varying degrees of insulin resistance and β -cell failure. In recent years, there is a surge in bioengineered animals, chemicals, viruses and diabetogenic hormones for the study of diabetes. The current study focuses on the various animal models and a comprehensive review of their efficacy to understand the disease.

Keywords : Diabetes Mellitus, Animal Models, β -cells, Insulin resistance, Diabetogenic Hormones.



Anti-aging Bioactive Peptide induced Hormetic Mechanism involving P38MAPK/ NFkB and Nrf2 pathways in aged Fibroblast Cells

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VLPVPQK is a novel bioactive peptide derived from buffalo milk casein exhibits cytoprotective and anti-aging activity. However, the cellular and molecular mechanism responsible for cytoprotective and anti-aging activity is still unclear. Hormesis is an adaptive mechanism generally activated by mild oxidative stress to protect the cells from further oxidative damage. Many phytochemicals have been shown to induce hormesis. The aim of the present study is to investigate the molecular mechanism on how peptide (VLPVPQK) induce cytoprotective and anti-aging activity via hormesis and related signaling pathway P38MAPK in aged fibroblast cells model system. Our result demonstrated that peptide induced a typical hormetic response in fibroblast cells, i.e. low dose of peptide significantly increased cell viability, enhanced antioxidative and anti-inflammatory action compared to known hormetic compound (curcumin) while high dose inhibited cell viability and caused detrimental effects in young and aged fibroblast cells. Moreover, low dose of peptide protected the cells from apoptosis and induces cytoprotective effects. The hormetic and cytoprotective effects exerted by peptide were mediated by downregulating P38MAPK/NFkB and upregulating Nrf2 antioxidative signaling pathways. The present data strongly suggested that the cytoprotective and anti-aging influence of peptide (VLPVPQK) were attributable to the hormetic mechanism via activating cell survival and antioxidative signaling pathway.



Exploring Dual Inhibitory Role of Febrifugine Analogues against *Plasmodium* utilizing Structure-based Virtual Screening and Molecular Dynamic Simulation

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Malaria is an endemic disease caused by the protozoan parasite *Plasmodium falciparum*. Febrifugine analogues are natural compound obtained from the traditional Chinese herbs have shown significant antimalarial and anticancerous efficacy in experimental model. Development of resistance against the existing antimalarial drug has alarmed the scientific innovators to find a potential antimalarial molecule which can be further used by endemic countries for the elimination of this disease. In this study, structure-based virtual screening and molecular dynamics (MD) based approaches were used to generate potential antimalarial compound against plasmepsin II and prolyl-tRNA synthetase of *Plasmodium*. Here, we have docked series of febrifugine analogues ($n = 11,395$) against plasmepsin II in three different docking modes and then it was compared with previously reported target prolyl-tRNA synthetase. Extra precision docking resulted into 235 ligands having better docking score were subject for QikProp analysis. Better ligands ($n = 39$) obtained from QikProp analysis were subject for ADMET prediction and docking protocol validation through the estimation of receiver operator characteristics. In the later stage, 24 ligands obtained from ADMET study were subject for the estimation of binding energy through MM-GBSA and same were also docked against prolyl-tRNA synthetase to get compounds with dual inhibitor role. Finally, MD simulation and 2D fingerprint MACCS study of two best ligands have shown significant interaction with plasmepsin II and homology against known active ligand with noteworthy MACCS index, respectively. This study concludes that FA12 could be potential drug candidate to fight against *Plasmodium falciparum* parasites.



Anti-diabetic Effect of *Lactobacillus* in Streptozotocin induced Diabetic Rats

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The progressive increase in the prevalence of diabetes constitutes a global public health problem. In a recent report by the International Diabetes Federation (IDF), it has been estimated that diabetes affects more than 378 million people worldwide and this figure is most likely to be doubled by 2035. Pharmacological agents that effectively reduce glucose levels are available for the treatment of diabetes; however, they are expensive and are known to have side effects sooner or later. People affected with diabetes may avert the use of anti-diabetic drugs to a larger extent by practicing either proper dietary regime or supplementation of probiotics or both. Probiotics are beneficial bacteria that influence the health of the host by improving their microbial balance. Moreover, modifications of intestinal flora have been associated with alteration in lipid and glucose metabolism. The anti-diabetic effect of probiotics is strain-specific as different strains exhibit different levels of anti-diabetic effects. Therefore, it is important to identify probiotic strains that exhibit significant anti-diabetic effects. In this study, Type 1 Diabetes (T1D) was induced in experimental rats by single intraperitoneal injection of streptozotocin (50mg/kg body weight) and then treated with *Lactobacillus* fermented milk for six weeks. After 6 weeks of experimental period, it was found that diabetic untreated rats exhibited significant ($p < 0.05$) higher fasting glucose, serum lipids profile, AI, CRI and lower serum insulin as compared to the non-diabetic rats. These alterations were reverted to near-normal in group given *Lactobacillus* fermented milk and milk treated groups, the effects were more pronounced in the *Lactobacillus* fermented milk groups compared to the diabetic control. The results indicate that probiotics exhibit hypolipidemic as well as hypoglycemic effects in the streptozotocin induced diabetic rats.



Anti-obesity Potential of Galactomannans : Efficacy to regulate Fat Mass Accumulation and Energy Homeostasis

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Obesity is a major health concern in both, the developed as well as developing countries and is associated with other metabolic disorders e.g. insulin resistance, type 2 diabetes, CVD. Recently, there is increased interest in finding nutritional interventions for obesity management. In the present investigation, effects of two types of functional fibers viz., fenugreek galactomannan (FGM) & locust bean galactomannan (LGM) were examined on diet induced obesity, IR and expression of selected genes related to energy homeostasis in C57BL/6J mice fed high fat/energy dense diet for 18 wk. Both, the body weight as well as epididymal fat were found to be significantly lower as a consequence of incorporation of galactomannans in high fat diet (HFD). Mean adipocyte size also indicated the efficacy of galactomannans. Both fibers were equally effective in resisting the rise in fasting blood glucose, hyperinsulinemia and increase in HOMA-IR score. A decrease in activities of key hepatic enzymes related to glycolysis, and increase in gluconeogenesis enzyme activities due to HFD was visible. Significantly higher pyruvate kinase and decreased PEPCK activities were observed on feeding functional fibers. mRNA expression of adiponectin (related to energy homeostasis), leptin (linked with fat mass) in E. fat tissue, Ppar α & cpt-1 (regulator of fatty acid oxidation) in liver evinced the anti-adiposity effects of FGM/LGM. Expression of pro-inflammatory markers (MCP-1 & TNF α) in adipose tissue further showed the protective effects of fibers. The findings of present investigation suggest that dietary incorporation of galactomannans exhibits anti-obesity potential under high fat diet fed conditions which may be linked with anti-inflammatory effects and also the catabolic effects on host metabolism. Further studies to target the interactions in gut environment in presence of functional fibers and metabolites can be of great relevance to unravel the detailed mechanistic aspects.



Poster Abstracts

Pharmacophore Modeling and Atom-based 3D-QSAR Analysis of Piperidine and Piperazine Derivatives as Acetylcholinesterase Inhibitors

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Background : Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the most common form of dementia affecting elderly population. Defects in cholinergic neurotransmission is considered to be an early event in progression of the disease. Acetylcholinesterase (AChE) enzyme is a key component of cholinergic signaling where it plays major role in the regulation of synaptic neurotransmission. Thus, inhibition of AChE enzyme has emerged as the most viable therapeutic approach for the treatment of AD.

Methods : To elucidate the essential structural elements for AChE inhibition, pharmacophore models were build using PHASE module of Schrödinger software, based on a series of substituted piperidine and piperazine derivatives with well-defined AChE inhibitory activity. Furthermore, pharmacophore models were validated through molecular docking studies using Glide module of Schrödinger.

