NCEHST-2022

1st National Conference on

Emerging Horizons in Science & Technology

26& 27th December 2022

Organized by

Faculty of Science & Technology (FOST)

University of Central Punjab

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1st NATIONAL CONFERENCE ON EMERGING HORIZONS IN SCIENCE AND TECHNOLOGY

26-27 DECEMBER,2022

(NCEHST-2022)

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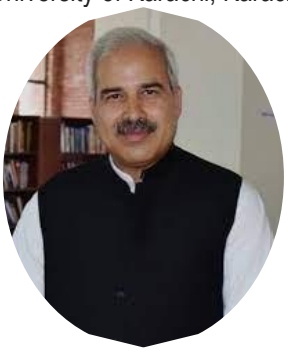

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MESSAGE BY PATRON IN-CHIEF

In the Name of Allah, the Merciful, the Beneficent. Praise be to the Lord of all worlds. Prayers and peace be upon our Prophet, Muhammad, his family and all of his companions. It gives me tremendous contentment to be presiding the 1st National Conference on Emerging Horizons in Science and Technology (NCEHST-22). The conference is an amalgamation of different scientific disciplines and is a platform for presenting innovative research work in many areas simultaneously. This multi-faceted event will provide important contributions for building "a better society". As a part of society, it is our responsibility to improve it. This event focuses on academia and industrial linkages to share innovative ideas, recent trends and future directions in the field of science and technology. It is an honour to have academic experts, researchers, entrepreneurs and students from various universities and Industries from different parts of the country share their knowledge simultaneously. I am sure that this conference would greatly benefit young scientists, entrepreneurs and researchers. The conference aims to provide a stage for researchers and practitioners from academia and business to learn about the efforts and the state-of-the-art advancement in science & technology aligning with the UN's Sustainable development goals

MESSAGE BY DEAN, FACULTY OF SCIENCE & TECHNOLOGY

In the name of Allah, most gracious and most merciful. To whom we belong and to whom we will return. "The 1st National Conference on Emerging Horizons in Science and Technology (HST -22) aims to achieve its objective of providing an effective forum for academician, researchers, and practitioners to advance their knowledge, inculcate new ideas in research and technological advancements in multi-disciplinary fields of Biotechnology, Bioinformatics, Microbiology, Biochemistry, Chemistry, Nanomaterials, Drug Design, Physics, Food Science & Technology, Human Nutrition and Mathematical Sciences. The conference organized has a vibrant scientific program presented and presided over by highly respected and internationally notorious speakers. Some interesting new developments and advanced techniques will be highlighted and we hope everyone participating will take away new ideas for academic research and entrepreneurial ventures.

MESSAGE BY CHIEF ORGANIZER / HOD BIOTECHNOLOGY

In the name of Allah, the Most Beneficent and the Most Merciful. May peace, mercy, and blessings of Allah be upon you. The focal drive of 1st National Conference on Emerging Horizons in Science and Technology (NCEHST-22), is to exchange ideas and by participating in this exchange, it is hoped that all participants who may benefit from the conference can apply it in managing activities in their areas of research and business. It is pleasing to note that the agenda of this conference covers a wide range of interesting topics related to all theoretical and practical aspects, but not limited to Biotechnology, Bioinformatics, Microbiology, Biochemistry, Chemistry, Nanomaterials, Drug Design, Physics, Food Science & Technology, Human Nutrition and Mathematical Sciences. The discussion on the latest innovations, achievements, trends, practical problems and challenges we face in these areas will harmonize National Academic & Industrial efforts to contribute towards the UN's sustainability goals.

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KEYNOTE SPEAKERS

EXPLORING THE DIVERSE WORLD OF MOBILE GENETIC ELEMENTS

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The mobile genetic elements (MGEs) or transposable elements (TEs) are the DNA segments having the ability of intra- or intercellular mobilization. They are the most copious elements covering few to 85% of the host genome. In addition to their own core genes, they capture some other important functional genes, endowing their host with resistance to pathogenicity, antibiotics, salts, stresses, and metabolism of new substrates. With their active mobilization within host genomes and capturing these functional genes, they contribute genome size duplication, evolution, diversification, and plasticity. The current work explored the identification, molecular characterization and diversity of superfamilies of MGEs in selected genomes using bioinformatics, molecular and cytogenetic techniques. The superfamilies of MGEs were identified by using different softwares like LTR_STRUC, LTR_Finder, JDotter, Dot plots, MITE-Hunter and few others. Among the MGES, the retrotransposons sub-classes LTR retrotransposons (Copia, Gypsy), and Non-LTR retrotransposons (SINEs and LINEs) predominated in plant and animal genomes, while the identified DNA transposons were represented by CACTA, hAT, Harbinger, Mariner, Mutator, MITEs and some unknown/novel superfamilies. The superfamilies like Helitron, Politron and Maverik were rarely observed in plants, but were found proliferating in animal genomes. The PCR characterization of reverse transcriptase (RT) of Retrotransposons and transposase (TNP) of DNA transposons showed their distribution patterns within various plants (Brassica, Banana) genomes, where some elements are genera specific, while others were mobilized by horizontal transfer. The fluorescent in situ hybridization (FISH) confirmed the random and patchy distribution on host chromosomes. The phylogenetic analysis of these elements segregated them into superfamily and family specific lineages, while others clustered together showing homologous sequences. The results enabled the Identification, annotation, distribution, evolutionary dynamics/diversity and understanding of structural features of full-length MGEs and their derivatives in various plant and animal genomes.

Keywords: *Brassica*, Mobile Elements, Genome, Retrotransposons, Gypsy, Evolution.

FUNCTIONAL NANOMATERIALS – TUNING THE SIZE AND SURFACE CHEMISTRY FOR APPLICATIONS IN RENEWABLE ENERGY TECHNOLOGIES, BIOMEDICAL AND ENVIRONMENTAL SCIENCES

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The unique chemical and physical properties of nanoscale materials have triggered much scientific interest to explore their potential applications in biomedical sciences, energy technologies, agriculture, environment, catalysis and industry etc. The chemical and physical properties of metal/ metal oxide nanoparticles can generally be tuned by controlling their size, shape and surface chemistry. In this regard, we have developed several reproducible protocols based on chemical reduction and precipitation approach to prepare functionalized metal/metal oxide nanoparticles from subnanometer to over 100 nm in aqueous/organic media with decent control over their size, shape, and surface chemistry. Many of these metal nanoparticles have been used as building blocks to design/synthesize new nanostructured materials using template-based and template-less strategies. The functionalized metal/metal oxide nanoparticles/nanoclusters possess interesting optical, recognition and catalytic/bio-catalytic properties and currently, we are focusing on the applications of these nanoparticles and nanocomposites in biomedical sciences (i.e., bio-sensing especially bacterial detection, bio-imaging, drug delivery, killing drug-resistant bacteria), environmental remediation (detection and removal of organic/inorganic pollutants from water, CO oxidation, and CO2 capture and conversion) and renewable energy technologies (mainly H2 production & storage and electrode materials for batteries). This talk would, therefore, be a brief overview of interdisciplinary research activities of Functional Nanomaterials Group at LUMS to synthesize customized inorganic/organic nanoparticles with tunable size and surface chemistry, and their composites having unique chemical and physical properties, and subsequent applications in biomedical sciences, environment, catalysis and renewable energy technologies.

Keywords: Drug delivery, functional nanomaterials, composites, renewable energy technologies

IDENTIFICATION OF GENES IN PAKISTANI FAMILIES WITH NEXT-GENERATION SEQUENCING (NGS)

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Inherited disorders are under vigorous investigation in last two decades and in this regard significant progress has been made by using the next generation sequencing (NGS). More than 100 types of rare disorders have been reported from Pakistan, but unfortunately, majority could not be diagnosed in the currently available health facilities. For this reason, genetic testing is an attractive alternate for the quick identification of the underlying gene. NGS has been extensively used to analyze Pakistani consanguineous families with various types of inherited rare disorders. The consanguineous families are a useful resource for the identification of autosomal recessive disease-causing gene by applying homozygosity mapping and whole exome sequencing (WES). The successful application of these techniques has identified large number of genes for rare disorders like hypotrichosis, retinal dystrophies, intellectual disability and ectodermal dysplasia. Our results from several rare disorder families highlight the implications of the consanguinity for the disease gene identification. So, in this work we will present data of different families with inherited disorders to highlight the importance of workflow required for the identification of disease-causing genes.

Keywords: inherited disorders, consanguineous, next-generation sequencing, variant, homozygosity mapping

DROSOPHILA MELANOGASTER: MODEL OF THE MODELS

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Since the early part of 20th century, Drosophila melanogaster has been extensively used as a model organism in the field of classical genetics. Over the period of time its usage has been expanded to resolve the cellular and molecular intricacies of developmental biology, pathology and pathogenesis. On the applied side, D. melanogaster are in use to screen drugs and potential bioactive compounds of different indication and contraindications. Despite the evolutionary divergence of over 800 million years, genomic architecture of the fruit fly bears uncanny similarities with that of humans. Shorter generation time, fast reproduction rate and traceable traits favors D. melanogaster over many other commonly used model organisms. At Dow University of Health Sciences, a dedicated fly lab has been established nearly two years ago which has been extensively upgraded over the period of time and now transformed as Dow Fly Research Lab and Stock Center. Several studies are currently undergoing at the campus involving fruit fly for example development of thrombosis model in the fruit fly for the screening of anti-thrombotic agents, long term effects of antibiotics usage on aging, screening of Chinese and local herbal medicine, development of the carcinogen detection system in the fruit fly and quantifying the anatomical, behavioural, physiological and developmental errors due to consanguineous breeding. This talk will highlight some of the interesting observations that we have made in this year and its relevance to human biology.

Keywords: Model organisms; Drosophila; Human biology; thrombosis model

EXAMINING THE MISCONCEPTIONS AND BELIEFS ABOUT CANCER AMONG PAKISTANIS: FROM ARTIFICIAL SWEETENERS TO CELL PHONE USE

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Lifestyle modifications could prevent almost one-third to one-half of all cancer cases. The awareness of cancer risk factors could motivate people to make such changes in their behaviors and lifestyles. This work aims to investigate the cancer awareness level in the Pakistani population. Telephone interviews of 657 individuals in Pakistan were carried out using the Cancer Awareness Measure (CAM) and Cancer Awareness Measure-MYthical Causes Scale (CAM-MY). We observed that participants scored significantly better on the CAM scale than the CAM-MY scale, and CAM scores were negatively associated with CAM-MY scores. Years of formal education or a biology major at undergraduate or graduate level did not affect our population's cancer awareness levels. Age displayed a weak but statistically significant negative association with CAM scores. Most participants failed to identify modifiable cancer risk factors, e.g., low physical activity. Efforts should be made to improve awareness of modifiable risk factors. We observed that brief training sessions could markedly improve people's understanding of cancer risk factors and myths.

Keywords: Cancer Awareness Measure; Cancer Awareness Measure–MYthical Causes Scale; Cancer Risk Factors; Cancer Prevention; Cancer Causes

REALITY OF BLACK HOLES

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This talk is mainly focused on some interesting compact objects so-called black holes and gravastars. I would briefly review the Einstein theory of general relativity which is necessary to understand such objects. This would lead to investigate the effects of gravity on spacetime. We can then discuss the classification, formation, and characteristics of black holes. How do we see/detect black holes? A gravastar is also known as an alternative to a black hole and is expressed by three distinct domains named as the interior domain, the intermediate shell, and the exterior domain. I would discuss these domains briefly.

Keywords: Black holes; Einstein Theory of Relativity; Compact objects

FOOD SYSTEMS TO ENSURE FOOD & NUTRITION SECURITY FOR THE WORLD POPULATION: RECENT TRENDS

Prof. Dr. Imran Pasha

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The rising trend in the world's population growth implies that by 2050 it would reach 9.7 billion. Supporting the food and nutritional needs of such massive population will be the ultimate challenge. Food and nutrition security includes consistent availability and affordability of the food, provision of adequate health care and safe environment to improve health and reduce diseases. Technological upgrading and modernization of food systems is the need of time as it would help in targeting the various parameters of food and nutrition security. Shifting the consumption trends from animal diet to plant diet could prove to be an effective strategy. As idea of food has changed from being just a source of calories to being a substance that prevents diseases, therefore an environmentally friendly food system is needed that not only generates adequate but healthy and nutritious food. This progression is quite complex and intricate. Firstly, the effective use of resources and valorization of food waste as new foods is required. Secondly, the incorporation of new approaches that would increase the food production is also very important. These approaches include vertical farming, cellular agriculture and genetic engineering. Ensuring food security would be beneficial in eradicating malnutrition as these are interrelated. The sustainable development goals focus on various parameters targeting the problems of food and nutrition security. These goals need to be incorporated in the development of food systems so that a better outcome is obtained.

Keywords: Food Security, Nutrition Security, Environment Friendly, Modernization, Waste Valorization

THE CLIMATE CHANGE: THE ROLE OF FUEL CELLS AND CHEMICAL LOOPING

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Since the industrial revolution the climate issues especial global warming has been increased because of greenhouse emission which leads to the many concerns all over the world. The CO_2 has the major contribution among other greenhouse gases. There are several technologies that have been introduced to tackle these issues; among these, carbon capture and storage has the potential for significant reductions in emissions and thus great impact.

Chemical-looping combustion (*CLC*) has been proved a very attractive and effective technology to mitigate climate issues with, inherently separation of CO_2 during the combustion of solid and gaseous fuels through the oxygen lattice of oxygen carriers (*OCs*) in preference to molecular oxygen. Another is fuel cell technology. The development of fuel cell is the only way to mitigate the effects of climate change and its unprecedented impacts on society. The development of advanced energy technologies has a big challenge. There are many energy technologies, but research activities on fuel cell technology in Pakistan have been reviewed and it is also discussed how this technology can resolve the current energy crises in Pakistan and can be the source of sustainable energy. It has been also reviewed that the country would greatly benefit from clean energy devices e.g., Fuel Cells.

Keywords: Clean energy devices; Climate change, Fuel cells, Chemical looping

INVITED SPEAKERS

METAL NANOCATALYST: CONTROLLED SYNTHESIS, MORPHOLOGICAL STUDY AND CATALYTIC PERFORMANCE

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Currently world is facing tremendous issues concerning the atmosphere, energy, and the environment. Catalysis innovations have all the earmark of being critical to energy, synthesis process, and environmental areas. In the recent years, transformation of the research on catalytic activities and advanced catalyst was seen with the advancement of nanotechnology.

Nano catalytic structure permits the rapid, specific chemical conversion with higher yield combined with the simplicity of catalyst separation and recovery. Recovery of catalyst is most significant qualities of any catalyst before being adequate for green synthesis processes at industrial level. Furthermore, at the nano scale, the interaction between reactants and catalyst enhanced significantly. Insolubility in the reactive solvents makes the catalyst heterogeneous and that can be easily separate out effectively from the reaction mixture.

Metallic Nanostructures (NCs) has been emerging as a new type of efficient materials. As catalytic properties are dependent on their physical/chemical factor, strategies for their controlled synthesis and the understanding of performance relationships have received great attention. In this work, we will discuss developments on well-defined noble-metal nanoparticles focusing on relationships between performance and physical/chemical features. We begin with control over shape, composition, and size. We will discuss how to the control over their composition, size, and surface morphology relate to catalytic performance

Keywords: Nanoparticles, catalyst, noble metals, LPD method

ROLE OF *SIRT1*-MEDIATED AUTOPHAGY IN TESTOSTERONE BIOSYNTHESIS

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Testosterone is the male sex hormone that supports the development of masculine characteristics and male reproductive system. It is mainly produced and secreted by the Leydig cells, and its deficiency may lead to primary or late onset hypogonadism (LOH) impairing the social life of the patients. SIRT1 is one of the members of NAD-dependent protein deacetylase which regulates multiple cellular functions such as metabolism, apoptosis and autophagy. While the functional role and underlying mechanism of SIRT1 in testosterone biosynthesis is yet unknown. In the present study, we have shown that steroidogenic cell-specific Sirt1-knock out resulted in reduced testosterone serum level and affected the sexual behavior of the mice. The reduction in testosterone was found to be a result of cholesterol uptake defect in Sirt1-deficient Leydig cells. Further analysis showed that Sirt1-deficiency resulted in Na+/H+ exchanger regulatory factor 2 (NHERF2) accumulation that down-regulated the scavenger receptor class B, type I (SR-BI) ultimately impairing the cholesterol uptake in the Leydig cells. Together, we found that SIRT1 promotes testosterone biosynthesis via mediating the autophagic breakdown of NHERF2 that boosts SR-BI activity and cholesterol uptake to fuel steroidogenesis.

Keywords: Autophagy, Leydig cells, Sirt1, Steroidogenesis, Testosterone biosynthesis.

