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Abstract: For mitigating the security breaches in FL based IDSs for Industrial IoT (IIoT) and to optimize the negative impact on model performance of Differential Privacy (DP) to prevent data leakages. In this paper, authors propose a novel approach of DP which is utilized at the time of training in FL for IIoT. Contextual Anonymization Aware Differential Privacy (CtxADP) is a mechanism applied by extending the concept of t-closeness in a context-sensitive manner and employed of DP once anonymization has been introduced using several parameters that optimize the privacy and utility tradeoff in the data. In addition to this, authors utilized the principle of Active Learning (ALrn) and Meta Learning (MLrn) in a Federated context, targeting to enhance the effectiveness and adaptability of the learning procedure. Moreover, to removes single points of failure, ensuring trust among IIoT devices without requiring a central authority. Authors employ Blockchain to enhance security in Federated Active Meta Learning (FedAMLrn) providing decentralized validation, immutability, and tamper-proof model updates. Unlike traditional FL, which relies on a central aggregator, Blockchain enables distributed consensus using Byzantine Fault Tolerance (ByzFT), ensuring that only legitimate model updates are accepted. Each model update is hashed and recorded in an immutable ledger, preventing adversarial modifications. Furthermore, authors generate evolving Actionable Intelligence Graph (AIG) that visualize detected threats and deliver insights for security administrators. Authors conducted experiments with CIC-ToN-IoT, Bot-IoT and UNSW-NB15 datasets across the proposed approach FedAMLrn that shows the significant trade-off between privacy and utility. Experimental results indicate that FedAMLrn achieves an accuracy of 96.7 percent, surpassing conventional FL 91.5 percent, MTL 90.5 percent, and DistL 89 percent, while maintaining the lowest communication overhead 5.5 MB and highest privacy preservation score 0.89 with BMC.

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Abstract: Background:Alzheimer's disease (AD) is the most common cause of dementia worldwide, affecting over 55 million individuals and projected to rise drastically in the coming decades. Characterized by progressive cognitive decline and memory impairment, AD involves complex pathological mechanisms including amyloid-beta (A beta) plaque accumulation, neurofibrillary tangles (NFTs) of hyperphosphorylated tau, and chronic neuroinflammation.Objective:This comprehensive review aims to provide a foundational understanding of the molecular, genetic, and immunological underpinnings of AD, with a focus on pathogenic proteins, glial cell responses, and current monoclonal antibody (mAb)-based therapeutic strategies.Methods:Literature on key pathological players such as A beta, tau, microglia, and astrocytes was mentioned to explain their roles in neurodegeneration. The impact of key genetic mutations (APP, PSEN1, PSEN2, APOE, BACE1, MAPT) was outlined. Additionally, recent clinical trial data of anti-A beta monoclonal antibodies (aducanumab, lecanemab, donanemab) were reviewed, with comparative analysis of efficacy, safety, and trial outcomes.Results:Neuroinflammation, mediated by activated microglia and astrocytes, exacerbates A beta and tau pathology, contributing to synaptic loss and neuronal death. Genetic mutations alter APP processing and promote plaque formation. Monoclonal antibodies show promise in reducing A beta burden and slowing cognitive decline: donanemab achieved 60% slower decline in mild cognitive impairment, while lecanemab showed 27% cognitive benefit in early AD. Aducanumab, despite initial promise, was discontinued in 2024 due to limited efficacy and safety concerns. Adverse events like amyloid-related imaging abnormalities (ARIA), particularly in APOE-4 carriers, remain significant.Conclusion:AD pathology is multifactorial, involving an interplay between protein aggregation, immune dysregulation, and genetic risk. While mAb therapies mark progress in disease modification, their success depends on patient stratification, early intervention, and safety profiling. Future directions must

emphasize combinatorial and personalized approaches incorporating early biomarkers, neuroimaging, and emerging technologies to effectively combat the rising global burden of AD.

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Abstract: The service requirements of the Internet of Things (IoT) are fulfilled by the Fog-Cloud system. Service placement in fog-integrated cloud environment is NP-class problem due to dynamism in resource availability and workload. In recent, Deep Reinforcement Learning (DRL) algorithms have gained popularity for addressing service scheduling problems due to their adaptability to the dynamic environment. This work proposes a DRL-based Twin Delayed Deep Deterministic Policy Gradient (TD3) model for service offloading in a fog-integrated cloud. While the standard TD3 model exhibits certain limitations, this work addresses those by incorporating few key enhancements. Additionally, Transfer Learning (TL) is applied to minimize the computational complexity of multi-agent based TD3 model. The proposed model has been simulated in Python platform using Google trace-2019 data. The efficacy is measured on various Quality of Service (QoS) metrics such as latency, energy, computing cost, and deadline violation, where it produces on average 14% 12%, 16%, and 1.5% better results respectively as compared to state-of-art models.