Results : The best pharmacophore model generated in the present study corresponds to PLS factor five and mainly consisted of five feature AADPR: two hydrogen bond acceptor (A), one hydrogen bond donor (D), one positively charged group (P) and an aromatic ring (R). The pharmacophore hypothesis AADPR.40 was considered to be the best candidate hypothesis which yielded a statistically significant 3D-QSAR model, with a correlation coefficient of $R^2 = 0.9812$ for training set compounds. The developed model was statistically robust with a correlation coefficient of $Q^2 = 0.6344$ showing good correlation between predicted and observed activities for the test set compounds. Furthermore, docking studies with the most active compound **5h** provided significant interactions with the major amino acid residues of *Torpedo californica* (TcAChE) active site and has further emphasized the importance of chemical features present in developed pharmacophore model.

Conclusions : In this work, a 3D-QSAR pharmacophore model of good predictive ability was developed with essential molecular features that may aid in the discovery of potential AChE inhibitors with dual binding mode of inhibition towards AChE active site.



Effect of Homocysteinylation on Intrinsically Disordered Proteins

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Abstract : Homocysteinemia is a condition characterized by the elevated level of plasma homocysteine (Hcy) or homocysteinethiolactone (HTL) in the blood. It is believed that HTL covalently modify lysine residues in proteins (a process called N-homocysteinylation) leading to structural and functional alterations in folded globular proteins. In this study, we have investigated the effect of N-homocysteinylation on the structure and function of intrinsically disordered proteins, α - and β -casein was studied using various biophysical techniques. It was observed that homocysteinylation affects the structure of α - or β -casein in a time dependent manner. During 3 hours incubation, there was no significant effect on the structure and hence on the functional chaperonic properties of both the α - or β -casein. However, at 18 hours incubation, there was dramatic structural alteration leading to the loss of chaperone activities. The loss of chaperone function was also found to be due to the aggregation of the proteins as a result of homocysteinylation. This study provides an insight into the possible role of homocysteinylation in protein aggregation disorders involving IDPs.



Mtb Invasion : Crucial Interacting Partners

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Mycobacterium tuberculosis is a major human pathogen that has evolved survival mechanisms to persist in an immune competent host under a dormant condition. WHO (World Health Organization, 2014) studies indicate almost 9.6 million new cases and 1.5 million TB deaths every year worldwide because of lack of a suitable vaccine or short-course treatment against its causative agent *Mycobacterium tuberculosis*. *Mycobacterium tuberculosis* (Mtb) invades lung phagocytic cells such as macrophages, monocytes, neutrophils and dendritic cells (DCs). Therefore, basic study necessary towards identification of exact mechanism of host-parasite interaction for entry into the host cell and downstream pathways is necessary.

ICAM-1 (CD54) is a type I transmembrane glycoprotein composed of five immunoglobulin superfamily (IgSF) domains, a hydrophobic transmembrane segment, and a short cytoplasmic tail. In addition, ICAM-1 has been characterised as the cell surface receptor for the major pathogens. Using bacterial two-hybrid technique which aims to identify interactions between proteins; two host-pathogen interaction pairs involving ICAM-1 as one of the interacting partner were found. Further, bacterial two-hybrid screen was then performed between ICAM-1 and codon-shuffled dicodon libraries, which yielded ICAM-1 binding novel polypeptide. Role of ICAM-1 in Mtb invasion was further studied using various techniques like confocal microscopy and siRNA mediated silencing.



Synthetic Fabrication of Gold Nanoparticles with Controlled Shape, Size and Surface Functionality

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Purpose : Gold nanoparticles (AuNPs), which are promising building blocks for engineering and tailoring nanoscale structures, have been prepared by different research groups using a variety of methods. They have been used in immunochromatographic identification of pathogens in clinical specimens, photo thermal therapy and drug delivery. Being non-cytotoxic these gold nanoparticles have also been explored as therapeutic agents to increase the efficiency of drug and thus destroying pathogens. The present project aims at synthetic fabrication of AuNP with controlled shape, size, and surface functionality.

Methods : Gold nanoparticles were synthesized by the reduction of tetrachloroauric acid (HAuCl_4) to metallic Au with trisodium citrate ($\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$). Different sizes of gold nanoparticle were obtained when concentration of tetrachloroauric acid (HAuCl_4) and trisodium citrate ($\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 2\text{H}_2\text{O}$) were changed. UV-Vis spectrophotometry (Agilent Cary60 UV-Vis Spectrophotometer, USA) and Zeta Nano-sizer (Malvern instruments, UK) were used to characterise and determine the average size distribution of gold nanoparticles.

Results : In the present study, optimal concentration of gold salt and trisodium citrate along with optimum temperature (150°C) were found to be 0.3mM and 1.0% respectively. Colloidal gold nanoparticles of 33-120 nm size were obtained. The absorption of gold nanoparticle was measured at different wavelengths (390-630 nm) and they showed absorption maxima between 520-560 nm. The negative charge on gold nanoparticles due to citrate ions is important indicator for particle size which was measured as zeta potential of the nanoparticle. In present study, zeta potential of the synthesized gold nanoparticles was highly negative (-9 to -10 mV). The negative charge indicates that the particle size is smaller than 100 nm.

Conclusion : The effects of various experimental parameters (gold salt and trisodium citrate concentration) on its size and size distribution at optimum temperature were investigated. In majority of the published literature on citrate reduction, AuNPs were synthesized from a dilute solution of 0.25mM tetrachloroauric acid (HAuCl_4). In present study the concentration of tetrachloroauric acid (HAuCl_4) was taken between (0.1mM to 0.3mM). But results showed in some colloidal gold solution polydispersity index (PDI) was more than 1.0. Beside this such a concentration yields aqueous AuNPs with low weight content (0.005%) as a disadvantage. So, for good yield of AuNPs the concentration should be more than that of used in the present work (10mM-30mM). Narrow size distribution and small monosize gold nanoparticles also offer advantages for self assembled monolayer formation and enhanced surface area.

Keywords : AuNPs, Zeta-potential, Polydispersity Index (PDI), Spectrophotometry.

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Dietary and Genetic Risk Factors for Coronary Artery Disease in Indian Population

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Abstract : Coronary artery disease (CAD) is the largest cause of mortality and morbidity worldwide and is reaching epidemic proportions in developing countries. Also, CAD occurs at a much earlier age in Indians than any other population. Studies indicate that vegetarian diet, due to its low cholesterol content, may be an environmental factor that may prevent CAD. Strikingly, in India, where a significant proportion of the population is vegetarian, incidence of CAD is very high.

Deficiency of vitamin B12 is fairly common in vegetarians and is also known to be associated with CAD. Current methods of Vitamin B12 estimation do not measure levels of the vitamin in the form in which it is finally absorbed (holoTranscobalamin or holoTC). Levels of Vitamin B12 were estimated in about 450 samples, by ELISA based method that measures levels of holoTC. Analysis performed to determine whether samples showing deficiency of Vitamin B12 by the old method had low holoTC levels as well indicated that individuals having low levels of Vitamin B12 may not always have low levels of holoTC. Correlation of Vitamin B12 levels with levels of known atherogenic risk factors such as LDL, HDL and triglyceride levels has been looked at.

In order to determine the association of CAD with Single Nucleotide Polymorphisms in Indian population, 10 SNPs that have been shown to be associated with CAD were genotyped in about 260 individuals. Analysis to ascertain whether their presence correlates with abnormal levels of various lipid parameters and Vitamin B12 is underway.



Characterisation and Comparison of Different Synthesis Methods of CuS Nanoparticles

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Purpose : In recent years, CuS nanomaterials have been widely used for different applications such as p-type semiconductor, secondary batteries, solar radiation absorbers, blood glucose sensors, biomarker in cancer diagnosis, catalytic activity, detection of DNA hybridization etc.

The current investigation has been aimed to synthesize, characterize and compare the methods of CuS nanoparticles synthesis.