TRAVELLING WAVE, SOLITARY WAVE AND SOLITON SOLUTIONS OF NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

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The modified auxiliary equation approach and the generalized projective Riccati equation method are used to solve Zoomeron equation which provided different types of exact traveling wave solutions, including some new dynamical behaviors. The governing model covers unique examples of solitons with distinct properties that emerge in a variety of physical situations, including laser physics, fluid dynamics and nonlinear optics. The achieved exact traveling wave solutions include solitary wave, periodic wave, bright, dark peakon, and kink-type wave solutions.

Keywords: Zoomeron equation, Riccati equation method

ON HOMOTOPY INVARIANTS

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Homology is a structure-preserving map between the worlds of topological spaces and algebraic structures.This structure-preserving map is called a functor and there is a rich (categorial) theory underlying this mapping. Questions about topological spaces can sometimes be translated into questions in algebra and vice versa.

In the first phase, we will introduce homology intuitively using some combinatorial concepts. For a given topological space X, we have a sequence of homomorphisms of abelian groups called chain groups. The nth homology group consists of the n-dimensional cycles "modulo" the n-dimensional boundaries of the topological space X. So we define an nth homology group as an n-dimensional cycle that is not a boundary of a contractible space. These quotients are abelian groups that describe the topological space. Moreover, the dimension of these abelian groups detects topological invariants to characterize a given topological space and we call them Homotopy Invaraints. The 3-dimensional sphere is the surface of a 4-dimensional ball just like a 2-dimensional sphere is the surface of a 3-dimensional ball and we don't have a good intuition about four-dimensional objects, so here we try to understand them and their surfaces by triangulation.In the second phase, we will move on to more general machinery known as simplicial homology where we will compute the homology groups of a torus, Klein bottle, and a 2-sphere.In the third phase, we will see the power of the fully general theory of singular homology with some nice applications.

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Keywords: Homotopy, Abelian groups, Homology Groups, Spanning Trees, Simplicial and Singular Complexes

BIOLOGICAL IMPLICATIONS OF EMOTIONAL STRESS IN FUELING BREAST CANCER METASTASIS

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Emotional stress is believed to be associated with increased tumor progression. Stress-induced epigenetic modifications can contribute to the severity of disease and poor prognosis in cancer patients. The current study aimed to investigate the expression profiles along with the prognostic significance of psychological stress-related genes in metastatic breast cancer patients, to rationalize the molecular link between emotional stress and cancer progression. We profiled the expression of selected stress-associated genes (5-HTT, NR3C1, OXTR, and FKBP5) in breast cancer including the stress evaluation of all participants using the Questionnaire on Distress in Cancer Patients–short form (QSC-R10). A survival database, the Kaplan–Meier Plotter, was used to explore the prognostic significance of these genes in breast cancer. Our results showed relatively low expressions of 5-HTT ($p = 0.02$) and OXTR ($p = 0.0387$) in metastatic breast cancer patients as compared to the non-metastatic group of patients. The expression of NR3C1 was low in tumor grade III as compared to grade II ($p = 0.04$). Additionally, the expression of NR3C1 was significantly higher in patients with positive estrogen receptor status. However, no significant difference was found regarding FKBP5 expression in breast cancer. The results suggest a potential implication of these genes in breast cancer pathology and prognosis. Furthermore, the findings have geared us to replay the depression model in rodent experimental design that confirmed the biological implications of emotional stress in brain, heart and liver of the rats.

Keywords: Emotional stress; HPA-axis; Stress-related genes; Breast cancer; Distress; Prognosis

PHASE TRANSITION OF NUCLEAR MATTER

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Phase Transition of Nuclear Matter is one the interesting problem in high-energy physics. Different parameters have been used to define phase transition of Nuclear Matter. Centrality is one of the parameters which we have used for our study. Our results show that if centrality increases then possibility of Phase Transition from hadronic phase to quark gluonic phase occurs which give signal of Phase Transition of Nuclear Matter.

Keywords: Phase Transition, Nuclear Matter, Centrality

HEALTH IMPACTS OF CHEESE WITH FOCUS ON BIOACTIVE PEPTIDES

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Cheese is one of the most popular fermented milk products with exceptional nutritional profile and functional properties. Proteolysis is the key feature of milk fermentation and cheese ripening. The diverse proteolytic behavior of cheeses during ripening releases an array of peptides with immense therapeutic impending. Such protein fragments with positive impact on body functions and health are considered as bioactive components. Milk proteins contain numerous bioactive peptides that perform certain therapeutic functions. Growing perception about diet and health relation, among the masses has extended the necessity for exploring the biologically active constituents to combat chronic diseases. In this context, bioactive peptides from milk products fermented with probiotics are of great interest. Probiotic bacteria are known to have high proteolytic activities. Temperature, fermentation time and bacterial species are the factors that affect the rate of proteolysis. Cheese containing probiotics is gaining admiration as a high-value milk product since it is a good source of bioactive peptides along with carrier of probiotics bacteria. These microorganisms are introduced in carrier food in adequate amount and result in biochemical reactions. These are able to survive in the gastrointestinal tract, delivering some positive effects to the intestinal environment. Probiotic cheese is the best example of functional food since its bioactive compounds improve immune and digestive systems, control stress and elevate mood, affect teeth, bone, and heart health and are helpful in diabetes and weight control. Hence, probiotic cheese is not only a food but prevention and cure in several health concerns.

Keywords: Cheese, probiotics, bioactive peptides, health, functional food

21ST CENTURY EXPEDITION: EXPLORING INDIGENOUS MICROBIAL RESOURCES FOR NOVEL ANTIBIOTICS

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The antibiotics resistance especially the emerging multidrug resistant (MDR) and most recently extensively drug resistant (XDR) bacterial pathogens necessitates the further screening and discovery of new antibiotics. Microbial natural products especially the secondary metabolites produced by many bacteria and fungi have served as the major source of most of the commercially available antibiotics and chemotherapeutics. The interesting fact is most of these natural reservoirs are still less explored with reference to the screening for new drugs. The actinobacteria are gram positive filamentous bacteria having high GC content in their genome and are the leading producers of most of the antibiotics and chemotherapeutics. In our search for novel antibiotics, we have isolated a large number of actinobacteria strains from different ecological niches in Pakistan and abroad. The isolated strains were identified by microbiological, biochemical and genomics approaches such as 16S rRNA gene sequencing and whole genome sequencing (WGS) etc. The laboratory scale fermentation of the strains and subsequent solvent extraction, chromatographic purification and structure elucidation of the active molecules by mass spectrometry (MS) and NMR spectroscopy, yielded a significant number of clinically useful antibiotics and chemotherapeutic agents. The compounds belonging to different structural classes (e.g. aminoglycosides, macrolides, nocardamine, ferrioxamine E, aranciamycin, actinomycins, SM-173-B, pactamycate, taurocholic acid, oxachelin C, mitomycin, benzoformamides and several new compounds were identified. Further the indirect screening approach using whole genome sequence data, genome mining and investigations through AntiSmash platform indicated the immense potential of the isolated strains for the production of medicinally useful secondary metabolites. Overall, the study revealed that the microbial natural products still are the major reservoirs for the discovery of novel bioactive molecules, and should continuously be explored to discover novel drugs.

Keywords: Microbial Natural Products, Antibiotics Resistance, Actinobacteria, Novel Antibiotics and Chemotherapeutics

EXPLORING THE THERAPEUTIC POTENTIAL OF CURCUMIN-BASED DERIVATIVE USING DIFFERENT DRUG DESIGN AND DELIVERY SYSTEMS

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In scientific history, curcumin has been used as a medication for more than two decades. The medicinal potential of curcumin has been investigated by numerous researchers from around the globe. According to a growing amount of scientific evidence, it has considerable biological benefits as an antibacterial, antifungal, anticancer, antioxidant, antidiabetic, anti-inflammatory, and neuroprotective agent. The therapeutic potential of curcumin has some limitations, such as a limited bioavailability caused by its poor aqueous solubility, low oral absorbability, and quick metabolic rate. Despite the fact that different strategies for overcoming curcumin's difficulties have been investigated by academics, the encapsulation of curcumin in carriers such metal-organic frameworks (MOFs) has been seen as a potential technique. In order to enhance the medicinal qualities and bioavailability of curcumin, cyclodextrin (β and γ-CD) was utilized as a linker with bismuth metal to create the curcumin-based metal-organic framework (Cur-CD-MOFs). By analyzing their FTIR and max spectra, the chemical structures of the resultant complexes Cur-CD-MOFs were confirmed. Using curcumin as a positive control, the biological activities of the produced complexes were assessed. In-vitro release kinetics and antibacterial effectiveness against multi-drug resistant microorganisms employing well and disc diffusion techniques were some of these activities. Cur-CD-MOFs were discovered to be significantly more efficient than curcumin in treating strains of 154 Staphylococcus aureus, 382-4 E. coli, 496 Pseudomonas aeruginosa, and Klebsiella. The outcomes showed that the encapsulation in CD-MOF enhanced the antibacterial activity of curcumin.

Keywords: Therapeutics, Drugs, Curcumin, Drug Design, Drug Delivery

APPROXIMATION OF COMMON SOLUTIONS OF CERTAIN NONLINEAR OPERATOR EQUATIONS USING INERTIAL-TYPE AA-VISCOSITY ALGORITHMS WITH APPLICATIONS

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Many nonlinear problems arising in real-life situations are mathematically modeled as nonlinear operator equations and inclusions. Many iterative algorithms have been proposed in the literature to approximate the solution of certain operator equations. The aim of this talk is to propose an inertial-type AA-viscosity algorithm for approximating the common solutions of certain nonlinear problems such as split variational inclusion problem, generalized equilibrium problem and common fixed point problem involving nonexpansive mappings. Additionally, we demonstrate strong convergence for the proposed method under some mild assumptions, and use our conclusions to approximate the solution of the split feasibility problem, relaxed split feasibility problem, split common null point problem and split minimization problem. Some numerical experiments are also given along with the graphical illustrations and comparison with various currently used approaches from the comparable literature.

Keywords: Viscosity Algorithm, Common Fixed Point Problem, Split Variational Inclusion Problem, Generalized Equilibrium Problem

DIRECT INTERFACING OF SENSORS WITH EMBEDDED SYSTEMS

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Sensors play a vital role in controlling and monitoring of physical systems. Their applications can be found in almost all fields of life. Passive sensors detect changes in ambient environment and generate signals accordingly, by varying their impedances. Digitization of these signals are required for further processing and storage in digital domain. Conventional analog-to-digital conversion schemes rely on additional circuits e.g. noise filters, amplifiers etc. to perform the task. This results into increased complexity, more power requirements and larger circuit foot print. Direct Interfacing Technique (DIT) is a simple and cost-effective approach to digitize analog signals acquired from passive sensors without employing additional circuits. In this talk, I'll introduce the basic mechanism of direct interfacing technique and will illustrate that how the built-in resources of commercially available microcontrollers are used to directly digitize these signals.

Keywords: DIT, Sensors, Embedded Systems, Interfacing Technique

TRANSFER MATRIX METHOD FOR THIN FILM OPTICS

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The transfer matrix method is a very effective theoretical technique investigating the optical properties of single and layered thin films. There are number of experimental methods to study the optical behavior of a THIN FILM in order to fabricate different optical devices. Before fabricating it for a specific purpose, it is better to study theoretically the optical nature of the thin film, such as transmission, reflection and absorption etc. either that thin film may be used for that specific purpose or not, to avoid the loss of time and resources. So, we need to explore the theoretical techniques that help us to study the optical behaviour of a thin film. We use the TRANSFER MATRIX METHOD (TMM), a theoretical technique in order to explore the optical behaviour of a thin film. Crystalline Strontium Titanate thin film deposited on a fused-quartz substrate by pulsed laser deposition were taken to compute transmittance and absorption spectra by transfer matrix method. Optical direct band gaps of these thin films were estimated using absorption data in Tauc plots. The predicted optical band gaps for 250 nm and 260 nm thick thin films are found to be consistent with the available experimental data. These gaps strongly depend upon thickness of the thin film. Its value is increased and redshifted as well by increasing thickness of thin film.

Keywords: Transfer matrix method; Optical properties; Thin film; Perovskites

CONTROLLING THE GEMINIVIRUSES THROUGH CRISPR/CAS9 SYSTEM

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Geminiviruses are the most notorious ssDNA viruses of the plant. These viruses infect more than 200 plants species including several important crops. These viruses are usually transmitted by insect vector i.e., whitefly and aphids. Several attempts have been made to control these viruses and recently gene editing. Mastreviruses are transmitted by leaf hopper and infect both monocot and dicot plants. Currently, there are insufficient ways to control this virus, but modern biotechnology provides us with a hope to cope these viruses. CRISPR/Cas9 based genome editing system has been recently used for begomoviruses but escape mutants are reported. In this study, infectious clone was made and the host plants were infiltrated by infectious clone to produce symptoms. Multiplexed CRISPR/Cas9 based constructs were agroinfiltrated into the leaves and efficacy of infectious clone was determined through Real-Time PCR by observing viral titer. Molecular analyses were performed to determine and viral titer after infiltration of CRISPR/Cas9 construct in tomato plant and the results were compared with control plants. Multiplexed constructs showed significant decrease in the viral titre as compared to control. From this study we can conclude that multiplexing is better in controlling the viruses than the single constructs.

Keywords: Gene editing, Geminiviruses, Mastreviruses, CRISPR/Cas9

SECTION A

MICROBIOLOGY

BIOTECHNOLOGY

ZOOLOGY

MOLECULAR SEQUENCING OF MULTIPLE DRUG-RESISTANT *STAPHYLOCOCCUS AUREUS* AND SCREENING OF SELECTED MEDICINAL PLANTS FOR ANTIBIOGRAM

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Staphylococcus aureus is a major healthcare due to increasing resistance to available classes of antibiotics. The current study was conducted to assess the antibiotic profiling of the isolates of S. aureus. The infectious agent was isolated from urine samples collected from different medical laboratories in Swat. The isolates were identified as S.aureus via biochemical test and further confirmed by the sequencing of 16S rRNA gene. The phylogenetic studies of amplified fragments from 16S rRNA gene of the isolate was closely related to Staphylococcus aureus isolated from Lahore (Punjab, Pakistan), Taif (Saudi Arabia) and Peru (Western South America). The molecular characterized isolates were then subjected to antibiotic sensitivity test. According to the findings of our research, five out of eighteen antibiotics were effective while the rest thirteen were resistant to S. aureus. Ciprofloxacin, Septran, Linazolid, Novobiocin with a sensitivity of 99%, 98%, 95%, and 93%, respectively. To overcome this extreme resistance to antibiotics, an alternate therapeutics source was searched. Nine local medicinal plants were extracted in four different polar (ethanol, water, n-hexane, and ethyl acetate) solvents. The extracts were then tested against S. aureus. The data revealed that ethanol extracts of medicinal herbs were more effective than other tested extracts. Variation in zone of inhibition was recorded for the extracts of different medicinal plants. Maximum zone of inhibition of 30 mm was noted for ethanol extract of Cinchorium intybus followed by Armoracia rusticana and Mantha longifolia each with 20 mm. The least zone of inhibition l2 mm was recorded in ethanol extract of Coriander sativum. The active groups responsible for the gigantic potential of ethanol extract of Cinchorium intybus, Armoracia rusticana, and Mantha longifolia against S. aureus were chemically characterized by Florescent Transmission Infra-Red (FTIR) Spectroscopy. The spectrum showed that these extracts contain Hydroxyl, Alephitic CH, Alkene C=C stretching and binding. The radical scavenging assay of the extract revealed that among the tested samples, Cinchorium intybus exhibited strong antioxidant potential (68%) at 1500ug/mL, followed by Mantha longifolia and Armoracia rusticana each with (64%) at the same concentration.

Keywords: Staphylococcus, antibiotic profiling, medicinal plant, FTIR, scavenging assay, and 16S rRNA gene

GENOME ENGINEERING FOR FOOD SECURITY: A WAY FORWARD FOR SUSTAINABLE DEVELOPMENT

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Climate change and anthropogenic activities are serious threat to food security for millions of people throughout the World. Current global food crop production is insufficient to meet people's food and nutritional requirements, and most importantly to achieve Zero Hunger, the 2nd Sustainable Development Goals (SDG2) by 2030. Under present circumstances, conventional breeding practices have practical limitations and are time consuming as compared to advanced breeding techniques. Recent advancements in the field of crop genetics and breeding such as Marker Assistant Selection (MAS), Genome Editing Technologies (GETs), Speed Breeding and importantly OMICS approaches are efficient, and less time-consuming for precision agriculture and crop breeding programs. CRISPR (clustered regularly interspaced short palindromic repeats), a third-generation genome editing method that is widely used in crop sciences and newly developed CRISPR/Cas9 variants i.e. Base Editing (BE) and Prime editing (PE) can help to produce transgene-free plants, therefore also used for knock-in/replacement and knocking-out of genes of interest. In this review, we provide detailed overview of the evolution of GETs, particularly the applications of CRISPR/Cas9 and other useful genome editing techniques. Moreover, we also elucidated the implications of forward and reverse genetics approaches in crop sciences. Thus, we focused on practically efficient and powerful crop breeding tools for food crops to achieve SDG2 by 2030.