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Abstract: Microglia, the immune cells of brain, can drive neurodegenerative diseases like Parkinson's disease (PD). The resting microglia can polarize into two extremes, either proinflammatory M1 or anti-inflammatory M2 phenotype under a specific microenvironment. Different transcriptional factors and the release of various cytokines characterize these states. The released proinflammatory markers from M1 microglia lead to neuroinflammation that ultimately causes irreversible loss of dopaminergic neurons in PD patients, on the contrary, the M2 microglia possess neuroprotective activity. PD is caused by aggregation and misfolding of alpha-synuclein in the affected dopaminergic neurons. The misfolded alpha-synuclein is cytotoxic and can propagate like a prion from one cell to the other, acting like a template, that can initiate the conversion of normal proteins into abnormal conformation. The extracellular alpha-synuclein can interact and polarize the microglia into the M1 phenotype resulting in inflammation, thereby driving the progression of PD. The progression of neuroinflammation-mediated neurodegeneration in PD is seen higher in menopausal women; likely due to the low circulating estrogen levels. Estrogen hormones possess neuroprotective activity, and one of the ways is that they can polarize the microglia into M2 phenotypes and reduce alpha-synuclein-mediated microglial activation. A detailed understanding of the signaling mechanisms underlying microglial polarization between M1 and M2 phenotypes is crucial for identifying druggable targets to reduce PD symptoms, including in menopausal women.

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Record 5 of 33

Title: The impact of intrinsic magnetisation and Ohmic diffusion on Jeans instability in strongly magnetised anisotropic quantum plasmas

Author(s): Sangwan, VK (Sangwan, Vinesh Kumar); Bhambhu, R (Bhambhu, Ravinder); Prajapati, RP (Prajapati, Ram Prasad)

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Abstract: We have investigated the modified Jeans instability and gravitational collapse in uniformly rotating, anisotropic quantum plasmas, including the effects of intrinsic magnetisation, viscosity tensor and Ohmic diffusivity. The closure of the Chew, Goldberger and Low and quantum magnetohydrodynamic fluid models describes the dynamical properties and modified dispersion characteristics of the system. The modified Jeans instability criteria and Jeans wavenumbers for the onset conditions of gravitational collapse are obtained, which are significantly modified due to spin magnetisation, quantum corrections and rotation of the system. Strong magnetisation and electrical resistivity are found to enhance the growth rate of Jeans instability, making the system more gravitationally unstable. The magnetic field shows both stabilising (in weak magnetisation limit) and destabilising (in strong magnetisation limit) influence on the growth rate by affecting the gravitational collapse mechanism of dense stars. The growth rate of pressure-anisotropy-driven firehose instability is destabilised due to pressure anisotropy, rotation and spin magnetisation effects. The results are discussed in order to understand the Jeans instability and gravitational collapse of low-mass strongly magnetised white dwarfs.

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Author(s): Yadav, Y (Yadav, Yogesh); Tiwari, A (Tiwari, Amul); Singh, K (Singh, Kavita); Sagar, R (Sagar, Ram)

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Abstract: In this study, a solvent-dependent ceric ammonium nitrate (CAN) and TMSCl-mediated synthesis of enantiopure 2,3-dideoxy-alpha,beta- unsaturated carbohydrate enals (Perlin aldehydes) in CH3CN and 1,4-di-oxane has been reported. This efficient protocol works well for the various D-glucals (O-acetyl, O-propyl, O-butyl, O-TIPS), and afforded Perlin aldehyde in acceptable to good yields. Thus, in this article we present a quick, efficient, and highly selective method for synthesizing Perlin aldehyde in 1.5 hat 70 degrees C in good yield.

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Author(s): Kujur, PP (Kujur, Punit Prasanna); Ellappan, S (Ellappan, Surendar); Mondal, AC (Mondal, Amal Chandra)

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Abstract: Empathy is the capacity to experience and understand the feelings of others, thereby playing a key role in a person's mental well-being essentially by promoting kindness and a sense of belongingness to the group. However, too much empathy may result in psychological problems such as empathic distress, compassion fatigue, and burnout, collectively termed empathic pain. Several brain regions are implicated in processing empathic pain perception. Neuroimaging investigations bring in the context of brain structures involved in this emotional exchange, pointing toward the anterior insula (AI) and anterior cingulate cortex (ACC), indicating an overlap between the neural representation of direct and simulative pain. To discern such overlaps, therapeutic techniques for managing empathic pain require understanding different brain regions and their respective neural networks. At the moment, empathic pain is being treated using various methods, including pharmacological treatments such as antidepressants and psychological treatments such as mindfulness or meditation. For instance, researchers have been exploring the modulatory effects of neurotransmitters like serotonin, norepinephrine, and oxytocin on individuals' responses to empathic pain experience. Importantly, this review focuses on the specific brain parts and their unique roles in neurobiological pathways associated with emphatic pain and how shared neural networks play into available treatment options, suggesting possible future health benefits. Such an understanding of empathy can lead to more efficient management of types of care, focusing on enhancing social connections and mental well-being.