Methods : CuS nanoparticles were synthesized by co-precipitation method (with and without capping agent) using metal acetates as metal source and sodium sulphide as sulphur source. Polyethyleneglycol-4000 (PEG-4000) was used as capping agent. Besides that, CuS nanoparticles were also synthesized by microwave method using different concentrations of copper sulphate (metal source) and thiourea (sulphur source) in a ratio of 1:1 in presence of surfactant SDS (i.e. sodium dodecyl sulphate). Size of the nanoparticles was determined by Zeta sizer nano-ZS (Malvern instruments, UK).

Results : CuS nanoparticles prepared by simple co-precipitation method with PEG-4000 as capping agent and without capping agent showed a size of 108 nm and 298.3 nm respectively. Microwave assisted synthesis of nanoparticles with using different concentration of metal salt (0.1M, 1mM, 5mM) showed best size of 265.5 nm at 0.1 M concentration of metal salt.

Conclusion : CuS nanoparticles with microwave method takes less time as compared to other methods, but size control was found better with the use of capping agents as it inhibits agglomeration. CuS prepared by using PEG-4000 as capping agent showed better results due to less agglomeration. CuS nanoparticles are easy to prepare at higher concentrations. So the concentrated solutions can facilitate the large scale production of CuS nanoparticles. There is no direct use of H₂S in the synthesis of above chosen nanoparticles thereby it helps in reducing the toxicity.

Keywords : CuS nanoparticles, capping agent, PEG-4000, agglomeration.

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Today's Superbug can be Tomorrow's Bioweapon —Multidrug Resistance Microbes

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Abstract : Multidrug resistance (MDR) is defined as insensitivity or resistance of a microorganism to the administered antimicrobial drugs (which are structurally unrelated and have different molecular targets) despite earlier sensitivity to them. Few multidrug resistance bacterial strains are MRSA (methicillin-resistant *Staphylococcus aureus*), Antibiotic resistant *Streptococcus pneumoniae*, Vancomycin-Resistant Enterococcus (VRE) etc. Antibiotic resistance evolves both naturally and can be engineered by implanting drug resistance genes. There are many factors contributing towards antimicrobial resistance in bacteria like incorrect diagnosis, unnecessary prescriptions, improper use of antibiotics by patients, and the use of antibiotics as livestock food additives for growth promotion. The mechanisms by which bacteria become multidrug resistance involve the presence of multidrug efflux pumps (extruding a wide range of drugs), enzymatic degradation of antibiotics, alteration in structure of drug targets etc. These multidrug resistant superbugs could be potentially used as bioweapons. Due to their small size and quick replication mechanisms, they can be lethal agents of biowarfare in near future. They can travel across the globe untraceable, which makes it the biggest threat. Once drug resistance gene is generated, bacteria can transfer them horizontally as well as vertically. Moreover, they cannot be detected until human infection occurs. The diseases caused by them could reach epidemic proportions and may wipe out complete populations as no treatments are available. The biggest concern is to find new tools and techniques to control the spread of antibiotic resistant pathogenic bacteria. A concerted, grassroots effort led by the medical community will be required to address this serious global threat.

Keywords : *Bacterium, Multidrug resistance, Superbug, bioweapons.*



Date Spread

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Abstract : The current treatment approach for the diseases prevention such as cancer and diabetes based on synthetic drugs is expensive, shows unwanted adverse effects; alter the genetic and metabolic pathways. Thus, a safe, effective, affordable approach is needed to control the disease development and progression. Phoenix dactylifera, commonly known as date or date palm, is a flowering plant species belonging to the Arecaceae family. It contains a number of functional and bioactive compounds like carotenoids, anthocyanins, phenolics, antioxidants and dietary fibre. Earlier studies have shown that constituents of dates act as potent antioxidant, anti-tumour as well as anti-inflammatory, provide a suitable alternative therapy in various diseases cure. The fruit has adequate levels of B-complex group of vitamins and vitamin K. It contains very good amounts of pyridoxine (vitamin B-6), niacin, pantothenic acid, and riboflavin. These vitamins are acting as cofactors help body metabolize carbohydrates, protein, and fats. A date spread was prepared using flesh and skin of date palm and seasoned with mango powder, black pepper and black salt. This date spread does not contain added sugar, only natural sugar present in dates is used to give the sweet flavouring to the spread. Dates that is the core ingredient of spread help in curing diabetes mellitus as they contain various active compounds that increases the output of insulin and inhibit absorption of glucose and maintain blood glucose level. Beta D glucan present in date shown the antitumor activity. Earlier studies have shown that constituents of dates such as phenolics and flavonoids act as excellent anti-inflammatory agents. We have developed this new product with the objective of helping people to cure various disease. The presence of pharmacological properties could be due to the presence of high concentrations of minerals and a variety of other phytochemicals of diverse chemical structure. Antioxidants present in date are playing an important role in the prevention of cancers, inflammation, diabetes and cardiovascular disease.



A Combination of Health and Taste — Amla Seasoning

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Abstract : *Emblica officinalis*, locally known as Amla, is a highly nutritious seasonal fruit. Amla tree is found in all parts of India. It is sour and bitter in taste. Amla is a rich source of vitamin C and contains 600 to 750 mg per hundred g of the fresh pulp. The fresh fruits contain about 75% of moisture. The objective of formulating amla seasoning arises from the fact that Amla, due to its extremely sour taste, has low acceptability in its raw form. There are various forms in which amla is preserved and used in households such as sweet tasting products like murabba, chutney, jam, candy etc. These products contain high concentration of sugar and thus unsuitable for diabetic patients. Other include salty products like pickles etc. have salt concentration of upto 10-15% and excessive consumption of these can lead to cell damage through osmosis, hypertension, high blood pressure etc. The product prepared here in is a perfect combination of dried amla powder along with various spices and condiments, salt which gives an amalgamation of sour, bitter, salty and a mild sweet aftertaste, which characteristic of flavor of amla. Also, it is found that vitamin content of dried fruits is not lost considerably. It may be due to the presence of tannins, which retards oxidation of vitamin C. The fresh amla which was suitably ripe, was coarse ground in a grinder to facilitate easy grinding into powdered form in the later stages of preparation and the pulp so obtained was dried in a tray drier. A light green coloured powder with characteristic flavour of amla was thus obtained. It was followed by addition of salt, spices and condiments which are generally used in food preparations in Indian households. Amla is helpful in various health ailments. This product is developed with an aim to improve eye sight and helps in curing sight loss and cataract. It gives relief in cardiac ailments and mental weakness. It is a boon for urinary disorders and helps in curing nocturnal enuresis and urinary bladder stones, removing blood impurities, treats high blood pressure, anemia, jaundice, digestive problems, and keeps diabetes in control. It plays an important role in reproduction due to its ability to control Leucorrhoea (estrogen imbalance). It helps to control hypertension and is vital for immunity. It acts as an antipyretic and helps to alleviate asthma. Amla has potential anti-cancer effects. It helps to control hypertension and is vital for immunity. It prevents liver injury.



An Economical Nanotechnology Approach to remove Pesticides from Waste Water bodies causing Acute and Chronic Toxicity to Human Health

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Abstract : The major sources of drinking water for humans are surface water and ground water. In urban areas water from these sources is pumped to water treatment plant and then to buildings whereas in rural areas individual wells are drilled into aquifer. Pesticides enter into surface water and groundwater primarily as runoff from crops and from industrial activities. Presently only about 10% of waste water generated is treated and rest is discharged into water bodies. Such water which is highly contaminated with pesticides is being used in household activities. Pesticide exposure to humans results in acute or immediate toxicity resulting from short term exposure like nausea, lung irritation, skin rash, vomiting, dizziness and even death and chronic effects that occur due to repeated exposure to small amounts of chemicals which include disorders of the nervous system, cancer, liver and kidney damage, damage to the immune system and birth defects.