Keywords: Food Security, CRISPR-Cas, Genome Editing techniques, Crop improvement, Sustainable Development.

ISOLATION AND CHARACTERIZATION OF MERCURY-RESISTANT ISOLATES FROM VARIOUS WATER SITES IN LAHORE

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Mercury (Hg) is one of the most toxic heavy metals found on earth, and has significant industrial and agricultural uses. Its release in the environment has led to extreme toxicity of Hg to all life forms in the food. Various strategies have been proposed for Hg removal; bioremediation has proved to be most promising among all. Bioremediation of Hg using bacteria is a useful technique. This study focuses on the isolation of Hg resistant bacteria from Ravi River and industrial wastewater samples. Several biochemical tests were performed like gram staining, catalase, oxidase, sugar fermentation, antibiotic resistance, and motility test. Minimum inhibitory concentration (MIC) was determined to screen the isolate resisting highest selected concentration of Hg. Salt tolerance and pH tolerance tests were also performed. Metal reduction analysis was also run to determine the reduction ability of the isolates for 1100ppm Hg. Hg-4 and Hg-7 were selected due to their higher MIC, salt tolerance, and pH values along with greater potential to reduce Hg^{2+} to Hg^{0}.

Keywords: Mercury, Wastewater, Bioremediation, Mercury reduction, MIC

IDENTIFICATION AND CHARACTERIZATION OF GUT BACTERIA FROM DWARF HONEY BEE (*APIS FLOREA)*

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Honey bees are eusocial flying insects that have close interaction with their surrounding environment. Among honey bees, Apis florea (Hymenoptera: Apidae) is commonly known as Asian dwarf honey bee being the most primitive one. Apis florea produces honey in small quantity and is not reared for commercial purposes but their contribution in pollination is agriculturally and ecologically important. Previous reports provide information regarding bacterial flora from gut of other species of Apis clade. No such studies are reported in regards to A. florea from Pakistan. Therefore, this study aimed to investigate the gut bacteria from Asian dwarf honey bee A. florea. The study reports isolation, identification and characterization of gut bacteria from dwarf honey bee specie A. florea through culture-based methods. Cultured bacteria were morphologically identified and characterized by staining, various biochemical tests (including catalase, urease, oxidase, lactose fermentation and hydrogen sulfite tests) and for molecular characterization through 16S rRNA sequencing the process is in progress. The dominant genera identified through culturing, staining and biochemical tests in gut samples of A.florea belonged to the Klebsiella, Enterobacter and Lactobacillus belonging to phyla Proteobacteria and Firmicutes. This study reported the occurrence of bacterial flora for the first time from gut of A.florea from Pakistan.

Keywords: Dwarf honey bee, Apis florea, Gut bacteria, 16S rRNA sequencing.

FUNCTIONAL CHARACTERIZATION OF GENE(S) ENCODING METABOLITES OF FLOURESCENT PSEUDOMONADS

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PB-St2 (*Pseudomonas chlororaphis* subsp. *aurantiaca*) is a plant benefactor strain which was isolated from the stem of sugarcane (*Saccharum officinarum*). This study specifically focuses on optimization of the maximum production of microbial metabolites, isolation and purification of metabolites, and characterization for their bio-control properties. The strain, PB-St2, was subjected to bulk extraction (5L) for isolation and purification of metabolites using thin layer chromatography (TLC), gravitational column chromatography and high-performance liquid chromatography (HPLC). Collected fractions were screened for antimicrobial activity against fungal phytopathogens (*Fusarium* sp., *Alternaria* sp.), bacterial pathogens (*Bacillus cereus*, *Pseudomonas aeruginosa*, *Salmonella enterica*, *Klebsiella oxytoca*) and cancer cell lines (HepG-2 and SF767). A greasy (PC1) and two crystal appearing compounds (PCY and PCR) were isolated through column chromatography. Furthermore, three pure compounds (P1, P2, P3) were isolated, from PCR compound, through HPLC. All isolated fractions were tested for their antimicrobial properties where PCR exhibited highest inhibitory activity against *Bacillus cereus*. Moreover, 50% inhibition activity was observed by PCR and PCY, against *Alternaria* sp., followed by P2 and P3 with 35.29% and 32.35% inhibition. Similarly, against *Fusarium oxysporum*, PCR showed highest antagonistic activity with 46.15% inhibition followed by PCY with 41.02% inhibition. Against HepG-2 fastest iC50 was achieved by PCR at a concentration of 25 µg. Similarly, PCR possessed highest cytotoxic activity against SF767 by achieving iC50 at a concentration of 20 µg.

Keywords: *Pseudomonas* sp.; Microbial metabolites; Bio-control; Antimicrobial activity

ROLE OF MELATONIN IN ALLEVIATION OF ARSENIC AND MERCURY STRESSES IN CHICKPEA (CICER ARIETINUM L.)

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Heavy metal stress is a significant factor in diminishing crop yield. Excess heavy metal is a global agricultural problem that inhibits plant growth and crop productivity. Melatonin (N-acetyle-5-methoxytryptamine) is a highly conserved and bioactive compound discovered in higher plants. Melatonin is a growth regulator in plants, with the ability to control root growth senescence and promotion of photosynthesis. Various studies have suggested specific physiological actions for melatonin in plants including growth-promoting activity and induction of rhizogenesis. Therefore, the present work was conducted to investegate the effect of melatonin on physiological and biochemical features of chickpea under arsenic (As) and mercury (Hg) stress. The result shows that when seedlings were exposed to the arsenic As and mercury Hg stress the root/shoot length and fresh weight of seedlings were decreased. Apart form that chlorophyll contents such as chlorophyll a, b and carotenoids were also decreased under As and Hg stress. Similarly, the level ROS such as H_2O_2, lipid per oxidation, TBARS and antioxidant enzyme like SOD, POD and APX were increased, while the CAT activities were decreased under As and Hg stress. Interstingly the exogenous application of different concentration of melatonin such as 0.1 uM 0.5uM and 1uM increased the root/shoot length, fresh weight and chlorophyll contents alone as well as in combination with As and Hg. Moreover, the level of ROS such as H_20_2, lipid per oxidation and antioxidant enzyme like SOD, POD and APX were decreased and the level of CAT were increased by the application of melatonin alone and in combination with As and Hg. It is concluded that melatonin has the capability to alleviate the phytotoxic effects of As and Hg stresses in chickpea by modulating the antioxidative defense system.

Keywords: melatonin, arsenic and mercury stresses, ROS, antioxidative system.

GREEN SYNTHESIS OF ZINC OXIDE NANOPARTICLES USING CITRUS LIMONPEEL EXTRACTS AND THEIR CATALYTIC EFFECT AGAINST MULTIDRUG RESISTANCE BACTERIA

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Multidrug resistant (MDR) pathogenic bacteria species is a major public health issue now-a-day. In order to control the phenomenon of antibiotic resistance, the health-care system must implement appropriate strategies to reduce antibiotics resistance phenomenon. *Citrus limon* peel extract was used in the current investigation to fabricate ZnO-NPs and then assessed theirbio-catalytic activity against MDR bacterial strains. In the current study, it was observed that the UV-visible spectroscopy gave an absorption peak at 290 nm which was in the prescribed range and confirmed the synthesis of ZnO-NPs. The SEM micrograph demonstrated the morphology of ZnO NPs while the EDAX spectrum expressed the extent of Sulphur, carbon, oxygen, calcium, chlorine, magnesium, and potassium in ZnO-NPs. FTIR analysis gave confirmation about capping of AgNPs and stabilization components of ZnO NPs (amide linkage and amino acid). The XRD peak gave information about the phase purity, size, crystalline nature of the ZnO NPs. From bioassay, it was observed that ZnO-NPs enhanced the antimicrobial activities of Cefepime, Ceftazidime, Amoxicillin, and Ciprofloxacin antibiotics against MDR bacterial isolates i.e., *Staphylococcus aureus*, (5.6-65.5%), and *Pseudomonas* sp.(8.5-71%) In addition, it was also observed that potential phytochemicals i.e., tannins, terpenoids and flavonoids were present in the extract of *C. limon peel*. It was concluded that ZnO NPs synthesized from the extract of *Citrus limon peel extract* could be of great importancein the pharmaceutical and medical science for their biocatalytic activities against MDR bacteria.

Keywords: *Citrullus limon peel* extract, Phytochemical constituents, ZnO-NPs, Bioassay, MDR Bacterial isolates.

ANTIBIOGRAM PROFILE OF *STREPTOCOCCUS PYOGENES* ASSOCIATED WITH TONSILLITIS IN PEDIATRIC PATIENTS

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Streptococcus pyogenes is the causative agent of tonsillitis. Tonsillitis affects both children and adults but most commonly infection found in children age of 5-15 years. Tonsillitis is the inflammation of tonsils. Tonsils acts as a defense mechanism in body as it provides immunity against certain pathogens. We use different antibiotics for this infection but when we use antibiotics more than its need bacteria become resistantto antimicrobial agents. This study aims to isolate and identify *S. pyogenes* from the clinical specimens of pediatric tonsillitis patients to evaluate antibiotic resistance profile of *S. pyogenes* against selected antibioticsand to characterize antibiotics resistant genes. A total number of 140 throat (saliva) samples were collected from the pediatric tonsillitis patients admitted in DHQ KDA hospital Kohat. Swab samples were cultured onblood agar medium and incubate it for 24 hours. After incubation biochemical tests were performed. Bacterial isolates were assessed for their resistance profile against selected antibiotics like macrolide and tetracycline class of antibiotics. After getting the particular resistant strain, DNA was extracted through phenol chloroform method and was stored at -20℃. The resistant strain was further processed for moleculardetection. Antibiotics activity and molecular results showed that *S. pyogenes* was highly resistant against erythromycin and tetracycline *mefA* and *tetM* gene were responsible for their resistance. Children age of 5- 10 years show high resistance against that particular antibiotic. The result of this study suggested that *S. pyogenes* isolated from tonsillitis patients was highly resistant against particular antibiotics, so we avoid irrational use of antibiotics without doctor's prescription.

Keywords: Tonsillitis, Bacterial Isolates, Antimicrobial Agents, Pediatric, Resistant strains, Tonsils

GREEN SYNTHESIS OF SILVER NANOPARTICLES (AGNPS), STRUCTURAL CHARACTERIZATION, AND THEIR ANTIBACTERIAL POTENTIAL

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In the field of nanotechnology, the metallic nanoparticles are of remarkable interest because of their unique electronic, chemical, and mechanical properties. In the present work, silver nanoparticles (AgNPs) were synthesized using bio-reduction method to overcome antibiotic resistance. Silver nitrate was used as metallic precursor and the extract of *Moringa oleifera* leaves with different concentrations was used as reducing as well capping agent. The extract exhibited strong potential in rapid reduction of silver ions for the synthesis of silver nanoparticles. The synthesized silver nanoparticles were characterized by UV-visible spectroscopy, X-ray diffraction (XRD), and scanning electron microscopy (SEM) techniques. The absorption SPR peaks appeared in the range of 415 to 439 nm. SEM analysis exhibited that particles were spherical in shape with size distribution range from 10 nm to 25 nm. The synthesized silver nanoparticles were pure crystalline in nature as confirmed by the XRD spectra with average crystallite size 7 nm. In vitro antibacterial activity of the prepared silver nanoparticles colloidal samples as well the extract was studied using different concentrations of AgNPs (C1 = 100 µg/ml, C2 = 50 µg/ml, C3 = 25 µg/ml) by well diffusion method against Gram negative Escherichia coli. The antibacterial performance was assessed by measuring the zone of inhibition (ZOI). The results suggested that AgNPs prepared by green approach can be considered as an alternative antibacterial agent.

Keywords: AgNPs; *Escherichia coli*; *Moringa oleifera*; antibacterial agent; green synthesis

CARDIAC STRESS INDUCED BY DEPRESSION LEADS TO ATRIAL FIBRILLATION, CARDIOMYOPATHIES, AND HEART FAILURE IN MICE

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Stress is a word that is used to describe challenging experiences that could be physiological or emotional. It is an adverse condition that disturbs the of the body and triggers adaptation responses. Emotional stress is one of the most prevailing health issues, and cardiovascular health is directly associated with it. Acute emotional stress is known to trigger multiple cardiovascular diseases by inducing cardiac stress that lead to various cardiac complications including heart toward failure. In this study we observed that depression like behavior in mice induces cardiac stress leading towards cardiac failure via atrial fibrillation, dilated cardiomyopathy, and tachycardia-induced cardiomyopathy. In this study C57 black mice are undergone a forced swim test and their behavioral analysis is done by tail suspension test while, cardiac stress and complications are studied at molecular levels by analyzing gene expression of *Ankrd1, Fhl1, Ttn, Myl4, Hcn4,* and *Myh7* gene. Also, the histopathological analysis is done to analyze the morphological changes in the cardiac tissue and biochemical analysis was done to study the impact of chronic emotional stress on Hb, MCH, platelet count, and cardiac enzymes level including CPK, Ck-MB, LDH, SGOT, and ProBNP(N-T) to confirm the onset of cardiac failure. This study proves that the mouse undergoing emotional stress is more prone to cardiac failure and these genes can be used as potential biomarkers for the diagnosis of various complications.

Keywords: Emotional stress, Depression, Cardiovascular diseases, Atrial Fibrillation, Cardiomyopathy.

EPITOPE BASED VACCINE DESIGNING FOR *PSEUDOMONAS AERUGINOSA* AGAINST AMERICAN POPULATION HLA ALLELES: AN IMMUNOINFORMATIC APPROACH

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Antibiotic resistance is a potential cause of mounting burden of *Pseudomonas aeruginosa* infections and becoming a serious source of unease for vaccine developer worldwide. Multiple types of advanced and conventional approaches have been considered to develop broad-spectrum therapeutics against *P. aeruginosa* but majority of these proved ineffective. Taking into account, the geographical distribution of *P. aeruginosa* genotypes and host genetics is a potential way of vaccine designing. In this research article, through in-silico tools, we highlighted the putative epitopes; showing the efficient restriction against the most common HLA alleles of American population. Sixty-nine non-allergen antigenic epitopes were filtered out to measure the binding affinities with the most prevalent HLA alleles in American population. Four Class-I epitopes (three of them belong to regulator proteins and fourth is a component of oxidoreductase enzyme) and one Class-II epitope (from an exotoxin type A) showed effective binding and covering 100% American population without any allergic response in virtual laboratory. Furthermore, these epitopes were shuffled in different arrangements to design vaccine constructs that were used to predict the possible 3D models by Aplhafold2 server. After the validation through NMSIM server, the most appropriate model was docked with HLA-A*02:01, the most prevalent HLA allele in USA. These predictions can be taken to wet labs for effective results of vaccine designing.

Keywords: Epitopes, HLA, NMSIM, *Pseudomonas aeruginosa*

EVALUATION OF BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS OF IMMUNOGLOBULINS IN CHILDREN WITH CELIAC DISEASE

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Celiac disease is an autoimmune illness which has affected about 1% of the population and it has appeared due to gluten intolerance in genetically susceptible people. The current study was designed to determine the level of immunoglobulin IgA and IgG in children with celiac disease and to estimate their impact on biochemical and hematological parameters. The current study was conducted on 120 subjects, including 60 blood samples were collected from diagnosed celiac disease children aged less than 12 years along with 60 healthy control subjects of same age range. The blood samples were collected from The Children's Hospital and University of Child Health Sciences Lahore, during two months period with a prior approval from the Ethical Committee of School of Biochemistry, Minhaj University, Lahore. The serum level of tissue transglutaminase immunoglobulin IgA and IgG were determined using ORGENTEC Diagnostika-GmbH Kit. Whereas, the serum level of biochemical parameters including serum alkaline phosphatase, serum calcium and serum phosphorus were determined by using chemical reagents on fully automated chemistry analyzer AU-480. Similarly, hemoglobin was determined using SYXMEX XP-300. The results of the present study have shown a statistically significant difference between celiac disease patients and control group. Value of immunoglobulin IgA in CD patients was 205.98 ± 181.48 U/ml as compared to the control group i.e. 4.18 ± 1.77 U/ml which showed a statistically significant difference. The mean value of immunoglobulin IgG in patients was 77.21 ± 71.35 U/ml as compared to the control group. The mean value of serum alkaline phosphatase in patients was 382.58 ± 114.99 U/L as associated to the control group. The mean value of serum phosphorus in CD patients was 4.64 ± 1.01 mg/dL as compared to the control group i.e. 3.85 ± 0.55 mg/dL. The mean value of serum calcium in CD patients was 8.69 ± 1.23 mg/dL as compared to the control group i.e. 9.76 ± 0.54 mg/dL. The mean value of Hb in CD patients was 9.18 ± 1.7 g/dl as compared to the control group i.e. 11.46 ± 0.46 g/dl. It has been concluded from the above results that in most of the cases of CD, values of serum IgA, serum IgG, serum alkaline phosphate, serum calcium, serum phosphorus and hemoglobin values can prove important clinical diagnostic markers for celiac disease which would ultimately be helpful in the management of this life-threatening disease.