Several approaches such as oxidation, fluid extraction, biodegradation, ozonation, chlorination and membrane separation are used for the removal of pesticide from aquatic environment. These techniques do not lead to complete removal of pesticide and further treatments are needed to convert the pesticides into harmless products such as carbon dioxide and water. Hence, there is need to develop an efficient techniques which should be economical and eco-friendly offering high removal rate. In the recent years heterogenous photocatalysis using semiconductor and photon energy has been emerged as a new approach for degradation of pesticides. It is based on the principle that when a semiconductor is exposed to a light source of a particular wavelength the electrons from valence bond are promoted to conduction band leaving the positive holes. The generated electron hole pairs move to the surface of semiconductor and degrades the pesticide into nontoxic product. In the present work we have synthesised nano-composites of transition metal based spinel oxide along with grapheme nano rods that produced a superior photocatalyst for pesticide degradation which utilizes visible radiation from sunlight. The characterization of the nanoparticles was done using transmission electron microscopy and dynamic light scattering pattern. The nanocomposites synthesized were used to degrade chlorpyrifos, a pesticide most commonly found in water, a significant increase in absorbance was observed with increasing concentration of pesticide. This indicates that the nanoparticles have ability to degrade the pesticide and can be used for treatment of waste water.



Bioactive Component Quantification and Inhibitory Activity of *Murraya koeingii* extracts against Key Enzymes linked to the Pathology and Complications of Type-2 Diabetes

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Abstract : Type-2 diabetes mellitus is one of the major health concerns worldwide. It is characterized by chronic hyperglycaemia due to insulin resistance and loss of pancreas beta cells function. Drugs used till date are causing many side effects, hence there have been an inclination towards natural products. Curry leaves have been used from ancient times for its medicinal properties. It has also been used for the management of diabetes. Curry leaves are proven to bring down the increased levels of glucose producing normoglycemia. It also slows down the starch to glucose breakdown in diabetic patients. The present work includes preparation of extracts of *Murraya koeingii* leaves (curry leaves) in various solvents like DCM, hexane, ethanol, and water. They were tested qualitatively and quantitatively for different phytochemicals present in the extracts. The extracts giving promising results were taken forward to test for antioxidant and antidiabetic properties. The analysis gave positive results and have shown presence of many important phytochemicals like flavonoids, saponins, tannins, terpenoids, alkaloids etc. and have shown strong antioxidant property by Phosphomolybdenum and Ferrozine assays and antidiabetic property by inhibition of alpha amylase enzyme and maltose standard assay.

Keywords : Hyperglycaemia, Insulin resistance, *Murraya koeingii*, Normoglycemia.



Design, Synthesis and Biological Evaluation of Novel Diallyl Disulfide derivatives as Potential Multifunctional Agents for the Treatment of Alzheimer's Disease

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Objective : The development of agents that affect two or more relevant targets have drawn considerable attention for their potential advancements in treatment of AD. Diallyl Disulfide (DADS), an active principle of garlic, has been reported to prevent APP processing in AD. But its use is restricted due to its volatile and unstable nature. Based on above understanding, novel DADS derivatives with greater stability were synthesized and evaluated to assess their potential as anti-Alzheimer's agents.

Results : Biochemical evaluation of synthesized DADS derivatives indicated that most of the target compounds exhibit significant inhibition of self-induced and Cu²⁺-induced β -amyloid (A β) aggregation, acted as potential antioxidants and AChE inhibitor. Molecular docking studies and ADMET analysis have further confirmed their efficacy and drug like properties. Furthermore, *in vivo* behavioral studies with best active derivative **compound 7k** showed attenuation of scopolamine-induced cognitive decline in a dose-dependent manner, as revealed by behavioral studies such as elevated plus maze, passive avoidance test and rota-rod test and biochemical estimations like neurotransmitters level and oxidative stress markers.

Conclusion : Taken together, our data indicate that DADS derivatives emerges as interesting anti-Alzheimer's lead compounds with potent anti-A β aggregatory, antioxidant, metal chelating and cognition enhancing effects.



Analysis of Phytoconstituents and Anti-mycobacterial Activity of *Justicia adhatoda* Leaves Extracts on *Mycobacterium Smegmatis* and *Mycobacterium Bovis*

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Abstract : Tuberculosis is an infectious disease caused by *Mycobacterium tuberculosis*, a soil bacteria, which gets transmitted from one person to another by means of air, water and food. The disease is as old as humanity itself, but still is very much of a global threat. According to WHO Global TB report, total 9.4 million new TB cases occur annually worldwide, in which 1.96 million cases come from India. In spite having numerous drug regimens for treatment, disease spreads all over the world. This is due to the fact that the course of TB medication is very long and taxing, causing the patients to leave the course in between, as soon as they feel ameliorated. And the continuous resistance development by bacteria against the drugs due to their long term exposure of on them. This leads to the severity of disease in patients emerging as MDR-TB, XDR-TB and TDR-TB. Moreover, the medicines which are used for treatment are potent and are of broad spectrum, causing much more side effects and also kill gut microbiota. The side effects are so much severe in some cases, that they can cause liver and kidney dysfunction in patients which is fatal. Another major factor is the cost of the whole treatment, which is very expensive and many patients cannot even afford the medicines.

Medicinal plants are proving themselves very much beneficial to mankind regarding the treatment of various diseases. The medicines developed from plants will be very much cost effective and much friendlier for host's body. As TB is a chronic disease, it can be better to use ayurvedic medicines rather than the synthetic one. Different old texts and approaches (Ayurvedic and Unani) pointed out numerous medicinal plants which are helpful in treating the tuberculosis disease. One of a very important plant is *Justicia adhatoda*, also known as Malabar nut tree, on which our present study deals with. Recently, studies on the plant stated its potentiality for anti-mycobacterial activity. Our preliminary study includes *in-vitro* analysis of anti-mycobacterial activity on *Mycobacterium smegmatis* and *Mycobacterium bovis* & isolation and characterization of bioactive compounds which are potent anti-mycobacterial in nature.

The phytochemical profiling of different extracts of *J. adhatoda* leaves was done. All extracts have been screened on *Mycobacterium smegmatis*. Ethanol extract came out to exhibit the best inhibitory effect on *Mycobacterium smegmatis* and have been further purified to obtain alkaloids (on the basis of phytochemical profiling). It was found out that basic alkaloids are more potent than weakly acidic one. Anti-mycobacterial analysis of leaf extracts and the isolated alkaloids on *Mycobacterium bovis* is in midway, which will be followed by bioactive guided fractionation. Further, cytotoxicity of isolated compound on THP1 and A549 cell lines will be evaluated.

Antibacterial and Antimycotic Effects of *N. arbo-tristis* , a commonly used Herbal Remedy in the State of West Bengal, India

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Abstract : Mycobacteriosis is emerging as a major health problem worldwide. Infections are characterized by erythematous or granulomatous inflammation on skin and visceral organs. With increased rate of incidence, the resistance of these mycobacterial species have been documented to be on an increase for different antibiotics like Erythromycin, Amikacin, Amoxicillin, Cefotaxime, Ceftazidime, Levofloxacin etc. To overcome this challenge, plant extracts have been regularly used for prophylaxis and remedy for mycobacterial infections and other related diseases. The current study was conducted to analyze the anti-mycobacterial effect of aqua-methanol extracts of *Nyctanthes arbo-tristis* (Sheuli) leaves. Phytochemical screening of *N. arbo-tristis* flowers and leaves revealed the presence of potential secondary metabolites like carotenoids, alkaloids and terpenoids having important medicinal value. 50 gm of freeze dried leaves were taken in five numbers of 200 mL conical flasks. Methanol and water were added in ratios of 9:1, 7:3, 1:1, 3:7 and 1:9 for each treatment batch. Well diffusion and titre assay was done for analyzing the effects of various dilutions in Middlebrook 7H10 agar supplemented with OADC. *Mycobacterium smegmatis* suspensions were prepared at 1×10^8 cfu/mL along with other strains like *Staphylococcus spp.*, *Escherichia coli* and *Bacillus spp.* Methanol solution and sterile distilled water were used as positive and negative control respectively for each bacterial strain. The antimicrobial activity of the extracts varied for the various dilutions. Crude extract was also used. 7:3 graded extract showed significantly larger ($p < 0.05$) inhibition zones i.e. $12.67 \text{ mm} \pm 0.05$ against *Mycobacterium smegmatis*, $7.3 \text{ mm} \pm 1.2$ against *Staphylococcus spp.*, $17.2 \text{ mm} \pm 0.6$ for *Escherichia coli* and $14.0 \text{ mm} \pm 1.0$ for *Bacillus spp.* respectively whereas 1:9 graded extract was found to show the minimum inhibition against *Mycobacterium smegmatis* ($1.46 \text{ mm} \pm 0.9$), *Staphylococcus spp.* ($2.74 \text{ mm} \pm 6.2$), *Escherichia coli* ($3.52 \text{ mm} \pm 0.56$) and *Bacillus spp.* ($5.09 \text{ mm} \pm 1.4$) in comparison to other dilutions. Crude extracts showed positively significant ($p < 0.01$) result but shelf life was short. Statistical analysis for the treatment groups were done by SPSS which showed significant correlations ($r = 0.743$). The aqua-methanol extracts of the leaves were significantly effective against the mycobacterial strain as well as laboratory samples at $p < 0.01$ in the titre plates. The extract was most effective against *Staphylococcus spp.* and *Bacillus spp.* among others. *E. coli* was shown to be in intermediate state.

The results suggest that *Nyctanthes arbo-tristis* is effective in checking the growth of *M. smegmatis* as well as *Staphylococcus spp.* and *Bacillus spp.* Herbal extracts can be used as a cost effective measure for phytoprophylaxis and concoctions of the extract can be helpful in treating various infections, thus reducing the use of antibiotics.

Keywords : Mycobacteriosis, Herbal remediation, Phytoprophylaxis, *Nyctanthes arbo-tristis* (Seuli).

Comparing the *C. elegans* N2 Strain with the Native ones to Study Behavioral Modifications due to Domestication

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Abstract : The free living nematode *Caenorhabditiselegans* is a major model species that is used in a range of biological research because of its simplicity. In the last five decades, the N2 strains of *C.elegans* have been cultured on a agar Petri plates with OP50 *E. coli* lawns as food source. It has been suggested that through generations, genetic modifications may have been accumulated through continuous laboratory culture. Recent studies have also suggested the genetic changes in *C.elegans* could have accumulated within the time in the siblings in the standard Bristol N2 strain before freezing techniques was developed. Thus the present study is aimed at isolating the native *C.elegans* and comparing them with the standard N2 strain (Lab Bred). The studies suggested that the domestication of strain probably has led to behavioral modifications. Further studies are also needed to ascertain the present hypothesis.



Study Interaction of *Plasmodium vivax* duffy binding Protein (pvdbp) with its Host Receptors the Duffy antigen (Fy) on RBC Surface using Bioinformatics Tools

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Purpose : RBC has several antigens on its surface on the basis of which it can be classified into several blood group system like ABO, MN, Rh, Kell, Duffy, etc. On correlating the effect of these antigens (mainly Duffy) to a specific disease (malaria in our case), we found that Duffy blood group system has antigen (Fy) which has receptors for interaction and invasion by the human malarial parasites *P. vivax* and *P. knowlesi*. It is reported by various groups that Duffy negative individual whose RBC do not express these receptors are believed to be resistant to merozoite invasion. The purpose of the present study is to investigate interaction of *P. vivax* Duffy binding protein (PvDBP) with its host receptor the duffy antigen (Fy) on RBC surface using bioinformatics tools and explore the structure of its proteome to identify key residues and if any site specific mutational changes may inhibit its invasion in the host. This study will help in the design of novel vaccine against malaria.

Methods : Various open source bioinformatics tools were used in the present study :

PHYMLIP : For phylogenetic tree construction of Plasmodium species.

PyMoL : To visualize the available PvDBP II and DARC crystal structures from PDB (Protein data Bank) and also to check the interaction of the PvDBP protein with DARC active site residues. It was also used to explore the effect of mutation of the crucial residues on the protein 3D structure and its potential role in inhibiting the binding.

MODELLER 9.16 : For homology modeling of the protein whose crystal structure is not available in PDB.

Results : The mutation of specific residues at primary interface site of PvDBP II causes great changes in terms of polar as well as hydrophobic contacts established with the neighboring residues, introduced strain and RMSD value deviation. Our study reported the extent to which these mutations affect the binding of RBC with DARC residues. It was found that mutating Y363 and A281 leads to complete loss of binding.

Conclusions : The Duffy and PvDBP interaction primarily allow the invasion of Plasmodium merozoite into the reticulocytes and initiating the cycle of Plasmodium in the RBC,

which is responsible for the progression of malaria. Examining these sequences in primary interface of DARC binding site, mutations (A281, Q356, R274, Y363) suggest the importance of critical residues that may act as a vaccine strategy against malaria caused by *Plasmodium vivax*.

Keywords : Homology modeling, PvDBP, Duffy antigen, DARC

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Mechanotransduction Network and Inter-individual Variations : An Ayurgenomics Approach

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Abstract : The complex interaction of an individual's genetic constitution with the environment determines the overall health. The ability to understand the influence of these interactions on the risk of developing a particular human disease might assist in better prediction and treatment of a disease. Ayurveda, the ancient system of Indian medicine, emphasizes on understanding the inter-individual variability in baseline health states for predictive, preventive and therapeutic medicine which is primarily based on individual's phenotypic assessment like anatomical, physiological, metabolism, psycho-socio behaviour, response to diet and environment, etc. which includes one's body constitution termed *Prakriti*. Ayurveda thus classifies all individuals into different *Prakriti* types based on relative proportion of three physiological entities (Tri-Doshas) with each type having a variable degree of predisposition to different physiological conditions like response to the same environment, vulnerability to a disease, its pathogenesis, course of clinical manifestation and progression. The integration of these principles of ayurveda with genomics is termed as Ayurgenomics – a potential novel approach that aims to achieve personalised mode of treatment.

In this study, we aimed to assess whether different *Prakriti* phenotypes would exhibit variability with respect to mechanotransduction genes (further classified in functional modules — sensors, transducers, effectors). Mechanotransduction is a ubiquitous cellular process that translates mechanical stimuli into biochemical signals in order to be detected, processed and responded, thereby enabling cell to adjust to external environment. A comprehensive resource is being established for carrying out genotype-phenotype correlations with respect to mechanotransduction as no such resource is available so far. Further analysis is being carried out to investigate any correlation of contrasting *Prakriti* types with the genetic variations in the four genes selected from the genes involved in mechanotransduction network.



Therapeutic Yoga : An Integrated Approach towards Alleviating Neurological Disorders

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Abstract : Common neurological disorder, particularly headache, has its roots since the dawn of civilisation which has haunted the mankind till now. It is one of the prominent disorders of the nervous system which despite its worldwide prevalence remains underestimated, underscored and even sometimes neglected by several ones. Transformation of episodic pain into chronic pain is unfortunately more excruciating. Chronic pain is not a symptom, rather a form of disease, developed due to neuroplastic changes in nervous system. Headaches elevate discomfort level when present in comorbidity with serious neurodegenerative disorders. Migraine is one of the most common neurological disorders. A study has documented the association of migraine with dementia. Dementia is a neurodegenerative disease manifested as slow progressive memory loss and cognitive alterations, most commonly found in elderly people. If statistics is taken into consideration then prevalence rates of migraine is around 11-40%. There is a dire need to explore more in this field so that debilitating nervous disorders can be treated, as the present therapeutics are unable to provide desired satisfaction.