Keywords: Celiac Disease, Immunoglobulin A (IgA), Immunoglobulin G (IgG)

EVALUATION OF CYTOTOXIC AND APOPTOTIC POTENTIAL OF HPBCD-PTX/PHB NANOPARTICLES FOR BREAST CANCER TREATMENT

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Paclitaxel (PTX) is a broad spectrum hydrophobic chemotherapeutic drug. It has potent anticancer activity against the variety of solid tumors, i.e., lung, ovarian, breast, leukemias, and head and neck carcinomas as a single agent. Currently taxol is made by devising in 1:1 mixture of Cremophor EL (a polyethoxylated castor oil) and ethanol. Cremophor EL is associated with sensitive allergic reactions, neurotoxicity, renal toxicity, and cardiotoxicity. In this study, the inclusion complex was prepared between the PTX and hydroxypropyl-β-cyclodextrin. Next, HPβCD/PTX inclusion complex was encapsulated in poly-3-hydroxybutyrate (PHB) to synthesize HPβCD/PTX-PHB nanoparticles using nanoprecipitation method. The *in vitro* application of HPβCD/PTX-PHB nanoparticles demonstrated pH dependent PTX release (73%) at pH 4 after 48 h. The HPβCD/PTX-PHB nanoparticles exhibited higher cytotoxic potential (2.56-fold) and enhanced apoptotic effect (8.45-fold) in MCF-7 cells as compared to free PTX. In summary, the HPβCD-PTX/PHB nanoparticles could be an innovative strategy for pH dependent sustained release of PTX for breast cancer therapy.

Keywords: Breast Cancer; Cytotoxicity; HPβCD Inclusion Complex; Paclitaxel; PHB Nanoparticles

EFFECTS OF SILVER NANOPARTICLES ON PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS OF MAIZE (*Zea mays* L.) UNDER SALT STESS

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Maize is the most important cereal crop throughout the world and an important staple food for more than 1.2 billion people globally. More than 300 million peoples depend on maize as the main staple food crop. Salt stress is one of most detrimental environmental stress, which causes ionic toxicity, osmotic stress, and oxidative stress simultaneously. It is one of the important limitations for crop production around the world. Almost 20% of the world cultivated land and 50% of irrigated land have salinity problem. Nano particles (AgNPs) is one of the useful nano-materials which are reported to have a beneficial effect in modern agriculture. The most interesting metal nanoparticles seem to be silver nanoparticles (AgNPs), which exhibit strong biological activity. In current study the AgNPs improve the growth of maize (Azam variety) under salt stress.The study was carried out in randomized block design with three replicas for 12 days. There were eight different treatment in comprising of control, AgNPs (20 µM), Salt (25, 50, and 100 mM) alone and in combination with AgNPs (20 µM).The result showed that pure AgNPs 20 µM and Ag NPs 20 µM combined with Nacl (25, 50 mM) significantly increased the growth parameters of maize and also increased the antioxidant enzymatic activities such as super oxide dismutase(SOD), peroxidase (POD), catalase (CAT). High concentration of pure salt (50 mM, 100 mM) significantly decreased the plant growth parameters. Non-significant decreased was also observed in lower concentration of pure salt (25 mM). The current study suggest that Ag NPs can be used in agriculture for improving the crop production and can alleviate the effect of salt stress.

Key words: Maize, Silver Nanoparticles, Salt Stress, Antioxidant

SALVADORA PERSICA MEDIATED SYNTHESIS OF SILVER NANOPARTICLES FOR ANTIMICROBIAL APPLICATIONS

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Silver nanoparticles (AgNPs) exhibit strong antimicrobial properties against many pathogens. Traditionally employed chemical methods for AgNPs synthesis are toxic for the environment. Here, we report a quicker, simpler, and environmentally benign process to synthesize AgNPs by using an aqueous 'root extract' of *Salvadora persica* (Sp) plant as a reducing agent. The synthesized *Salvadora persica* nano particles (SpNPs) showed significantly higher antimicrobial efficacy compared to earlier reported studies. We characterized SpNPs using UV–Vis spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Transmission Electron Microscopy (TEM), Field Emission Scanning Electron Microscopy (FE-SEM), Dynamic Light Scattering (DLS) and X-ray powder diffraction (P-XRD). UV–Vis spectrum showed the highest absorbance at 420 nm. FTIR analysis depicts presence of bond stretching including OH– (3300 cm^{-1}), C=N– (2100 cm^{-1}) and NH– (1630 cm^{-1}) which are attributed in the involvement of phenolics, proteins or nitrogenous compounds in reduction and stabilization of AgNPs. TEM, FE-SEM and DLS analysis revealed the spherical and rod nature of SpNPs and an average size of particles as 37.5 nm. XRD analysis showed the presence of the cubic structure of Ag which confirmed the synthesis of silver nanoparticles. To demonstrate antimicrobial efficacy, we evaluated SpNPs antimicrobial activity against two bacterial pathogens (*Escherichia coli* (ATCC 11229) and *Staphylococcus epidermidis* (ATCC 12228). SpNPs showed a significantly high inhibition for both pathogens and minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were found to be 0.39 µg/mL and 0.78 µg/mL for *E. coli* while 0.19 µg/mL and 0.39 µg/mL for *S. epidermidis* respectively. Further, Syto16 staining of bacterial cells provided a supplemental confirmation of the antimicrobial efficacy as the bacterial cells treated with SpNPs stop to fluoresce compared to the untreated bacterial cells. Our highly potent SpNPs will likely have a great potential for many antimicrobial applications including wound healing, water purification, air filtering and other biomedical applications.

Keywords: Silver Nanoparticles, *Salvadora persica*, TEM, XRD, Dynamic Light Scattering

CHARACTERIZATION OF *SLFSR* GENE IN TOMATO BY USING DIFFERENT BIOINFORMATICS TOOLS

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Solanum lycopersicum is commonly known as a tomato. Tomatoes are predominately used in cooking food and salads. It makes the food more delicious. Tomatoes have a very small shelf life due to being temperature sensitive. Many genes are involved in controlling the ripening process of tomatoes. This research is based on, the *SLFSR* gene. This gene has great potential to reduce the ripening process of tomatoes. The *SLFSR* gene is controlled by the transcription factor GRAS which also controls many other TF. All the genes that are controlled by the GRAS transcription factor family are involved in the ripening process of the fruit. If the *SLFSR* gene stops performing the function that may increase the shelf life of the tomato. Here, in this *in silico* based research, many bioinformatic tools were employed to identify the structure, molecular function, half-life, atomic composition, and the number of amino acids of the *SLFSR* protein. These tools include *Expasy* translate tool, *Expasy* Portparam, Inter ProScan, Swiss model, and ClustalW. The *in silico* tools predicts that the *SLFSR* gene product has instability index of 48.52, 89.77 aliphatic indexes, and a -0.245 grand average of hydropathicity. These values strongly predict that the *SLFSR* is unstable and belongs to the transcription GRAS family that may alter the expression of the genes for the desired product by using DNA binding protein.

Keywords: Shelf Life, SLFSR, Tomato, GRAS, InterProScan

STRUCTURAL AND FUNCTIONAL ANNOTATION OF SQUIRREL POX VIRUS HYPOTHETICAL PROTEINS: PRIORITIZING THE NOVEL DRUG TARGETS

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Genetic engineering and sequencing projects of genome have made it possible for modern day science to explore various aspects and dimensions of complex cellular networks containing different and large number of proteins. Most of the sequences of multi cellular organisms are available. However, during the exploration it has been revealed that various proteins that are experimented in the lab have not yet found to have any function. Such proteins whose function is unknown and which are not categorized without knowing their functions are called hypothetical proteins. Various modern-day approaches and models are used to find the function of such HPs. In-silico characterization is an advanced computerized approach to find the function of these HPs. In the current study, in-silico characterization of HPs found in squirrel pox virus is done using 9 proteins as sample. The sample proteins are obtained from UniProt and then we used PSIPRED and I TASSER to predict their 2D and 3D structures respectively. Different approaches of in-silico characterization are used to deduce the results. The goal was to characterize 25 randomly collected hypothetical proteins by determining their physiochemical properties, subcellular localization, function and structure using different sequence and structure-based bioinformatics tools.

Keywords: PSIPRED, UniProt, Squirrel Pox Virus, Drug Targets

MOLECULAR ANALYSIS OF GENETIC VARIANTS IN NAIL DISORDER FAMILY

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Nails are differentiated mini epithelial structures developed to cover the soft tissues of the proximal digits of the toes and fingers from physical assaults and injuries. The greater genetic heterogeneity makes it very difficult to find out factors underline Nail Disorder phenotype. The prevalence of of nail disorder is not well reported, however, it is frequently found in Pakistani population due to high rate of endogamy and consanguinity. A consanguineous Pakistani family in which Nail disorder phenotype was segregating as an autosomal recessive trait was ascertained from district Bannu. On the basis of results of clinical investigations of affected members of this family disease was diagnosed as inherited nail disorder. Written informed consent was obtained by the parents of an affected individuals for participation in this study. Blood samples were collected from clinically diagnosed three affected and twelves phenotypically normal individuals of this family. In this study, whole exome sequencing (WES) was performed on DNA of an affected individual to find the disease causing variant in the family. The co- segregation of the disease causing variant in the family was confirmed via Sanger sequencing. The pathogenicity of disease causing variant was determined by using bioinformatic tools. A missense homozygous mutation c.1079G>T was detected in exon 7 of the *PLCD1* gene in all the affected members of this family. The phenotypically normal members were detected carriers for the *PLCD1* mutant allele. The missense mutation c.1079G>T results in substitution of cysteine amino acid residue to Phenylanaline (p.Cys360Phe) that produces an abnormal PLCD1 protein in the affected members to cause leukonychia totalis, a nail dsorder phenotypes. The bioinformatic tools confirmed the mutated protein expression from *PLCD1* mutated gene. Molecular genetic analysis precisely established the genetic diagnosis for leukonychia totalis in a consanguineous Pakistani family that might be helpful in genetic counseling of family members.

Keywords: Nail Disorder, Whole Exome Sequencing, Co-segregation Analysis, Missense Mutation

IN-SILICO ANALYSIS OF POLYMORPHISM FOR HEAVY METAL BINDING IN DMT-1

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Divalent metal transporter 1 (DMT1) recognized as (NRAMP2) associated to human chromosome 12q13 with a metal ion transporter domain, accountable for iron endorsement in kidney. By dysregulation of DMT1, heavy metal toxicity may take place and genetic variation is essential in DMT1 encoding sequence. Different bioinformatics tools (SIFT, I-TASSER, I-Mutant, Clustal W, Provean, PhdSNP, PolyPhen 2, Mupro, Ramachandran plot, and docking) were run after submitting the sequence as input, for the estimation of quality and accuracy of model, to predict the 3D structure and to verify the effects of polymorphism on structural and functional stability of protein. Results obtained from various bioinformatics tools illustrate that best effects of SNPs on structural and functional stability of protein was expected by I-Mutant and Mupro. Highest C- score value was determined by I-TASSER software and 3D structure of protein (NRAMP2) was created. Binding sites of DMT1 were characterized by docking and model number 9 was considered as the best one in our result showing the greatest energy values. It can be concluded that in-silico study may provide an innovative approach for molecular mechanism, structural and functional stability of protein.

Keywords: In-silico Analysis, Polymorphism, DMT1 Transporter, SNPs, Molecular Docking

ASSOCIATION OF CLINICAL MARKERS WITH SARS-CoV-2 INFECTION-A STUDY FROM PAKISTAN

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COVID-19 caused by the SARS-CoV-2 virus that initially started in China and became a pandemic causing >1 million deaths as of October 2020. Pneumonia was first thought to be the most prevalent and lethal complication of COVID-19, which was initially thought to be a respiratory illness. However, we still don't have a clear understanding of the illness itself. During the early diagnosis of this illness, several clinical markers were found to be altered from the normal range that can be used as a predictor of disease severity. The current study was designed with the aim to find possible biochemical predictors of hospitalized COVID-19 patients and establishing the predicted cutoff values for each. For this study, individuals with clinical signs and symptoms, with or without a positive radiographic finding (X-ray, CT), and a result from the nasopharyngeal swab SARS-CoV-2, identified by the RT-PCR technique, were used to diagnose COVID-19. After diagnosis, only 113 individuals over the age of 18 years including 73 COVID-19-positive ICU hospitalized patients and 41 COVID-19-negative individuals were included. For the association of biochemical predictors of disease clinical and laboratory data were obtained. The clinical markers included lactate dehydrogenase, D-Dimer, Ferritin, Procalcitonin, interleukin and high-sensitivity C-reactive protein. The gathered information was entered into Microsoft Excel 365. (Microsoft, Redmond, WA, USA). Prior to analysis, all patient records that were included were made anonymous. IBM SPSS Statistics 27 (IBM Corp., Armonk, NY, USA) was used to conduct the statistical analyses (MedCalc Software, Ostend, Belgium). Median values of the clinical markers were used to find the association with the SARS-CoV2 infection. ROC curve was used to find the cut-off values of associated markers. In the current study, 63.7% were males and 36.3% were females with a median age of 42 years. CRP and D-Dimer were found to be associated with SARS-CoV2 infection with a *p*-value of 0.01 and 0.02 respectively. The cutoff values predicted for in-hospitalized positive patients of clinical markers were CRP > 5 mg/L, D. Dimer > 0.5 mg/ml, LDH > 333 IU/L, Ferritin > 300 ng/ml, and Procalcitonin > 2.0. ROC curve analysis showed CRP ($p<0.001$), LDH ($p=0.009$) and Ferritin ($p=0.02$) to be a good diagnostic marker of disease. We found an association of CRP level, ferritin, procalcitonin, LDH, D-dimer with SARS-CoV2 infection that can forecast complications as well as severity in COVID-19 infection.

Keywords: COVID-19, SARS-CoV-2, Clinical Markers, CRP, D-Dime

COMPUTATIONAL ANALYSIS AND CHARACTERIZATION OF P TYPE COBALAMIN ATPASE IN *MYCOBACTERIUM TUBERCULOSIS* H37Rv

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There are enormous number of protein functioning in the body of an organism where many of them have uncharacterized function and are known to be hypothetical proteins. These hypothetical proteins act as a bridge between structural and functional genomics as well as proteomics. Tuberculosis is one of most fatal contagious disease caused by Mycobacterium tuberculosis. It results in the damage of lungs with symptoms like cough, sneeze and fever. For this purpose, diverse database and programming have been utilized as instruments to characterize the selected hypothetical protein like Pfam, I-TASSER and STRING etc. Docking have been performed to study the molecular interaction between selected protein and different TB drugs. The chosen speculative protein is anticipated to be an ATPase protein that is a P-loop nucleoside triphosphate and related to CbiA family. It acts as transporter protein in plasma membrane and seen to be involved in ATPase activity, ATP binding and in down regulation of cell division. The molecular interaction analysis shows good interaction between selected protein and Clofazimine with the binding affinity of -10.2 kcal/mol. It is anticipated to be a potential objective for medication or antibody advancement for the treatment of tuberculosis in patients. These findings deliver elementary structural and functional information of selected hypothetical protein and its role in tuberculosis treatment. In future, it can be used to design a drug target to kill or inhibit the growth of Mycobacterium tuberculosis causing tuberculosis in Homo sapiens.

Keywords: *Mycobacterium tuberculosis*, Hypothetical proteins; ATPase; Clofazimine

EFFECT OF NOISE POLLUTION OF THE BREEDING BIOLOGY , *(CORACIAS BENGHALENSIS)* IN DISTRICT OKARA, PAKISTAN

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The effect of sound on the breeding biology of Indian roller *(Coracias benghalensis)* was study in district Okara, Pakistan. A total of 25 nest were in study area and breeding activity was recorded from 20 active nests. The old trees of kiker (*Vachellia nilotica*) were a very preferable place about (95%) of nest were found on kiker (*Vachellia nilotica*) and (5%) on sheesham (*Delbergia sissoo*) tree. Total 95% of nests were located near the bank canal and roadside. One reason is that old trees were only found near the road and canals. The higher number of nests were recorded with clutch size 3(55%) followed by 2(40) and 1(5%). Total 50 eggs were found in 20 nests, from which 64% infertility due to sound pollution because bird can't enough time to incubate, 12% predation were observed. Bank myna also seen to fight the Indian roller *(Coracias benghalensis)* for nest. 24% hatching were recorded which nestling predation 50% were recorded and 50% fledgling. Total traffic recoded in study area 82% motor bike, 10% cars truck and Bus 0.88 and 7% Trackter tralli were also record. It is concluded that breeding biology of Indian roller *(Coracias benghalensis)* in Okara have unique features with preferred plant for nest construction kiker (*Vachellia nilotica*) and the fast decline of old trees (*Vachellia nilotica*) are very dangers for Indian roller *(Coracias benghalensis)* in Okara, Pakistan. The increase in number of fast vehicles in these types of area product bad effects on Indian roller *(Coracias benghalensis)* population and the population going toward the declines.

Keywords: Noise pollution, Indian roller

ENGINEERED MULTIFUNCTIONAL COPPER OXIDE NANOCOMPOSITE HYDROGEL WITH ENHANCED BACTERICIDAL ACTIVITY AGAINST MULTIDRUG-RESISTANT BACTERIA

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Infectious wounds cause serious medical complications endangering human health. Antibiotics are traditionally used to treat the bacterial infections. Nevertheless, excessive use of antibiotics increases the generation of multi-drug resistant strains leading to the development of chronic wounds. Thus, it is crucial to develop effective antibacterial techniques. Therefore, in the current study, the nanocomposite hydrogel containing poly (vinyl alcohol) (PVA) and cuprous oxide nanoparticles (Cu2ONP) was prepared using the freeze-thaw method. The physical and mechanical properties of the nanocomposite hydrogel were significantly enhanced due to the presence of Cu2O NPs. The nanocomposite hydrogel treatment achieved excellent antibacterial activity against ATCC strains (Escherichia coli and Staphylococcus aureus) and multidrug-resistant strains (Staphylococcus aureus, Pseudomonas aeruginosa, and Klebsiella pneumoniae). Thus, the synthesized nanocomposite hydrogel indicates a good prospect for clinical application as an antibacterial wound dressing.

Keywords: Hydrogel, Nanocomposite, Antibacterial, Cuprous Oxide Nanoparticles, Wound Dressing

INTERPRETATION OF TOP2A/UBE2C/CKS2 GENES AS MUTUALLY INCLUSIVE THERANOSTIC SIGNATURES OF BLADDER AND PROSTATE CANCER: THE THERAPEUTIC POTENTIAL OF DRUG-DRUG CONJUGATES

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Prostate and bladder cancer have both increased globally in recent years. Urothelial carcinoma (UT), the most prevalent pathological form, is responsible for nearly 80% of bladder and prostate cancers. Men are more frequently being diagnosed with both prostate and bladder cancer at the same time, but there is no proven connection between the two according to recent research. In addition, many anti-cancer medications have been observed to have side effects like fatigue, haematuria, and urinary tract infections (very light blood in the urine). Therefore, it is crucial to identify new targets and therapies for prostate and bladder cancer. In this study, transcriptomics approach was used to search for promising BLCA and PRAD-targeting diagnostic indicators. A signature gene known as TOP2A/ubiquitin-conjugating enzyme, 2C/cyclin K2 (CKS2) and UBE2C were found to be overexpressed in cohorts of bladder and prostate cancer. These gene have been linked to resistance, immuno-invasive phenotypes, metastasis, cancer development, and poor clinical outcomes in bladder and prostate cancer cohorts. FDA-approved medications Octocrylene, Dioxybenzone, and Vemurafenib have recently been found to have powerful anticancer effects. According to a molecular docking analysis, the drug-drug conjugate of Octocrylene and Dioxybenzone was able to block the effects of TOP2A/UBE2C/CKS2 genes. In comparison to conventional therapeutics, the current research indicates that the drug-drug conjugate of Octocrylene and Dioxybenzone may be used as an effective treatment against BLCA and PRAD.

Keywords: Transcriptomics, Bladder Cancer, Prostrate Cancer, Drug-Drug Conjugates, TOP2A/UBE2C/CKS2 Genes, Dioxybenzone

PROBING PERIPHERAL VARIATIONS IN HEMATOLOGICAL PARAMETERS AS BIOMARKER FOR PSORIASIS

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Nearly 125 million individuals worldwide are affected by psoriasis, a skin condition characterized by papules and plaques on the skin's surface. Physical discomfort, emotional misery, and even social isolation can be brought on by this illness, which can have a considerable negative influence on a person's quality of life. This study's objective was to determine whether peripheral haematological variables could serve as a viable biomarker for psoriasis diagnosis. Psoriasis patients' blood samples (200 samples) and healthy volunteers' blood samples (200 samples) were both taken and sent to the lab for CBC (complete blood count) analysis. For several haematological parameters, the T-test was used to calculate the difference between the two groups. A statistically significant difference was noted in HB ($p<0.0001$), HCT ($p<0.0001$), RBCs ($p<0.0001$), MCV ($p=0.0002$), Platelets ($p=0.0039$), WBCs ($p=0.0002$), Neutrophils ($p=0.0001$), Monocytes ($p<0.0001$) and Eosinophil ($p=0.0467$). No significant difference was observed in MCHC ($p=0.3989$), and Lymphocytes ($p=0.3842$) of both groups. We also found that the patients with psoriasis had a higher neutrophil and lower lymphocyte counts than the healthy controls. Elevated NLR was found with a significant difference. According to our findings, the NLR ratio may serve as a diagnostic and prognostic indicator of psoriatic inflammation.

Keywords: Psoriasis, Hematology, Biomarker, neutrophils to lymphocyte ratio, Pakistan

EXAMINING THE HEMATOLOGICAL PARAMETERS FOR THE DIAGNOSTIC POTENTIAL OF HBV INFECTION

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The hepatitis B virus (HBV) is a serious threat to people's health everywhere since it can lead to acute and chronic liver infections. This study's major goal was to compare hepatitis B patients with healthy controls and demonstrate how alterations in peripheral haematological parameters might be used as a diagnostic biomarker. Blood samples from various Punjab hospitals were taken from healthy volunteers and HBV patients. These samples were subjected to a complete blood count (CBC) and the results were analyzed using the t-test. The outcome of the analysis of our cohort reveals that there is a statistically significant difference between the cases and controls of HB ($p<0.0001$), HCT ($p<0.0001$), MCHC ($p<0.0001$), MCV ($p=0.0116$), MCH ($p=0.0116$) and in NLR ($p=0.5303$), having ($p<0.05$). Whereas, the other factors showed no such significant association; WBCs ($p=0.4015$), RBCs ($p=0.2400$), Platelets ($p=0.3955$), Neutrophils ($p=0.5750$), Lymphocytes ($p=0.4718$), Monocytes ($p=0.4275$), Eosinophils ($p=0.0379$), having a $p>0.05$ in Hepatitis B patients. Our findings offer a rapid, low-cost, and simple biomarker to track HBV infection utilizing data from haematological parameters.

Keywords: Hepatitis B virus, HBV, CBC, HBV, Punjab

IDENTIFICATION AND CHARACTERIZATION OF ANTIBIOTIC RESISTANT BACTERIA FROM THE GUT OF HONEY BEE (*APIS MELLIFERA)*

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Apis mellifera (western honey bee) have been domesticated for honey production,crop pollination and wax nest construction etc. The function of the gut microbiota (GM) in controlling the health of *A. mellifera* has become more evident in recent years. Antibiotic resistance of bacteria is increasing worldwide in beekeeping andmay results in public health problem. Studies on identification of the GM of honey bee and its resistance towards antibiotics in Khyber Pakhtunkhwa is needed. As per citation no recorded data is found on antibiotic resistance of honey bee gut bacteria in Pakistan. So, this study aimed to isolate and identify bacterial strains from the gut of *Apis mellifera* and to examine antibiotic resistance potential of the isolated bacterial strains. Bees were collected from different regions of Kohat, dissected, guts were extracted and bacterial colonies were grown on nutrient agar medium. Morphology ofthe isolated colonies were observed on subculture plates, and the bacterial strainswere checked for antibiotic resistance by applying various antibiotic discs particularly Oxytetracycline (OX), by disc diffusion method. The isolated colonies of *E.coli* were resistant to Oxytetracycline with zone of inhibition 10mm which is less than 11 mm (compared with CLSI table). Experimental results reported that gut bacteria might have a key role in antibiotic resistances. Although further confirmation and molecular identification is yet to be analyzed.

Keywords: *Apis mellifera*, *E.coli*, Gut microbiota, *A*ntibiotic resistance, Khyber Pakhtunkhwa

NEUTROPHIL TO LYMPHOCYTE RATIO AS A BIOMARKER IN ASTHMATIC PATIENTS FROM NAROWAL, PAKISTAN

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Asthma is a chronic inflammatory disease of the human respiratory system. In the inflammatory process, both neutrophils and lymphocytes play an essential role. Our study aims to determine the neutrophils-lymphocytes ratio (NLR) as a biomarker for the diagnosis of asthma.176 Complete blood count (CBC) reports (88 affected and 88 normal) were collected from different hospitals of district Narowal, Pakistan from January 2021 to July 2022. The haematological parameters such as red blood cells (RBCs), white blood cells (WBCs), neutrophils, lymphocytes, eosinophils, and monocytes were analyzed by applying a t-test for the comparison between affected and normal subjects. A statistically significant difference was shown in HB ($p<0.0001$), RBCs ($p<0.0001$), WBCs ($p<0.0001$), HCT (p0.0017), MCV ($p<0.0001$), MCH ($p<0.0001$), MCHC ($p<0.0001$), platelets ($p<0.0001$), neutrophil ($p<0.0001$), lymphocytes ($p<0.0001$), monocytes ($p=0.1072$), eosinophil ($p=0.0048$), Erythrocyte Sedimentation Rate (ESR) ($p<0.0001$) and NLR ($p<0.0001$) among control and cases.The difference in NLR in our data suggests that it is a promising biomarker in the diagnosis of asthmatic patients.

Keywords: Asthma, Hematology, neutrophil-lymphocyte-ratio, Complete Blood Count, Pakistan

IMPACT OF MELATONIN ON POST-HARVEST OVER RIPENING OFGUAVA (PSIDIUM GUAJAVA L.)

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The guava (Psidium guajava L.) tree is widely cultivated throughout the world's tropical and sub-tropical regions. It requires little maintenance and offers excellent economic rewards. Guava fruit has the highest nutritional value. Global production of guava is about 40 million tons because it is not only cultivated in Pakistan but also produced in more than 60 countries around the world. Guava fruit has a limited post-harvest shelf life. Melatonin plays a key role in agricultural development since it has the ability to increase crop yields. Because of the antioxidant properties of melatonin, its absorption in plant can be excessive, and extending the shelf life of plants and increasing crop production. Moreover, the scavenging of H_2O_2 results in oxidative stress, which is reduced by the induction of melatonin. Therefore, the present research project is designed to evaluate the effect of melatonin on the post-harvest overripening of guava fruit. The present research study shows that melatonin plays an important role in delaying the softening of guava fruit, especially an optimal melatonin treatment (300µM melatonin treatment, 2h) has given the best result in delaying the post-harvest overripening of guava fruit. Moreover, melatonin can maintain the quality ofguava fruit by effectively enhancing the antioxidant capacity of antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), and ascorbate peroxide (APX) and can prevent the buildup of ROS such as H_2O_2 by triggering defense system, which postpones fruit ripening.

Keywords: guava, melatonin, post harvesting, antioxidant.

IN-SILICO CHARACTERIZATION AND MUTATIONAL ANALYSIS OF THE HUMAN T1R FAMILY'S RECEPTORS

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Sweet-tasting proteins Brazzein, Monellin, and Thaumatin are naturally occurring proteins. The enhancement in their flavor has not yet been performed. Interaction between proteins and receptors should be known for this purpose. The goal is to enhance the sweetener of these proteins, for this data retrieved through NCBI, BLAST p was used to check analogues, Expasy portal's tools for the prediction of physiochemical properties, after retrieving 3D structure, for structural validation Ramachandran plot and GalaxyWEB used, pathways for all of these retrieved through Quick GO, AutoDock Vina to dock sweet proteins with taste enhancers, Cyclamate, Hexosaminidase, NHDC, Perillartin, Trilobatin. Docking shows good interaction of proteins with sweet taste receptors TAS1R1, TAS1R2, and TAS1R3 as well. Docking of proteins revealed that ligands enhance the sweetener of proteins. Recombinant expression of these proteins helps us to achieve low-cost sweetener that could be commercialized.

Keywords: Sweet-tasting proteins, Expasy portal's tools, GalaxyWEB, AutoDock Vina

PRECLINICAL ASSESSMENT OF PLANT-BASED NUTRACEUTICAL FORMULATION FOR THE PREVENTION OF PERIODONTAL DISEASES

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Periodontal diseases represent one of the six most prevalent non-communicable diseases around the globe. Gingivitis is the first step of periodontal diseases, involed gum inflammation in response to the stimuli of the bacteria embendded within the plaque near the gum line. Periodontitis is a chronic inflammation of the tissue surrounding the tooth, caused by oral microbiome dysbiosis, which induced inflammatory response, destroying the periodontal tissues and bones that support the tooth, leading to tooth loss, in the most severe forms. Oral hygiene, routine dental check-up, smoking cessation, reducing alcohol consumption, and a healthy diet (that maintain oral eubiosis) are some of the main strategies to prevent periodontitis. In this context the use of herbal products in oral hygiene products and functional foods i.e., caramels or chewing gum enriched with substances with antimicrobial activity against pathogenic bacteria may be very useful. The main advantages of these plant extracts are that they do not generally exert antimicrobial activity against eubiotic bacteria and do not induce the phenomenon of bacterial resistance, however, the main disadvantage is that they show very low antibacterial activity even at high concentrations. The aim of this study is to determine whether the combination of several plant extracts can have a synergistic antibacterial effect. Six commercial extracts obtained from, *Sambucus nigra* L., *Melissa officinalis* L., were tested alone for their antimicrobial activity against *Porphyromonas gingivalis* (ATCC 33277), one of the main responsible pathogen for periodontitis. *S. lateriflora* and *Cistus* × *incanus* alone inhibited the microbial growth by 16%, and 4%, respectively at the concentration of 30 mg/mL. Differently, when tested in combination at the same concentration (i.e., 30 mg/mL), *S. lateriflora* and *Cistus* × *incanus* resulted to inhibit the growth of *P. gingivalis* by 48%, showing an enhanced antimicrobial activity. The combination of *S. lateriflora* and *Cistus* × *incanus* can be considered a promising component of oral hygiene products and functional foods.

Keywords: Periodontal diseases; Prevention

SECTION B

CHEMISTRY

FOOD SCIENCES

BIOCHEMISTRY

ALCOHOL BASED NOBLE METAL FREE ELECTROCATALYST PRODUCTION FOR VALUE ADDED PRODUCT DEVELOPMENT

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Low-molecular-weight aliphatic alcohols like methanol and ethanol are good fuels for direct alkaline alcohol fuel cells (DAAFCs). Selective oxidation of these alcohols to carboxylate offers both decent poweroutput and value-added chemicals, which is environmentally and economically more desirable than their full oxidation to CO_2. Herein, we report the in-situ fabrication of oxygen-vacancies-rich CuO nanosheets on copper foam (CF) via a simple ultrasonication-assisted acid-etched method. The CuO/CF monolith electrode enables an efficient and selective electrooxidation of ethanol (274 mA cm^{-2} at 1.82 V *vs*. RHE) and methanol (247 mA cm^{-2} at 1.82 V *vs*. RHE) into value-added acetate and formate with ~100% selectivity. First principles calculations reveal that oxygen vacancies in CuO nanosheets efficiently regulatethe surface chemical and electronic structure, provide abundant active sites, and enhance charge transfer that facilitates the adsorption of reactant molecules on the catalyst surface. The selective oxidation of alcohols to value-added chemicals in DAAFCs without CO_2 emission is highly favorable to power electricalequipment with decent current densities. The generation of value-added chemicals will sufficiently lower the overall cost of DAAFCs.

Keywords: DAAFCs, Electrooxidation, ultrasonication-assisted acid-etched method, CuO nanosheets

SYNTHESIS AND CHARACTERIZATION OF MOFS AND INVESTIGATION ON ADSORPTIVE REMOVAL OF WATER POLLUTANTS

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Alcohol and alcohol-based compounds especially resorcinol is documented as emerging contaminants in water and are considered as major menace to public healthiness all over the world. Synthesis of operative adsorbents to alleviate water contamination having high level efficacy is major challenge for all researchers. Herein, two zeolitic imidazolate frameworks (ZIF-8 and ZIF67) were synthesized by the reaction of 2-methyl imidazole with zinc and cobalt metals displaying excellent adsorption capacities (ZIF-8 = 478.39 & ZIF-67 = 538.13 mg/g) for highly toxic pollutant resorcinol. From thermodynamics study it was concluded that adsorption for resorcinol elimination is endothermic, followed spontaneous process and physical adsorption process takes place as indicated by ΔH_{ads} (30.473 KJ/mol). Langmuir isothermal model and pseudo 2nd order kinetics is best fitted for adsorptive removal of resorcinol and separation factor values for 30 – 100 ppm resorcinol concentration was in the range of 0.0239 – 0.1312 which displayed that adsorption process is favorable. Furthermore, these MOFs have same organic linker and same topology but different adsorption capacities. This difference is due to presence of zinc and cobalt metals having different electronic configuration which results in different porosity (ZIF-8 = 1278 and ZIF-67 = 1876 m^2/g) and adsorption capacities.