The periaqueductal ganglion (PAG) and rostroventromedial medulla (RVM) system forms the root of pain modulation pathway. The existence of “on-cells” and “off-cells” of RVM projects to spinal dorsal horns which govern the positive and negative pain modulations and shows dynamicity due to neuroplasticity. Yoga, a unique method that integrates pathways in central and peripheral nervous system, contributing to the state of calmness, increasing parasympathetic drive, regulating neuroendocrine release and thalamic generators, is attracting eyeballs as a potent multimodal therapeutic. It encompasses various postures (VrakshAsan), breathing (Anlom-Vilom), (Brahmari pranayama) and meditation. It offers plenty of health benefits with highlighted ones being depression, anxiety, stress, memory, cognition and painful conditions. Despite its documented benefits, Impact of yoga on brain connectivity’ and pathways is less worked upon by scientific fraternity. We propose and working on a study which would help in characterisation of changes in connectivity among various brain circuits that are integrated during Yoga to produce behavioural and mental changes. It may result into the association of effect of yoga on RVM/PAG system, governing transformation into chronic pain.

Every individual has different thought processing and emotional level. No two persons can perceive the pain in same ways. Elucidation of these pathways will help in designing tailored therapeutics depending upon individuals’ physiological and psychological connect.

Neuroprotective Potential of Phytomedicines : A Future Prospect for Neurodevelopmental Diseases

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Abstract : Neuroprotection is an umbrella term including various processes to remove noxious stimuli and substances that can damage the brain and/or neuronal cells, thus lead to the onset of neurological disorders. Phytomedicines are potential phytochemicals (polyphenols, alkaloids, terpenes, quinones, flavonoids, catechins, coumarins, saponins etc.) that may alleviate a neuronal disease or disorder.

Brain consumes almost 20% of respiratory oxygen and thus it is susceptible to the oxidative stress. Formation of reactive oxygen species (ROS) can be endogenous or exogenous and it is known fact that superoxides, hydrogen peroxides and hydroxyl radical are produced in the body. To combat against ROS, there are protective physiological mechanisms in the body and such substances are source from the nutraceuticals and phytomedicines through the food cycle. Hypo-production of antioxidant species can create malfunction of bodily functions by interrupting nervous system *e.g.* affecting acetyl cholinesterase activity, while the dietary antioxidants function analogous to *de novo* antioxidants.

Nutraceuticals and phytomedicines have the potential to be taken as neuroprotective agents to reduce the level of damage and antioxidant potential of any neuroprotective plant material. Traditional Knowledge (TK) is the repository of the knowledge, innovation and practice of indigenous and local communities around the world. There are ample examples of Neuroprotective phytomedicines of Indian continent in traditional knowledge, with major examples include such as, *Bacopamonniarae*, *Zingiberofficinalis*, *Sesamumindicum*, *Centellaasiatica* and *Withaniasomniferaetc.* These phytomedicines show specific activities in neuroprotection and thus have potential to reduce the burden of neurodegeneration and delaying of onset of neurodegeneration in humans.



Design, Synthesis and Evaluation of Antidiabetic Activity of New Substituted Alkyl Carboxylic Acid Derivatives

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Abstract : Diabetes is one of the largest global health emergencies of 21st century. According to the IDF Diabetes Atlas 2015, India is home to the second largest number of adults living with diabetes. Current treatments such as metformin, sulfonylureas etc. are deployed primarily to either improve insulin secretion, peripheral insulin sensitivity, or both. In the development of novel insulinotropic agent, GPR40/FFA1 is attractive target because, GPR40 agonists can directly increase Ca^{2+} concentrations in pancreatic β -cells enabling a robust insulinotropic effect, mediate insulin release which is glucose dependent, hence low risk of hypoglycemia and restore or preserve islet cell function. In the current study, a novel series of substituted alkyl carboxylic acid derivatives (101-106 and 201-206) were synthesized and their anti-diabetic activity was evaluated using in vitro assays. The synthetic compounds consist of three different substructures. Every sub structural part was optimized keeping other parts static. The structures of the compounds were confirmed by 1H -NMR, ^{13}C -NMR, FT-IR, and LC-MS. Among all the synthesized derivatives some compounds showed moderate alpha amylase and alpha glucosidase inhibition. ADME profiling of the synthesized derivatives was also done using Schrodinger software. Results of this study suggest that these synthetic compounds can serve as novel molecular templates for construction of potentially anti-diabetic drugs.



Cryptococcus and it's Synergistics with AIDS

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Abstract : *Cryptococcus* is a human pathogen acting both on immunocompetent and immunocompromised individuals, target host varying with species. Cryptococcosis being the fourth most common infection in Sub- Saharan Africa and due to AIDS pandemic holds huge medical importance. In the present study, out of 1000 samples from different 9 environmental sites investigated, soil contaminated with pigeon excreta yielded maximum isolates (34%) followed by soil contaminated by other birds excreta (18%), human urine polluted soil (16%), household garbage soil (12%), soil around hospitals (4%), dairy soil (4%) and Eucalyptus tree (0.8%). Soil contaminated with decaying vegetable and fruits was negative for *C. neoformans var. grubii*. It was interesting to find decaying wood hollows of living trees and Eucalyptus yielding both the varieties of *C. neoformans*, i.e., *C. neoformans var grubii* and *C. neoformans var gattii*. The majority of the isolates in this study were *var grubii* (serotype A), i.e. 72.2%. The other study to ponder upon is there are approximately 11,500 HIV-positive people in the state, according to an estimate of MPSACS. In immunocompetent individuals despite early exposure childhood or environmental exposure of the host to pathogen, they are able to maintain the fungus in the latent state, highlighting its opportunistic behaviour which can act by causing superinfection on the immunocompromised host. Thus we conclude that exposure to nitrogenous sources can lead to transfer of pathogen to host which may be a causative agent or act as a superinfection.

Keywords : Immunocompromised, infection, superinfection, causative, pandemic.



Meditation and Brain-derived Neurotrophic Factor (BDNF) : A putative approach to study towards Neural Plasticity and Neurodegenerative Diseases

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Abstract : Neurodegenerative disease is an umbrella term for an array of detrimental conditions which majorly affect the neurons or network of neurons in the human brain. These neurodegenerative diseases are incurable and debilitating conditions that results in progressive degeneration and/or death of neurons. Such diseases include- Alzheimer's disease (AD), Parkinson's disease (PD), motor neuron disease, Huntington's disease (HD) and many more. There are number of causes that contribute to these disease conditions which are either genetical or environmental.

At molecular level BDNF (Brain Derived Neurotrophic Factor), encoded by member of the nerve growth factor family of proteins, is one of the crucial factor in neurodegenerative diseases as binding of this protein to its cognate receptors, promotes neuronal survival in the adult brain. The expression of BDNF gene gets subsided substantially in Alzheimer's, Parkinson's and Huntington's disease patients. BDNF along with Serotonin (5-HT) are known to regulate synaptic plasticity, neurogenesis and neuronal survival in the adult brain. In that regard number of studies are being conducting all over the world to decipher its role and to develop the possible strategies for enhancement of BDNF level. Similarly, Meditation shows a substantial increase in BDNF level in those who are practicing it from a long time. This practice has shown ample healthy brain ameliorations including the possibility of preventing dementia and improving cognition, by improving the white matter density in the areas of the brain related to cognition. Brain-derived neurotrophic factor has been linked to numerous aspects of neural plasticity in the brain. Stress-induced remodelling of the prefrontal cortex, hippocampus and amygdala has shown the coincides with changes in the levels of BDNF supporting its role as a trophic factor modulating neuronal survival and regulating synaptic plasticity. It's worth enough to unearth the correlations of BDNF with brain neural plasticity and healthy brain.