Keywords: ZIF-67 & ZIF-8, Zeolitic Imidazolate Frameworks, Resorcinol Adsorption, Water Purification, Adsorption Study

A THEORETICAL STUDY FOR THE DEGRADATION 2, 3, 7, 8-TETRACHLORODIBENZO-*P*-DIOXIN (TCDD) BY DENSITY FUNCTIONAL THEORY USING GAUSSIAN

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Gaussian calculations of 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) under the computational tool, i.e., Density Functional Theory, were carried out to obtain the electronic descriptors and polarizabilities. These relationships were found for the electronic descriptors with different aryl hydrocarbon receptor (AhR) binding affinities of TCDDs. A different mathematical model, like ligand-receptor and solute-solvent interactions based on regression analysis or curve fitting method, is suggested by proving the electrostatic interactions of TCDD with aryl receptors.

Keywords: Gaussian calculations, Computational tools

CRYSTAL STRUCTURE OF A NOVEL FURO-FURAN LACTONE FROM *HELIOTROPIUM EICHWALDI*

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Heliotropium is a large and complex genus of annual or perennial herbs, distributed over the tropical and temperate zones in both hemispheres. In Pakistan, genus *heliotropium* is represented by 23 species. This specie belongs to the genus *heliotropium* of the family *Boraginaceae*. Family *Boraginaceae* is one of the most significant family from the therapeutic point of view. The natural products isolated from the members of *Boraginaceae* exhibit many interesting biological effects including anticancer, anti-bacterial, antifungal, anti-inflammatory, anti-tumor, analgesic, immunostimulant, anti-AIDS and anti-pyretic activities. *H. eichwaldi* Steud is an erect, soft, hairy and annual herb. It grows in cultivated fields, gardens and shallow lands of the province of Sindh, Pakistan. It is categorized as an unsafe and poisonous herb containing alkaloids which cause atrophy and liver damage, causing fatalities. There have been reports of the plant causing fatalities in livestock due to atrophy and liver toxicity. Phytochemical investigation on *Heliotropium eichwaldi* leads to isolation and structural elucidation of a novel compound Furo-furan lactone which was obtained as a colorless fine needle from mixture of $CHCl_3$/MeOH, melts at 172 $^{\circ}$C. The HRMS (FAB+ve) showed a quasi-molecular ion $[M+H]^+$ peak at *m/z* 275.1131 (calcd. 275.11308) corresponding to molecular formula $C_{12}H_{19}O_7$. The assignments of signals in ^{1}H and ^{13}C-NMR spectra were done with the help of ^{1}H-^{1}H COSY, HMQC and HMBC correlations, whereas the stereochemistry was completely authenticated by NOESY experiments. The structure and relative configuration of the compound were made by single crystal X-ray diffraction studies. Although natural products with two fused furan rings have previously been reported in literature but this compound is the first ever isolation of a novel natural product with three fused furan rings.

Keywords: Novel Furo-Furan Lactone, X-ray Diffraction, NMR, *Heliotropium eichwaldi*

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PLASMA-BASED OZONOLYSIS OF LIGNIN WASTE MATERIALS FOR THE PRODUCTION OF VALUE-ADDED CHEMICALS

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The biorefinery concept is based on the development of sustainable sources of industrially important chemicals rather than petrochemicals. In this regard, cellulose and lignin from plant biomass are the most attractive raw materials for synthesis of value-added chemicals. Among these raw materials, lignin is the second most abundant and underutilized heterogeneous biopolymer obtained from plant biomass. Current methods to convert lignin into valuable fuels and chemicals are facing challenges like expensive catalysts, energy cost, and difficulty in the separation of a complex mixture of products. Herein, a room temperature and catalyst free targeted synthesis of vanillin has been reported using ozone produced by non-thermal plasma. The changes in the lignin properties as a result of ozonolysis have been determined by Fourier transform infrared spectroscopy (Fourier transform Infrared spectroscopy (FTIR), Scanning electron microscopy Energy Dispersive X-Ray Analysis (), Scanning electron microscopy Energy Dispersive X-Ray Analysis (SEM/EDX), and Heteronuclear Single Quantum Coherence (Heteronuclear Single Quantum Coherence (HSQC)). Operational conditions have been investigated to optimize vanillin production. Under optimum conditions, ~ 60% of vanillin (based on GC–MS analysis) was obtained with only 10 minutes of treatment. The product selectivity has been controlled by reaction time and reactant lignin concentration. The recovered lignin having a partially oxidized structure was subjected to depolymerization to get more value from this biopolymer. Hence, we suggest an ecofriendly and economical method of lignin processing for industrial uses of lignin. The current study is promising for ecofriendly and economical use of lignin in industry.

Keywords: Lignin depolymerization, Ozonolysis, Cold plasma, Vanillin production.

FACILE SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL ACTIVITIES OFNANOPARTICLES AND NANOCOMPOSITE

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Nanoparticles find their way in many industries like food, pharmacology, medicine, and agriculture. The current report aimed to synthesize and characterize various metallic nano-heterostructures *i.e.*, AgO, YtO and Fe_3O_4 nanoparticles and AgOYtO nanocomposite using sol- gel process. Their average size was in range of 100-200 nm except Fe_3O_4 nanoparticles which liesin the range of 900-1000 nm. Their morphology was recorded by scanned electron microscopy. The AgO and YtO nanoparticles showed spherical shape while Fe_3O_4 nanoparticles and AgOYtOnanocomposite showed non-spherical flakes. The XRD analysis revealed crystalline nature of all synthesized nanoparticles and nanocomposite while UV-Visible and FTIR analysis showed their respective peaks of energy band gaps and bonds. An effort was also made to evaluate their biological potential. So, various biological activities like antidiabetic, scavenging, anti- inflammatory, antibacterial, hemolytic, thrombolytic and insecticidal activities were estimated. The nanocomposite showed highest antidiabetic (%) (35.2 ± 0.001), scavenging (%) (55.3 ± 0.001), anti-Inflammatory (%) (2.7 ± 0.001), hemolytic (8.7 ± 0.001 at 200 µg/mL), thrombolytic (3.1%) and insecticidal activities. The nanocomposite and AgO nanoparticles showed zone of inhibition against *Klebsiella pneumoniae.* The AgO nanoparticles showed minimum antidiabetic (17.2 ± 0.003), anti-inflammatory (33.3 ± 0.001) and thrombolytic (0.6%) activities. The YtO nanoparticles showed minimum scavenging (12.3 ± 0.004) while zero insecticidal activity against *Trogoderma granarium*. The Fe_3O_4 nanoparticles showed minimum hemolytic activity (4.3 ± 0.001 at 200 µg/mL). The AgOYtO nanocomposite can be further evaluated for its potential use in various industries.

Keywords: AgOYtO, Biological-activities, chemical-synthesis, silver-oxide,

Antibacterial nanoparticles

DISTRIBUTION OF ABO AND RH BLOOD GROUPS AMONG TYPE-II DIABETIC PATIENTS IN POPULATION OF PESHAWAR, PAKISTAN

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Many epidemiological studies discuss the relation between the ABO blood group and the risk of developing diabetes mellitus. ABO is the major blood group system. Diabetes mellitus is a metabolic disorder characterized by hyperglycemia. It is firmly considered that like other congenital characters and qualities blood types probably relate to diabetes mellitus. The study duration was three months from June to August 2021. Study design was a comparative cross - sectional study. In our study, 400 participants were included: 200 were confirmed diabetics and 200 were non – diabetic and were taken as control. This study was conducted in the department of Pathology at Rehman Medical Institute, Peshawar. After obtaining informed consent from every patient three mL of Blood samples in the EDTA tube were collected, labeled and sent to the laboratory for identification of blood group. Slide agglutination test for the determination of ABO and Rh blood groups was used. It was observed that blood group B was significantly more common among diabetic subjects (p- value < 0.05). Our study showed a higher percentage of blood group B in the diabetic group (46.5 %) compared to controls (27 %). We conclude that there was an association between blood groups and Diabetes Mellitus. The outcomes suggest that the frequency of blood group B is significantly (P < 0.05) higher in type 2 diabetes as compared to non - diabetes. This study suggests the potential involvement of blood groups and RH factors in onset, development and progression of disease. However, we recommend further biochemical and molecular validation of work and investigation of associated mechanisms.

Keywords: ABO Blood Group, Type 2 Diabetes Mellitus, Lahore.

ANTI-INFLAMMATORY AND ANTI-CANCEROUS EFFECTS OF TURMERIC

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Turmeric is a primeval spice derived from the rhizomes of Curcuma longa, it belongs to family which is (Zingiberaceae). Turmeric has many health related benefits like antioxidant, anti-inflammatory, antibacterial, anticancer, antigrowth, anti-arthritic, anti-atherosclerotic, antidepressant, anti-aging, antidiabetic, antimicrobial, wound healing, and memory-enhancing activities. Curcumin is the main ingredient in the turmeric which is involves in anti-inflammatory effects but there are some other ingredients which provides health benefits. Turmeric oil increases the bioavailability of curcumin. Curcumin-free turmeric (CFT) components carries various biological activities which includes anti-inflammatory, anticancer, and antidiabetic activities. Elemene from turmeric is proved for treatment of cancer. Turmerin, turmerone, elemene, furanodiene, curdione, bisacurone, cyclocurcumin, calebin A, and germacrone are components of turmeric which exhibit anti-inflammatory and anti-cancer properties. High performance liquid chromatography (HPLC) analysis of turmeric extract (TE) revealed the existence of potent phenolic and flavonoid anti-oxidants and curcuminoids and some functional monosaccharides. TE shows magnificent resistance to artificial human gastric and intestinal juice as compared to the standard prebiotic (inulin). TE not only is digested by probiotics including Lactobacillus rhamnosus and Bifidobacterium animalis, but also keep up the growth of these bacteria in spite of 72 h. TE is helpful for acute inflammation of carrageenan-induced paw edema and xylene-induced ear edema. And also helpful for chronic inflammation of cotton pellet-induced granuloma. TE inhibits the growth of Chinese Hamster Ovary (CHO) cells and the component curcumin play a role of cytotoxic to lymphocytes and reduces the development of animal tumor. Natural mixture of turmeric, ginger and garlic with or without tamoxifen is effectives for breast cancer.

Keywords: turmeric, anti-inflammatory, anti-cancerous

GASTRO ESOPHAGEAL REFLUX DISEASE: ACID REFLUX FOODS TO AVOID

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Acid reflux arises when there is acid backflow from the stomach into the esophagus. Although it occurs frequently, it may also result in difficulties or unfavorable sensations like heartburn. Studies show that when the sphincter at the base of the esophagus isn't working properly, stomach fluid can pass through and enter the esophagus. The worst foods for GERD might make uncomfortable symptoms worse while other foods can make them go away. Citric acid and malic acid are two acids that tomatoes have that cause heartburn, according to research. Hiatal hernia sufferers and, unsurprisingly, those with GERD experience worsening reflux symptoms when peppermint is consumed. Tea and coffee that contain caffeine make acid reflux worse. It causes anxiety, agitation, and sleep problems in some people. Acid reflux and heartburn can be brought on by fried, greasy, and fatty foods. Ginger tea, certain fruit and vegetable juices, and plant-based milks may help people who suffer from acid reflux and heartburn. Avoiding citrus juices, carbonated beverages, and alcohol can also help reduce the frequency and severity of symptoms. Acid reflux may be induced by some drugs. Doctors advise finishing your meal two to three hours before bed.

Keywords: Gerd diet, Acid Reflux, Heart Burn, esophagus, Food, beverage, Tea

EXPLORING THE APPLICATION OF NANOTECHNOLOGY IN FOOD AND FOOD PROCESSING

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Food nanotechnology, is one of the emerging techniques, which provide radical changes in food industry as well as agriculture. Properties of nanomaterials, nanocarriers and nanocomposite provide variety of application. Nano laminates, being thin in nature, are used in edible coating of vegetables and fruits. Incorporation of nano particles in packaging material is a promising way to enhance strength and resistance against oxygen, moisture, bacterial growth and mycotoxins. Nano carriers ensure controlled release of fertilizers, pesticides and herbicides which as a result increase their efficiency. This technology is able to enhance quality and sensory attributes such as taste, texture, appearance and viscosity during food processing. Nano sensors are used in food processing plants which are able to detect the presence of microbes. It helps to reduce the microbial infestation in final product, resultantly decrease food wastage. Bioavailability of functional foods has been increased due to subcellular size of nano encapsulation, which directly get release and act on the target site. Silicon nano materials are able to carry flavor and aroma of a final product. This advancement in technology provides smart and intelligent packaging system, which is able to detect the presence of gaseous molecules in food surroundings. Oligosaccharides produced by E. coli O157:H7 can be detected by DNA sensors composed of gold nanoparticles. In different food industries, nano composite packaging is being used in which two or more nano layers are combined. Nano technology has been proved to have great potential in food production to food processing and ensure safe and quality packaging of end product.

Keywords: Food nanotechnology, food production

POTATO PROTEIN; AN ADAPTABLE, BENEFICIAL PLANT-BASED ELEMENT

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Due to growing awareness and desire for healthy food, protein has recently risen to prominence. Some studies have shown that potato alone accounts for roughly 3% of the required daily amount of protein worldwide among the many sources of protein. Potato proteins have a great biological value of 90–100, with a protein level of 1–3% of the fresh weight of the tuber. Numerous vegetarian and vegan goods use potato protein, since they are "Generally Recognized as Safe" and non-allergenic. When compared to proteins from other sources, potato proteins exhibit antibacterial, antioxidant, and other health-promoting qualities. Potato proteins can be easily isolated using a variety of separation processes, such as ion exchange and expanded bed adsorption, and their functional characteristics can be altered for a variety of purposes. Moreover, clear beverages and other food and drink products can be enriched with potato protein, which has the potential to be an excellent protective carrier for vitamin D and perhaps other hydrophobic bio-actives. By adding this plant-based component, the fortification can make up for the lack of vitamin D. Additionally, it was utilized in the development of dairy-free yogurt. The inclusion of potato protein in foodstuffs to make up for nutritional deficiency and as a vegan replacement has a wide range of applications.

Keywords: potato protein, plant based, non-allergic, enrichment

UTILIZATION OF EGGSHELL WASTES-SUSTAINABLE GROWTH DEVELOPMENT

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The rise in the consumption of chicken eggs around the world resulted in an increased amount of egg waste that is disposed of, primarily eggshell and eggshell membranes. Significant environmental problems have been caused by the manufacture of cement using nonrenewable resources and CO_2 emissions. To make construction materials including concrete, cement mortar, brick, an alkali-activated binder, and a soil stabilizer, the eggshell powder can be used. Eggshells are valuable when changed to new value addition, due to their high calcium contents, which benefits human beings and the environment. The high calcium helped to cure osteoporosis, and protects teeth from decay. It also acts as; a food additive in desserts and savory dishes, a catalyst in the production of biodiesel, acts as an absorbent in the removal of heavy metals from soil and water, and a stabilizer in the civil engineering industry. Recently used as a UV blocker in nylon and polystyrene and even being incorporated into a number of compositions for anti-aging skin care products in the cosmetics sector. Eggshell wastes were simply converted to low- or high-purity calcium carbonate grades by washing, crushing, and drying to use as raw materials for manufacturing highly valued calcium phosphate products in order to utilize their waste. The calcium phosphate samples were prepared to utilize an easy and environmentally friendly process employing eggshells and phosphoric acid. This finding supports the idea that zero waste operations can be used to create products with value added in order to achieve sustainable development as well as material recycling and waste management in the future.

Keywords: Waste utilization, Eggshell waste, Calcium, Cement, Food additive

PLASTICIZED LIFE, MICROPLASTICS IN FOOD, A FOOD SAFETY ISSUES

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This study aims at omnipresent problems of microplastics in waters as they are receiving global attention. They can accumulate in the human body through biological chain amplification. In the past 70 years, virgin plastic production has increased 200-fold, and has grown at a rate of 4% each year since 2000, according to a 2017 study in Science Advances. Only a small portion of plastics are recycled, and about a third of all plastic waste ends up in nnature. According study, one person consumes approximately 1,769 microplastic particles every day, including through vegetables and fruits. The apple we consume may contain 195,500 microplastic particles per gram, while the carrot may contain more than 100,000. Single-use water bottles, to-go containers, food cans, and storage wraps are examples of common plastic-based food packaging that contains microplastics. Scientists consider at least 15 of the chemicals manufacturers use to make plastic packaging to be endocrine disruptors. Endocrine disruptors are structurally similar to some hormones in the body — such as estrogen, testosterone, and insulin — and mimic and disrupt their natural functions, leading to adverse health effects and increasing a person's risk of chronic conditions. Exposure to plastic through food is high, but you can minimize it by limiting your consumption of highly processed foods, choosing eco-friendly food packaging, and replacing plastic water bottles with glass or stainless-steel ones.

Keywords: food safety, health, microplastics, packaging, hazards, chronic effects

DEVELOPMENT OF MINIATURE CHEESE WITH PLANT PROTEASES AS RENNET ALTERNATIVES

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Cheese is a fermented dairy product that offers several health advantages. As rennet is imported into Pakistan to make milk coagulate while the cheese industry is still in its infancy, the cost of creating cheese has increased. One ethical question is whether rennet is made from halal or haram sources. The current study's objective was to evaluate Citrus aurantium, bromelain (from pineapple), ficin (from fig latex), and melon juice as feasible, affordable, halal sources for cheese manufacturing, and to compare their activities to those of rennet. When starter cultures (Lactococcus lactis subsp. Lactis and Lactococcus lactis subsp. Cremoris) and vegetative coagulants extract (CFE) were added in varied amounts, buffalo milk used to make cheese was compared to one controlled rennet one. Cheese made with bromelain and Citrus aurantium had a longer and somewhat softer texture than cheese made with ficin and melon, which had semi-hard, brittle textural features and a low grain holding capacity to rennet added cheese. Protein research showed that vegan cheese had a substantially higher protein content than rennet-coagulated cheddar due to the presence of proteins that formed up to 20 to 35 mg/mL of total protein contents and that may make up to 85% of the overall content. In Pakistan, the creation of halal food is a crucial concern, thus halal products must not only be halal but also offer the consumers safe, healthful, and nutritional benefits.

Keywords: Plant protease, Rennet replacer, Miniature cheese, Halal source.

BACTERIOPHAGES AS BIOCONTROL AGENTS AGAINST FOOD BORNE PATHOGENS AND FOODSPOILAGE MICROORGANISMS

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Biocontrol is the use of living organisms or organic products to prevent or reduce damage caused by harmful microorganisms. A biocontrol agent has high inhibitory action againstthe growth of pathogenic microorganism, spoilage microorganisms but it should not change the nutritive value of food products. Listeria monocytogenes is a foodborne pathogenic bacterium that is considered as a major causative agent of serious diseases in humans. Listeria monocytogenes has been identified as a cause of high mortality and hospitalization rates. Dairy products and ready-to-eat meat are the most important sources of energy for humans but contamination with L.monocytogenes can cause fatal infections in a large population. The contamination of foodproducts requiring product recall presents large economic burden to industry and is further exacerbated by damage to the brand. The use of lactic acid bacteria or monocytogenes peptides can be use to control listeria monocytogenes in meat and dairy products. Bacteriophages, which have the ability to infect and lyse specific bacteria, have been used as a best agent to control the growth of food borne pathogens. The utility of phages has included the treatment of diseases in humans and animals, decontaminating meat carcasses after slaughter, and targeted inactivation of pathogenic and spoilage bacteria on food contact and non-contact surfaces as well as surfaces of ready to eat products and during packaging and storage. The use of phage to control biofilms in food production environment is of great importance to enhance the food product shelf life andto ensure food safety.

Keywords: Food Borne Pathogens, Biocontrol, Biofilms, Industry, Food safety, food spoilage

POMEGRANATE PEEL EXTRACTION BY HIGH VOLTAGE TECHNIQUE AND ITS APPLICATIONS

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Pomegranate (*Punica granatum*) is a fruit of the Punicaceae family. The fruit is sweet-tart in tastecontaining about 234 calories, 4.7g protein, 3.3g fat, 52g carbs, and 11-13g dietary fibers that contribute to maintaining health. Pomegranate is one of the healthiest fruit worldwide with a vitalamount of phenolic compounds. One of the waste materials that make up 43% of the weight is thepomegranate peel (pp) while its seeds comprise 11% of waste. Researchers are now incorporatingpomegranate rind and seed into bioplastics and edible coatings for food packaging and their significant antioxidant and antibacterial properties when used as natural food additives. Pomegranate peels' polyphenols and dietary fiber reduce serum levels of TAGs, LDL, and lipid peroxidation, which protect against cardiovascular disease. Ellagic acid, caffeic acid, chlorogenicacid, syringic acid, ferulic acid, vanillic acid, gallic acid, and cinnamic acid are the primary phenolic acids found in pomegranate peel extracts (PPEs). PPEs have a lot of tannins such as ellagitannins, punicalagin, granatins, pedunculagin, gallagyldilactone, and tellimagrandin. About 196-199mg/g of polyphenols can be extracted using a high voltage electric discharge technique byapplying 38-70 kV/cm of electric field intensity with a flow rate of 12-16mL/min and the liquid- to-solid ratio of 35-36 mL/g of the medium. The extract of pomegranate is used in several differentproducts like meat and meat products, antioxidant-rich tea, bakery products, and the cosmetic industry. It is also being used in animal feed to improve feed efficiency. Several boosters and weight loss drinks are being developed from it. Based on the research now available, it is clear thatPP has a wide range of applications, so creating a system that effectively uses PP will assist in fully realizing its potential benefits.

Keywords: Pomegranate waste, Pomegranate peel, Natural Preservative, High voltage,Extraction, Preservation

NIGELLA SATIVA (BLACK SEED) AND ITS ACTIVE CONSTITUENT THYMOQUINONE (TQ) AS ATHERAPEUTIC AGENT

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Black seed *(Nigella sativa)* is significant dietary supplement and food additive with a long history in folk remedies used by Indian and Arabian civilians. Nigella Sativa (NS) is the member of the Ranunculaceae family, has a variety of medicinal benefits including anti-oxidant, anti-inflammatory, anti-cancer and anti-viral properties. The active constituent, Thymoquinone (TQ) play vital role in prevention and treatment of different disease and also help to improve immune system. Thymoquinone inhibits the growth of cancer cells through a variety of methods including selective antioxidant and oxidant activity, interference with DNA structures, impacting carcinogenic signaling molecules and pathways, and immunomodulation. Clinical trials showed that, a healthy volunteer who received NS oil (5ml/day) for 8 weeks reported no significant liver, renal, or gastrointestinal side effects. Additionally, research demonstrates that type 2 diabetes patients who consume NS oil (equivalent to oil obtained from 0.7g of seeds) for 40days are safe. Black cumin seed contains fixed oil, proteins, alkaloids, saponins, and essential oils. The fixed oil (32–40%) contains beta-sitosterol, cycloeucalenol, cycloartenol, sterol esters, and sterol glucosides in contrast to unsaturated fatty acids like as arachidonic, eicosadienoic, linoleic, linoleic, oleic, almitoleic, palmitic, stearic, and myristic acid. Vitamins, carbohydrates, enzymes, and proteins along eight or nine vital amino acids constitute the nutritional makeup of N. sativa. The NS and few of its isolated compounds such as TQ (including its derivatives), nigellone, α-hederin and linoleic acid have been demonstrated for a number of important pharmacological activities. Conclusively, Black seed is a health promoting herb and potential therapeutic tool.

Keywords: Nigella sativa, nutraceutical, therapeutic agents, dietary supplement

FUNCTIONAL AND BIOACTIVE COMPOUNDS OF CORN AND THEIR EMERGING EXTRACTION TECHNIQUES

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Whole grain has a wide range of health benefits of decreasing the risk of chronic diseases. Corn is commonly consumed grain having rich profiles of nutrients in comparison to other whole grains. Corn nutrients and phytochemicals include vitamins (A, B, E, and K), minerals (Mg, P, and K), phenolic (ferulic, coumaric, and syringic acid, flavonoids (anthocyanins), carotenoids,and dietary fiber. Economic improvement of efficiency of corn can be achieved, revenue can be brought back to rural communities and environment can be benefited by the utilization of corn by-products. As a result of corn processing there is a production of valuable products, coproducts, and byproducts such as DDGS (dried distillers' grain with soluble), ethanol and corn oil. During corn starch processing, several by-products produced abundantly that are separated by technical process includes following like corn gluten, steep liquor, corn germ andcorn bran. More specifically starch is converted into ethanol as the main ingredient of the cornkernels, through the fermentation process. The emerging extraction techniques includes Supercritical-Fluid Extraction (SFE), Ultrasound-Microwave-Assisted Extraction (UMAE), Pressurised-Liquid Extraction (PLE), Microwave-Assisted Extraction (MAE), Ultrasound- Assisted Extraction (UAE), high isostatic pressure, ohmic heating, Enzyme-Assisted Extraction (EAE), and Liquefied Gas Extraction (LGE) over the conventional methods (Soxhlet extraction or maceration). These advanced techniques requires optimum conditions for well-organized results of extraction of targeted bioactive compounds. The aim of emergingtechnologies is to protect food for longer period without causing negative effects on its organoleptic characteristics and nutritional content, and provide such overall method at the same time that is energetically and environmentally more effective.

Keywords: Extraction techniques, corn, bioactive compounds, fermentation, starch, emergingtechnique

BANANA PEEL EXTRACT: AN EXCELLENT ANTIMICROBIAL AGENT

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Food borne pathogens are harmful for human beings because they cause serious outbreaks. They increase the rate of mortality and hospitalisation. Currently, it can be controlled by different techniques such as heating, freezing and by adding chemical preservatives but these techniques have negative effects on food i.e., High heat decreases the nutritional value of food, freezing forms crystallization which causes breakage of cell membranes and food loses its texture, and adding chemical preservatives can cause serious health hazards. Control of microorganisms with natural additive is of great importance. Banana (*Musa Sapientum*) belonging to a family called "*Musaceae*" is a nutrient rich fruit aid in the healthy metabolism. The Banana Peel (*Musa Sapientum*) that we consider as a waste but it also has a high nutritional content. It has many benefits for us as it is anti-cancerous, anti-aging and used for medicinal purposes. Recent studies have shown that banana peel extract is an excellent antimicrobial agent against 2 Gram-positive bacterial (*Staphylococcus aureus* and *Streptococcus pyogenes)*, 4 Gram-negative bacterial (*E. Coli, Klebsiella pneumoniae, Enterobacter aerogenes* and *Moraxella catarrhalis)* and yeast (*Candida albicans).* The aqueous extraction of banana peel has shown different levels of antimicrobial activity against different types of bacterial specie. The tannins are present but the flavonoids are absent in the extract of *Musa sapientum*, it is probable that the antimicrobial activity of the liquid extract from banana peel is related to tannins and not to flavonoids. In addition, it has astringent action, with ability to precipitate proteins, which may affect the bacterial peptidoglycan.

Keywords: Pathogens, metabolism, antimicrobial, anti-cancerous, tannins, waste utilization

IDENTIFICATION OF MUTATION IN CONSANGUINEOUS FAMILIES WITH MICROPHTHALMIA FROM THE REGION OF PUNJAB

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Anophthalmia and microphthalmia (AM) are, the absence or reduced size of the ocular globe compared to the globe size of normal population in same age respectively. FOXE3 is a 319 amino acid long transcription factor which is involved in formation of eye. Mutations in FOXE3 result in AM phenotype. In Pakistani population, FOXE3 is primarily involved in AM phenotype. For genetic screening of mutation in two autosomal recessive families of AM of Pakistani population, we sequenced FOXE3 and analyzed the results by using Bioinformatics tools such as SIFT, Provean, PolyPhen-2, MutationTaster, Condel, PantherPSEP etc. We found a homozygous mutation in family 1, a missense mutation located at chr1:47882276A>G, DNA position c.289A>G and p. I97V. In family 2, we found a nonsense mutation located at chr1:47882707C>A, cDNA.964C>A and p.C240X. Both mutations were successfully segregated when we sequenced and analyzed parents' FOXE3 sequence. We also found two polymorphisms in family 2 which are already reported in 1000G browser. We compared the physical parameters such as the height weight and head circumference of affected individuals with the standard values. All affected individuals were underweight. That shows that nutrition might influence the AM phenotype. This study also highlights high frequency of the involvement of FOXE3 mutation in AM patients. Cohort studies should be conducted on patients of AM for better understanding of causative genes specially in Pakistani population. Expression level studies should be done to understand the phenomenon that how FOXE3 interacts and affects eye formation.

Keywords: Anophthalmia, Microphthalmia, FOXE3, Mutation, Nutrition, Eye disorder.

BIOSORPTIVE POTENTIAL OF RADISH POD LEAVES BIOMASS FOR THE REMOVAL OF TOXIC DYES FROM THE WASTEWATER

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Toxic dyes are discharged into the water bodies that cause deleterious effects on the living organisms and environment. Different methods have been reported for the removal of dyes from the water sources. Biosorptive removal of toxic dyes from the water sources is preferable method as compared to the other reported methods due to its eco-friendly nature. Biosorbents are cost-effective, easily available and efficient for the treatment of toxic dyes present in the wastewater. Here, Radish pod (*Raphanus caudatus*) leave powder was used as an adsorbent for the removal of methyl orange (MO), crystal violet (CV) and Rhodamine B (RhB) dyes from the aqueous medium. Effect of different factors such as adsorbent dose, agitation time, pH, and temperature of the medium on the value of percentage removal of dyes and the adsorption efficiency of the biomass for the dyes was studied to optimize the reaction parameters. Langmuir and Frendlich isotherm models were applied to evaluate the mechanism of adsorption process. The value of regression factor (R^2) for the Langmuir isotherm model was found as 0.999, 0.998 and 0.999 for the removal of MO, CV and RhB as compared to Freundlich isotherm model found as 0.978, 0.972 and 0.942, respectively. It illustrates that adsorption process best followed the Langumir model as compared to Freundlich model. Kinetic study depicts that removal of dyes followed the pseudo second order model.

Keywords: Biosorptive, Radish pod, biomass, toxic dyes

SYNTHESIS OF SILVER NANOPARTICLES USING DESERT PLANT FOR DYE DEGRADATION: A GREEN CHEMISTRY EXPERIMENT

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The capacities and potential of low-cost agricultural waste for the removal of acidic dye from was investigated. Different techniques were used for the characterization of synthesized nanomaterials including FTIR, SEM-EDX etc. Different models were applied to the study the equilibrium sorption capacity of nanomaterials. It was observed that the equilibrium sorption capacity increased with increasing the initial dye concentration. The extent of dye removal decreased with increase in the temperature. Kinetic parameters and sorption isotherm models were studied for determination of kinetic rate and maximum sorption capacity of biomass. The negative values of ΔGo and ΔHo indicated the spontaneous, feasible and exothermic nature of the sorption process. The studies indicated that the synthesized nanomaterials were very attractive material for removing the selected dye from dyed effluents than many of those reported in the literature.

Keywords: Silver Nanoparticles, Desert Plant, Dye Degradation, Agricultural Waste

EFFECTS OF DIETARY FIBRE ON GUT MICROBIOTA IN PATIENTS WITH TYPE 2 DIABETES

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An imbalance in the population of microbes that live in the gut has been related to both systemic inflammation and metabolic problems. There is evidence to indicate that a dysfunction in the gut microbiome, known as dysbiosis, contributes to the genesis of type 2 diabetes via regulating metabolic pathways. Indications interact with dietary components, regulate intestinal permeability, and affect the metabolism of glucose and lipids, insulin sensitivity, and energy balance. Most studies from the Systematic Literature Review (SLR) revealed that faecal shotgun metagenomics and a randomized clinical trial of isocaloric diets were used to demonstrate that only a subset of Short Chain Fatty Acids (SCFA) producing bacteria was favoured by dietary fibre, whereas the majority of other putative producers were diminished and, in some cases, unchanged in patients. In addition, the various fiber-promoted SCFA manufacturers enhanced glucagon-like peptide-1 secretion and decreased haemoglobin A1C. Multiple physiological pathways relevant to human health have been found to be influenced by gut microbiota and its metabolites. SCFA are microbial metabolites that modulate many metabolic processes. On the other hand, some research revealed that food could influence gut microbiota makeup and activity, thus regulating the risk of obesity, insulin resistance, and type 2 diabetes, which are all examples of metabolic illness. The studies concluded that dietary fibre might play a significant role among dietary components due to its prebiotic effect on fibre-fermenting bacteria, which may boost SCFA synthesis. The goal of this review was to synthesize and evaluate current research on the role of dietary fibre in modulating the link between glucose metabolism and microbiota composition in people. The examination of data from observational studies and randomized dietary interventions investigated the connection between Type 2 Diabetes, gut microbiota, short-chain fatty acids, and glucose metabolism. The mechanisms behind this relationship were also addressed.