Evaluating a Hierarchical Scheme of Identifying Novel Multiantigenic Vaccine Candidates of *Chlamydia trachomatis*

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Abstract : *Chlamydia trachomatis* is an obligate intracellular parasite. It is the most common cause of sexually transmitted infections (STIs) throughout the world causing considerable morbidity and mortality. Despite the availability of antibiotic therapy, infection rates are increasing worldwide. This is due to the asymptomatic nature of most infections and the lack of effective screening programs. Vaccination is therefore considered to provide the best means of controlling chlamydial infection, however, till date there are no successful vaccines for chlamydial infection. Traditional approaches used to develop vaccines against this organism are inadequate. In the present study, we decided to devise a computational hierarchical approach/*in-silico* approach for the identification of candidate genes that could be used as Potential Universal Vaccine Candidates (PUVCs). The genome sequence of one of the sequenced strain of *C. trachomatis* was analyzed. We shortlisted a list of secretory, membrane bound and lipoproteins using SignalP4.0, PrediSi, HMMTOP and LipoP online bioinformatics tools from among the proteomic sequences of *C. trachomatis* D/UW-3/CX. Antigenicity of each of the filtered out proteins in these three subgroups was analyzed by using VaxiJen v2.0 antigen prediction server. A total of 16/22 secretory proteins, 4/4 membrane bound proteins and 4/5 lipoproteins proteins with varying VaxiJen scores were shortlisted. These proteins were also evaluated for homologous proteins in Humans in order to decrease the chances of autoimmunity. Further analysis was undertaken for the presence of T cell and B cell epitopes. All of these shortlisted PUVCs possessed both T cell and B cell epitopes, further confirming them to be considered as potential antigens. These warrant further investigation as vaccine antigens in the development of vaccine against *C. trachomatis* infection. The identified antigens include proteins not conventionally believed to be potential vaccine candidates such as hypothetical proteins and housekeeping genes, which include cysteine rich proteins, phospholipase and thiamine biosynthesis lipoprotein. The result has identified several novel antigens that are thought to be capable of stimulating strong immune responses and after proper validation might facilitate vaccine development.



Food Pathogen Detection using Molecular Signature Markers : Progressive Development of the Kit at the “Speed of Light”

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Abstract : Food poisoning and various food-borne diseases are the most common disease nowadays. Millions of people are infected by these food-borne diseases. These diseases infects all age of people. Various pathogens are present on the surface of the fruits and vegetables. These pathogens are not washed away by just simple washing with the water only and they cause very deadly disease in our body. Traditional methods of identification of food-borne pathogens, which cause disease in humans, are time-consuming and laborious, so there is a need for the development of innovative methods for the rapid identification of food-borne pathogens. Recent advances in molecular cloning and recombinant DNA techniques have revolutionized the detection of pathogens in foods. In this study the development of PCR-based technique for the rapid identification of the food-borne pathogens *Salmonella* and *Escherichia coli* was undertaken. Suitable primers were designed based on unique genes of both these organisms. Among the selected genes, we used specific gene *fimA* of *Salmonella* and gene *afa* of pathogenic *E. coli* for amplification (unique marker points). Agarose gel electrophoresis and subsequent staining with ethidium bromide were used for the identification of PCR products. The size of the amplified product was 120 bp and 200 bp for *Salmonella* and *E.coli*, as evidenced by comparison with marker DNA. These studies have established that *fimA* and *afa* primers were specific for detecting *Salmonella* and pathogenic *E. coli*, respectively, in the food samples. Thus an extremely rapid, sensitive and reliable technique for the detection of *Salmonella* and pathogenic *E. coli* was developed. Attempts are being made to develop a multiplex kit covering primarily all the known food pathogens.



Medicinal Properties of Some Indian Seed Spices

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Abstract : The term seed spice refers to the crops, whose dried fruits or seeds are used as spice. Most of the Indian seed spices possess various medicinal properties. Their importance and role as spices is immense. Some of the major seed spices are coriander, cumin, anise, celery, dill, mustard, poppy, caraway, bishop's weed or ajowan, pomegranate, fenugreek, fennel seeds. Coriander possess antioxidant activity, diuretic, anti-convulsant anti-diabetic activity, anti-mutagenic, anti-microbial activity, anthelmintic activity, stimulant, stomachic, refrigerant, analgesic, anti-inflammatory activity. Cumin holds importance in Ayurveda due to its digestive, carminative, astringent, anti-inflammatory, constipating, diuretic, revulsive, and uterine & nerve stimulant properties. [Anise has a spice aroma and liquorice taste. Oil of anise can relieve flatulence and can be added to cough syrups and acts as an antiseptic. Celery has stimulant, tonic, diuretic, carminative, anti-inflammatory activities and thus can be used as home remedy for rheumatism, nervine etc. Dill seeds are used in medicine for its carminative, stomachic, antipyretic role. Mustard is frequently used to relieve joint pain, fever, cough, swelling, and in cleaning the cranial cavity. Poppy seeds are used to cure diarrhoea, dysentery and are said to have therapeutic uses. Caraway seeds (caraway) are used in the treatment of diarrhea, dyspepsia, flatulent indigestion and improve liver function. [Ajowan is much used as a medical plant to protect against diseases of the digestive tract and fever and act as antiasthma, antibronchitis, pain killer, wound healing, antiinfluenza and mouth disorders. It is a domestic remedy for indigestion. Pomegranate seeds and pulp are stomachic and cardiac respectively. It has astringent, cooling, tonic, aphrodisiac, laxative, diuretic effect and can be used in pectoral diseases, dysentery, diarrhoea, vomiting. Fenugreek reduces inflammation and has gastro protective effect. Fenugreek seeds can lower serum cholesterol, triglyceride, and low-density lipoprotein in humans. Fennel is a medicinal herb with anti-inflammatory, antispasmodic, antiseptic, carminative, diuretic and analgesic effect. It cures gastrointestinal disorder treatment. It is used to treat neurological disorders due to its anti-oxidant and anti-ulcer properties. The article reflects the importance of these seed spices in medicine. The purpose of the review paper is to provide a comprehensive view of multiple functions of Indian seed spices and their health benefits.



Edible Food Packaging — A Solution for Reduction of Plastics in Food Packages

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Abstract : Plastic and plastic made articles which we use in our day to day life, are grave health hazards as they degrade not only environment but also affect human and animal life. According to the International Organization for Standardization (ISO), the plastic production was 322 million tons in 2016, 22-24% of the plastics is disposed on land worldwide and approximately 10-20 million tons of plastic end up in the ocean every year. According to Central Pollution Control Board, India generates 5.6 million metric tons of plastic waste annually. On one hand, Plastics are non-biodegradable and release toxic components as they breakdown which is a potent source of environment contamination, on the other they are responsible for causing serious health disorders in humans such as **cancer, birth defects, skin problems, impaired immune dysfunction etc.** The International Medical Organization in the field of endocrinology and metabolism reported that **BPA** migrating into foods from plastic packages can affect the hearts of women and appear to be entering the human body from unknown sources. This problem can be overcome by replacing plastic packages with edible packages, i.e. packages that can be eaten which are available in the form of starch based wrappers, casein films, fruits casings etc. These packaging materials can be produced by utilizing by-products of food industry such as peel, fruit pulp etc. Moreover, such edible packages reduce non-biodegradable plastic waste and also, prevent the growth of mounds of refuse.



Evaluating the basis for Resurgence of Tuberculosis

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Abstract : Recognised as the deadliest disease of the 19th century, Tuberculosis, has been responsible for the death of millions of people during the 19th and early 20th century. The year 1921, saw a huge advancement in the prevention of the disease, due to development of Bacillus Calmette-Guérin (BCG) vaccine by Leon Calmette and Camille Guérin, effective against the transmission of pulmonary Tuberculosis. In the 1940s and 50s, the discovery of Streptomycin and Isoniazid, and later Rifampicin in 1967, brought about revolutionary changes in the chemotherapy of Pulmonary Tuberculosis. Both, the vaccine and the drugs, being used in conjunction, WHO undertook a first of its kind campaign to control tuberculosis, vaccinating 14 million people by 1951, leading to a huge decline in the incidence of tuberculosis throughout the world as the risk of infection decreased by 13% annually and 80% cure rates in field conditions. However, recently Tuberculosis has resurged as one of the major global killers, responsible for the death of 1.5 million people in 2014 alone. This discrepancy can be attributed to the waning effect of BCG vaccine within 10-15 years of its administration leaving the adult population susceptible to re-emerging bouts of LTBI. BCG vaccines have also proved to be ineffective for individuals with prior mycobacterium infection (in the form of NTM and Mycobacterium avium infections) as the magnitude of BCG induced immune response is highly diminished. Usually considered as easily treatable, recent years have seen development of MDR (Multiple Drug Resistant) and XDR (Extensively Drug Resistant) strains of TB leading to 60-70% of the cases observed in South East Asia being caused by MDR-TB while the rest are equally proportioned into XDR and pan susceptible strains. In the present study we are elucidating the different factors responsible for resurgence of *Mycobacterium tuberculosis* in the context of an epidemiological distribution.



Emotion Mapping and Neurotransmitters — A New Way to look at Psycho-diagnosis

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Abstract : Emotions significantly influences the way we perceive any situation, affecting our ability to make decisions and take actions. Every emotional experience instigates brain activity in specific regions. This activity is common for the same emotion in different people. Emotion mapping allows us to monitor and analyze these activities, using either fMRI (functional Magnetic Resonance Imaging) or PET (Positron Emission Tomography) scans, enabling us to better understand the role of emotions or lack thereof, in relation to behavioral and cognitive diseases prevalent today. A vast and protean collection of data is be required to reach a conclusive and thorough correlation of brain mapping with different emotions. Different regions of the brain, triggered by different neuronal activity and neurotransmitter release has to be studied extensively using a large and diverse This technique will further our knowledge about the intensity and reactivity of diseases and how they are affected by varying conditions, for example in cases of addiction, social anxiety, etc. In our present study, we are analyzing a wide population of brain scan data and finding correlations for neurotransmitter and MRI scans with different emotions. A deeper understanding will ultimately carve a path for novel methods of diagnosis and treatment, giving more people the opportunity of living a normal and healthy life.



Tumor Cells no Lame Dog, Tumors modulating their Killers

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Abstract : NK (Natural Killer) cells occupy a unique position in the immune system, owing to the fact that they possess traits characteristic of both the innate and the adaptive immune systems. The regulation of NK cell activity depends on the balance between the stimulation of two sets of receptors — activating and inhibitory. MHC-I (Major histocompatibility complex-I) expressed by all nucleated cells stimulates the inhibitory receptors on NK cells thus preventing autoimmunity. Some tumors downregulate the expression of MHC-I in order to evade T cells, which makes them a potent target for the NK cells. Our study has shown the involvement of certain ligands other than MHC-I in the regulation of NK activity. Certain tumor-derived factors present on YAC-1 (NK susceptible tumor) exhibited strong binding to the known activating receptors on NK, whereas, a set of tumor-derived factors present on P815 (NK resistant tumor) exhibited strong binding to known inhibitory receptors on NK. The present study involves a comparison of NK activity when cultured in the presence of NK susceptible vs. NK resistant tumor cell lines. A significant role in immune regulation is played by the microenvironment of tumors during the initial stages of their development and certain tumor derived factors are even capable of modulating mature NK cells. However, the molecular mechanisms involved in these processes are yet to be understood completely. This study intends to unearth those molecules present on the surface of tumors, which effectively modulate the activity of NK cells. The knowledge of the same can be applied in the development of combinatorial therapies involving NK cells.

Keywords : MHC-I, NK cells, cytotoxicity, receptor profile, tumor microenvironment.



Application of Machine Learning in Medicine

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Abstract : With a complex and rapidly evolving domain like biology comes huge data which needs to be analyzed, interpreted and acted on to be useful. Machine learning technique serves this purpose. Machine learning is one of the major branches of artificial intelligence and also the most rapidly developing subfield. It provides a variety of statistical, probabilistic and optimization techniques and tools that utilize previously entered data, primarily to make better decisions and accurate predictions, and therefore has vastly improved understanding of the human genome. Machine learning methods may help in the integration of computer based system in healthcare environment providing opportunities to facilitate and enhance the work of medical experts and ultimately provides predictions about risks and future outcomes.

Conventional techniques are not sufficient enough to allow us to gain a casual understanding of the underlying disease mechanism, including gene-gene and gene-environment interactions. Availability of medical data and the difficulty in performing medical tasks have made it desirable to employ machine learning methods in medicine. Precision health is the future of medicine and one of the major applications of machine learning is providing personalized predictions for individual patients based on their unique histories and trajectories and in optimizing the use of diagnostic tests to make diagnosis. Various applications of machine learning include extraction of medical knowledge for outcome research, for therapy planning and support, for overall patient management, tracing the similarities in complex registration tasks and image understanding, organ localization, learning of anatomical shapes, tissue classification and computer aided diagnosis. Hence, machine learning can alleviate the burden of solving many biological problems and is the most time saving and cost effective method.

With the combination of enormous amounts of medical patient data with such powerful machine learning data-analytic algorithm, there may be pronounced development in medicine and transition from a static to a dynamic and personalized approach for patient treatment.



Understanding the Genetic Involvement in Acute Myeloid Leukaemia (AML)

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Abstract : Cancer has been described as an evolutionary process parallel to Darwinian natural selection. Complex organisms have evolved highly efficient systems to protect their cellular genomes from accumulating DNA mutations; however, such mechanisms are not impenetrable and cells slowly accumulate mutations over time, even in the absence of identifiable exogenous mutagens. The change from a normal to a cancer cell requires acquisition of multiple somatic mutations that imparts the potential for limitless self-renewal, although it is recognized that in leukaemia this capacity is often restricted to a sub-population of tumour cells, known as the cancer or leukaemia stem cells (CSC/LSC).

Acute myeloid leukaemia (AML) is an aggressive malignancy characterized by a block in myeloid differentiation and uncontrolled proliferation of abnormal myeloid progenitors that accumulate in the bone marrow and blood. Some cases develop from other haematopoietic disorders or follow genotoxic therapy for unrelated malignancies, but most arise de novo. Several genetic markers have been identified to stratify patients into prognostic groups, which are used to guide treatment decisions. Although chemotherapy results in high rates of remission, the majority of patients relapse and the overall 5 year survival is only 40–45% in young patients and less than 10% in the elderly. Presently, we propose to understand the events and processes underlying the genetic evolution of AML with an attempt to understand and improve anti-AML therapy. The observed variations in AML patients are suggestive of sequence polymorphisms in SRSF2 gene playing a pivotal role in AML. SRSF2 protein encodes is a serine/arginine (SR)-rich family of pre-mRNA splicing factors, and mutations therein are indicative of loss of or altered gene splicing and regulation in cancer cells.



Complexity of Repeat Sequences in Differential Genomes of Plant/animal infecting Viruses

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Abstract : A typical prokaryotic genome can now be sequenced in less than a day and the now is on extracting maximum information from these sequences. This includes discerning the distribution of various types of sequences present in the genome, coding and non-coding, simple and compound microsatellite and other satellite sequences. Amongst these the simple sequence repeats or microsatellites have evoked great interest owing to the establishment of its increasing presence across different species in both coding and non coding regions. The repeat sequences are known to be responsible for regulation of gene expression at transcriptional and translational level or even by gene silencing and with their potential; to act as recombination hot spots in viral genomes and shape their evolution its quintessential to have an exhaustive knowledge of the repeats composition (mono-nucleotide, di-nucleotide and so on); presence as compound microsatellites (cSSR); comparative distribution across coding/non-coding regions and correlation with genome features (size, GC content), if any. Present proposal would undertake the analysis of viral genomes enlisted from the databases of International Committee on the Taxonomy of Viruses (ICTV) and NCBI using Imperfect Microsatellite Extractor (IMEx) software. A comprehensive compilation of the same would be carried out based on the annual ICTV reports and the extracted data would be used to build viral specific database for simple sequence repeats.







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