Keywords: Gut microbiota, Short Chain Fatty Acids (SCFA), dysbiosis, faecal shotgun metagenomics

THE DIOSCOREA GENUS (CHINESE YAM): AN INNOVATIVE NON-CONVENTIONAL NUTRACEUTICAL TUBER

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Continuous work has been done to enhance the world's food and health systems in the pursuit of a world where everyone has access to safe and wholesome food. While these systems appear to be stabilized in the industrialized nations, there are still significant difficulties in various regions of the world. Yam (Dioscorea species) is an orphan crop that is widely grown throughout the world. It has made a significant contribution to food security, particularly in sub-Saharan Africa, thanks to its role in generating revenue and offering nutritional advantages. Yam also contains non-nutritional elements termed bioactive chemicals, which have a variety of health advantages, from cancer prevention to the treatment of degenerative disorders. Recently, there have been additional promising developments about the use of diosgenin and dioscorin, among other chemicals discovered from yam. Despite the advantages of yam, research on its nutritional and healing properties is lacking. Chinese yam might be included into a new round bio-economic system, with the tubers and bulbils used to provide dietary foods as well as pharmaceutical products, and the peel used for the extraction of bioactive compounds and as a useful feed for livestock and the aquaculture enterprise.

Keywords: Chinese yam; Dioscorea; nutritional composition; bioactive compounds; therapeutic potential

CHARACTERIZATION OF MICROSTRUCTURE, PHYSICOCHEMICAL AND FUNCTIONAL PROPERTIES OF HIBISCUS VARIETIES USING DIFFERENT ANALYTICAL TECHNIQUES

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Recently, the role of Hibiscus and its properties is a field of active research with a view to improving the quality of products being produced from Hibiscus. In the current study, scanning electron micrographs and textural attributes of three commercially available Hibiscus varieties were measured. The present study clearly explored a significant variation in the nutritional and chemical profile of Hibiscus varieties. The change in the chemical and molecular structure of different Hibiscus was recorded through scanning the Hibiscus pellet using FTIR. The results illustrated that the chemical attributes showed significant variation in Hibiscus varieties. The results of SEM revealed more intense bonding and round to oval shape with soft and sharp edges results in more water absorption capacity. In the current study, variations in storage modulus and loss modulus were observed corresponding to quality and process ability. Water was determined on the basis of H and OH group in the range of 1637 cm−1 and 3000–3700 cm−1 while protein was measured on the basis of amides (I &II) in the range of 1550 cm−1 and 1600 cm−1 respectively. The study concludes that analytical techniques (FTIR, NIR) are more reliable to analyse physicochemical mapping and molecular structure.

Keywords: Hibiscus varieties; advanced techniques; rheological analysis; molecular aspects; chemical attributes

CURRENT APPLICATION OF NANOTECHNOLOGY IN FOOD INDUSTRY

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Recent innovations in nanotechnology have emerged with increased uses in various fields of food science such as food processing, packaging, development, food safety, and shelf-life extension. In the food industry, Nano polymers can be utilized to detect bacteria in packaging. Nanostructured aerosols are very effective at killing foodborne pathogens such as *E. coli*, *Listeria* and *Salmonella*. Nano tracers or Nano sensors can be utilized to prove the presence of contaminants, mycotoxins, and microorganisms in food. Nano-based delivery systems improve the nutraceutical values of the food components. Nano-emulsification and Nano structuration are the different techniques which have been applied to produce stronger flavours, colour quality and encapsulate the substances to more effectively deliver nutrients like protein and antioxidants. SiO2 nanomaterial is one of the most used food nanomaterial as carriers of flavours in food products. TiO_2 is used as a colouring in the powdered sugar coating on doughnuts. Nano green tea, Neosino capsules, Nutralease are the common commercialized nanotechnology-based products in the market. There should be appropriate labelling and regulations advised for marketing of Nano foods which can help to increase consumer acceptability. Thus, utilization of these nanotechnologies, if managed and regulated correctly, can play a significant role in improving food processing and product quality which will benefit human health and well-being. A uniform international regulatory framework for nanotechnology in food is the need of the hour.

Keywords: nano-materials, nanotracers, food processing, nano-delivery, antioxidants

ADZUKI BEANS AS THERAPEUTIC AGENT

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Adzuki beans, also known as red beans, are cultivated in several nations throughout the world and are very well-liked in Asia, where they are frequently prepared in a variety of cuisine forms. Due to its well-known characteristics in prevention and treatment of diabetes-induced renal disease, or kidney damage it is used as anti-inflammatory, antibacterial, and antioxidant qualities for human health. This supports the idea that adzuki beans may be used both as food and medicine and helps to advertise them as a nutritious legume. Additionally, it includes calcium, magnesium, and potassium, the three essential minerals for regulating blood pressure, and they are a low-fat, cholesterol-free source of high-quality plant protein. Red beans and most other meals that promote cardiovascular health and aid in weight management are useful in preventing type 2 diabetes. This impact is mostly a result of the high dietary fibre and resistant starch content of these foods, which work together to slow down the breakdown of meals and speed up the absorption of nutrients. As a high-fiber food, red beans may help prevent breast cancer. Beans include a natural protein that has the potential to upset the stomach and result in nausea, vomiting, and diarrhoea. Adzuki beans have the highest concentration of the toxin phyto-haemagglutinin of all common beans (PHA). Make sure to fully cook kidney beans because cooking eliminates the toxin. In addition to being a fantastic source of vegetable protein, fibre, and specific micronutrients for the human diet, red beans (Phaseolus vulgaris L.) also contain a wide range of bioactive substances. Simple molecules with biological activity known as bioactive compounds have the capacity to alter one or more metabolic pathways, thereby improving health conditions. Different bioactive substances have been examined for their favourable influence on human health, such as the following: enzymes, probiotics, prebiotics, fibres, phytosterols, peptides, proteins, saponins, unsatured fatty acids, and phenolic compounds, among others. Phenolic chemicals are particularly abundant in colourful beans. The primary phenolic chemicals found and described in beans are phenolic acids, flavonoids, and anthocyanidins

Keywords: Red beans, phenolic compounds , therapeutic agents , nutraceutical

SECTION C

PHYSICS

MATHEMATICS

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COBALT OXIDE THIN FILMS: SYNTHESIS, CHARACTERIZATION AND APPLICATION

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Cobalt oxide (Co_3O_4), the most stable form of cobalt, is a metal oxide semiconductor with an intriguing energy band gap that is used in a number of applications. In this research work, Co_3O_4 thin films were synthesized by sol-gel dip coating technique using cobalt nitrate hexa-hydrate and sodium hydroxide as the precursors. Their structural, functional groups, morphological, magnetic, and optical characteristics were studied using XRD, FTIR, SEM, VSM, and UV-Visible spectrophotometry characterizations. The X-ray diffraction (XRD) results confirmed the formation of the cubic phase of Co_3O_4 at various withdrawal rates with no other impurity peak. By using SEM examination, films with a porous structure can be seen. Fourier transform infrared (FTIR) spectroscopy bands were observed in the range ~ 550−860 cm^{-1}. Direct optical absorption resulted in minimal band gaps in the IR and visible areas, 2.3 eV at 100 mm/s withdrawal speed and 2.12 eV at 250 mm/s withdrawal speed. Coercivity (H_c), saturation magnetization (M_s), squareness ratio, and remanence were all evaluated using the hysteresis loop. Increased withdrawal speed results in an increase in the saturation magnetization (M_s) of thin films of Co_3O_4. It served as a significant turning point for the Co_3O_4 film's eventual application as window layers in solar cells. Since ferromagnetic activity can be observed in all thin films, which can be used in spintronics technology.

Keywords: Co_3O_4; cubic; bandgap; magnetic; Optical analysis; spin coating; optoelectronic devices; porous structure; remanence; saturation magnetization.

STRUCTURAL AND MECHANICAL PROPERTIES OF ORGANIC ADDITIVE STABILIZED ZIRCONIA

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In this current study, zirconia nanostructures are prepared with aiming applications in dentistry and bone implantations. Dried egg shell powder is used as additive to enhance the stability and hardness of the zirconia crystals. Egg shell contains rich calcium which is one of the constituent elements for bones reproduction. Five different samples are prepared by adding egg shell content as, 1 g, 2 g, 3 g, 4 g and 5 g in aqueous zirconium oxychloride sol. The x-Ray analysis shows the metastable phase zirconia for 1 and 2 g egg shell content. Phase pure tetragonal zirconia (t-ZrO2) is achieved at 3g of egg shell content with crystallite size ~8.70461 nm. X-ray density calculations reveal dense zirconia at 3g of egg shell content. This high density and phase purity divulges the high value of hardness (~1389 HV). Scanning electron microscopy (SEM) analysis illustrates the formation of dense 2D nanostructures at 3g of egg shell content. Structural transformation along with hard agglomeration and connected grains are observed for other egg shell content due to presence of monoclinic phase. Phase purity of t-ZrO2 is further confirmed by FTIR analysis. Fundamental tetragonal bands at 460 and 750 cm' are assigned to t-ZrO2. It is worth mentioning here that phase pure t-ZrO2 using egg shell powder as additive with high density has been obtained without any post heat treatment.

Keywords: nanoparticles, egg shell powder, tetragonal zirconia.

NUMERICAL CALCULATIONS OF NONEQUILIBRIUM SPACECRAFT CHARGING AT GEO ALTITUDES WITH TWO TEMPERATURE NONEXTENSIVE DISTRIBUTION

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Surface charging at geosynchronous altitude (GEO) has been the main concern for satellites and spacecrafts. Spacecraft anomalies are associated with extreme surface charging events, especially during substorms in which the GEO plasma is better modeled by two temperatures non-Maxwellian plasma. In such case, we employ two temperature q-nonextensive distribution function to determine the onset of spacecraft surface charging which becomes complex since many parameters control the surface charging. We developed the threshold condition theoretically to better explain the charging behavior at the threshold due to secondary and backscattered electron yields, non-extensivity, population ratio, and the temperature ratio of hot to cold non-extensive electrons. The modified current balance equation predicts critical and anticritical temperatures for various space-grade materials both analytically and numerically. A significant change is observed in the quantities characterizing the charging current, average yield, and density ratio in the presence of super-extensively ($q<1$) and sub-extensively ($q>1$) distributed two-temperature electrons. The mechanism underlying different charging behaviors at or near the threshold is also indicated at various plasma parametric domains. Furthermore, the general conditions of potential jump are also obtained theoretically, predicting the sudden or smooth potential transition.

Keywords: Threshold, Non-extensive, Substorms, Super-extensively, Sub-extensively

DYNAMICALLY CONSISTENT NUMERICAL MODEL FOR TRANSMISSION DYNAMICS OF RUBELLA VIRUS

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In this research work, a mathematical model of a Rubella disease integrating Susceptible-Exposed-Infective-Recovered (SEIR) sub-Populations are numerically analyzed. Reliable numerical modeling must preserves some vital properties of underlying continuous dynamical system like for example positivity, boundedness and dynamical consistency. Standard numerical procedures like forward Euler and Explicit Runge-Kutta method of order 4 (RK-4) do not preserve the important features. A novel unconditionally stable Non-Standard Finite Difference (NSFD) numerical scheme is proposed and analyzed to investigate the dynamical behavior of the disease in a population. Numerical investigations are provided and results are compared with standard finite difference schemes being already used to handle such problems. Standard finite difference schemes give conditional convergence and do not behave well in certain scenarios. The proposed numerical scheme is dynamically consistent with the biological nature of the continuous model and preserves all of its essential properties.

Keywords: Rubella Virus, Numerical Model, Standard Methods, NSFD scheme, convergence.

OPTIMALLY ANALYZED CORONAVIRUS MATHEMATICAL MODEL AND THE IMPLEMENTATION OF COMUTAIONALLY EFFICIENT NUMERICAL APPROACH

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Corona virus disease which has caused frustration in the human community remains the concern of the globe as every government struggles to defeat the pandemic. In this manuscript, we have extensively studied a new deterministic SEQIHR model of deadly Corona virus pandemic governed by nonlinear ordinary differential equations to provide deep insight into the dynamics of the disease. The purpose is to perform a complete mathematical analysis and the design of an optimal control strategy for the developed deterministic model by utilizing the preventive measures of quarantine and hospitalization. Some comprehensive mathematical techniques are employed to demonstrate the positivity and boundedness of solutions. Two main equilibrium points of the pandemic model are stated. To handle the future dynamical behavior of the pandemic, the threshold parameter value is computed using the next-generation method. The local and global stability of equilibrium points is carried out successfully. A numerical analysis to observe the effectiveness of quarantine and hospitalization strategies is performed and illustrated by graphs. We implemented the well-known NSFD method to find the numerical solution of model. An optimal control problem is introduced for the proposed model to determine the best controls for the implemented hospitalization and quarantine strategies. With the attention of reducing the number of exposed and infected persons, an optimum control problem and its derived associated optimality conditions of Pontryagin type are explored. An important feature of this study is to employ NSFD method backward in time for the first time to solve optimal control problem instead of other standard methods. The extremals are obtained numerically. We have shown the effectiveness of the applied controls and their impact on the dynamics of the different classes.

Keywords: Covid-19, Quarantine, Hospitalization, Properties, Stability, NSFD Method, Optimal Control, Numerical simulations

LONG-TERM SIMULATIONS OF OUTER SOLAR SYSTEM USING ERKN PAIRS WITH ROUND-OFF ERROR CONTROL TECHNIQUE

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N-body simulations of the Sun, the planets, and small celestial bodies are commonly used to model the evolution of the Solar System. Enormous numerical integrators for performing such simulations have been developed. The primary objective of this project is to analyse the error growth for embedded explicit Runge-Kutta-Nyström (ERKN) integrators. The experiments are performed with a round-off error control technique for ERKN64 (explicit Runge-Kutta-Nyström pairs of order 6 and 4 with 6 stages) integrators applied to the Jovian problem over a long interval of duration, as long as, one million years with the local error tolerance ranging from $10-16$ to $10-08$. Error is estimated in terms of global error in the position and velocity, and the relative error in energy and angular momentum. The efficiency of the integrators is also observed.

Keywords: Jovian Problem, ERKN pairs, Simulations, Round-off Error

RELIABLE NUMERICAL ANALYSIS OF ROTAVIRUS EPIDEMIC MODEL WITH VACCINATION STRATEGY

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This work deals with the numerical modeling for transmission dynamics of Rotavirus disease in a population. A novel unconditionally stable Non-Standard Finite Difference (NSFD) numerical scheme is proposed and analyzed to investigate the behavior of the disease in a population. Numerical experiments are provided and results are compared with standard finite difference schemes already existing in literature. Standard finite difference schemes give conditional convergence and may diverge for certain choices of discretization parameter. The proposed numerical scheme is independent of step size and remains consistent with the actual continuous dynamical system in all scenarios. Moreover, the impact of vaccination strategy on dynamics of Rotavirus disease has also been discussed numerically.

Keywords: Rotavirus disease, Vaccination Strategy, Numerical Analysis, Stability

EXISTENCE OF STATIC WORMHOLES IN F(G,T) GRAVITY

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This paper investigates static spherically symmetric traversable wormhole solutions in f(G,T) gravity (G and T represent the Gauss-Bonnet invariant and trace of the energy-momentum tensor, respectively). We construct explicit expressions for ordinary matter by taking specific form of red-shift function and f(G,T) model. To analyze possible existence of wormholes, we consider anisotropic, isotropic as well as barotropic matter distributions. The graphical analysis shows the violation of null energy condition for the effective energy-momentum tensor throughout the evolution while ordinary matter meets energy constraints in certain regions for each case of matter distribution. It is concluded that traversable WH solutions are physically acceptable in this theory.

Keywords: Wormhole solutions; f(G, T) gravity

SOME ZAGREB CONNECTION INDICES OF SUDUKO NETWORKS

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A function g : TOP R, where TOP represents finite simple networks and R denotes set of real numbers. Thus, a topological index (TI) is such a relation that connects the chemical or molecular structures to the numeric numbers. These TIs are commonly used in the study of quantitative structures activity and property relationships. The first degree-based TI was defined by Gutman and Trinajstic´ in 1972. Now, degree-based TIs can be classified into two ways degree (number of those neighbors which belong to at distance one) as well as connection number (number of those neighbors which belong to at distance two). Moreover, the data provided by the website http://www.moleculardescriptors.eu shows that the connection-based Zagreb indices have better absolute values for the correlation coefficients of the thirteen physicochemical properties of octane isomers. In this paper, we obtain some Zagreb connection indices such as third, fourth, fifth, sixth, seventh, eighth and fifth multiplicative Zagreb connection index of Suduko Networks.

Keywords: connection number, Zagreb indices, Suduko network