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Abstract: Delhi experiences severe air quality deterioration in winter. The role of atmospheric aerosols is well known for affecting human health, visibility, cloud formation, and other atmospheric processes. Ozone also plays a very important role in the atmospheric chemistry of any city. Previously, high ozone concentrations were observed in Delhi during the lockdown. This article investigates the concentration of ozone in the troposphere with chlorine concentrations. The main anthropogenic sources of chlorine in the atmosphere are coal combustion, biomass burning and, burning chlorinated substances, including plastic waste. To study the relationship between gaseous Cl- (Clg)/HCl and tropospheric ozone (O3), we measured particulate Cl-, Clg, PM10, PM2.5 and ozone on an 8-h interval period during severe air pollution conditions in Delhi (November-December 2023). In this study, average concentrations of ozone, particulate Cl-, PM2.5, PM10, and Clg were recorded as 35.56 mu g m-3, 0.91 mu g m-3, 219.59 mu g m-3, 333.80 mu g m-3, and 19.06 mu g m-3 respectively. Results showed a significant negative correlation between ozone and particulate Cl- (r = - 0.51) which suggested that higher concentrations of particulate chlorine were associated with lower ozone levels. The study emphasize the need for a larger program involving remote sensing data to explain recent ozone spikes reported in the Delhi region.

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Abstract: Toxicological assays on fish cell lines are an alternative tool for rapidly and reliably assessing the toxic properties of chemicals or mixtures. In the present study, the gill cell line of Catla catla fish (ICG) was employed to understand the ecotoxic impacts and probable mechanism of toxicity of heavy metal cocktails (Cd, Pb, Cr, Zn, Cu, Co, Ni, Ag, and As) in the study area. Evaluation of individual and combined toxicity of heavy metals was done via MTT and alamar blue (AB) methods. Four cocktails were prepared to mimic concentrations of heavy metals found in different sites in the Yamuna River. Besides determining the cytotoxic effects of heavy metal cocktails, assays were performed to detect the production of reactive oxygen species (ROS), loss of mitochondrial membrane potential (MMP), and cell cycle arrest. To the best of our knowledge, this is the first attempt to study the impact of environmentally relevant river sediment concentrations of heavy metal mixtures on fish cell lines. The present study's findings elucidate how aquatic organisms respond to individual and cocktail pollutants. Further, the results emphasise the need to consider environmentally relevant concentrations of the heavy metal mixture while assessing their toxicological impacts in environmental conditions.

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Title: CRCNet: convolutional multi-layer perceptron encoder with attention module for colorectal cancer segmentation

Author(s): Singh, MK (Singh, Manoj Kumar); Chand, S (Chand, Satish); Kumar, D (Kumar, Devender)

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Abstract: Colorectal cancer (CRC) segmentation is a difficult task because of the structural complexity of polyps in colonoscopy and endoscopy imaging. This paper proposes CRCNet, a novel deep learning (DL) framework to address these challenges using specifically designed components that improve feature learning and localization precision. CRCNet combines a convolutional multi-layer perceptron (MLP) encoder that preserves both spatial and contextual representations; a synchronized feature boost (SFB) module to maintain fine-grained low-level features usually lost during downsampling. A convolutional block attention module (CBAM) to focus on diagnostically relevant areas using spatial and channel-wise attention. Further, a semantic-local feature aggregation (SLFA) block merges semantic context with localized information to enhance boundary clarity in the decoder. CRCNet is evaluated on four benchmark datasets: CVC-ClinicDB, ETIS, CVC-ColonDB, and CVC-300. It achieves dice coefficient of 0.9519, 0.9139, 0.8677, and 0.9421 intersection over union scores of 0.9083, 0.8438, 0.7692, and 0.8909, respectively. The model also demonstrates exceptional boundary accuracy and lowers mean absolute error (<= 0.0180\documentclass[12pt]{minimal} \usepackage{amsmath} \usepackage{wasysym} \usepackage{amsfonts} \usepackage{amssymb} \usepackage{amsbsy} \usepackage{mathrsfs} \usepackage{upgreek} \setlength{\oddsidemargin}{-69pt} \begin{document}$$\le

0.0180$$\end{document}) with a structure measure (Sm) above 0.93 and an enhanced measure above 0.95 across all datasets. The lightweight architecture (1.18 M parameters) of CRCNet ensures computational efficiency by preserving detailed anatomy details in low-contrast areas. These experimental results show the superior performance of CRCNet over existing techniques by focusing on its adaptability in managing various polyp shapes, scale modifications, and imaging artefacts. CRCNet improves the accuracy of CRC diagnosis by fusing attention systems and advanced feature enhancement.

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Author(s): Kundu, RP (Kundu, Rajendra P.); Pandey, SG (Pandey, Siddhi Gyan)

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Abstract: We propose a game theoretic model for multiplexity in signed networks through strategic interactions amongst n players who are linked to each other in an existing signed network of friendships and enmities g, which shape the incentive structure faced by players in their pairwise interactions with each other. These interactions take the form of simultaneous move cooperation games of complete information, wherein network effects create incentives to cooperate due to the presence of common friends as well common enemies. The set of pure strategy Nash equilibria in the strategic interactions between players i and j determine the nature of the tie between them in G(g), which is the new layer of the signed multiplex. We investigate how properties of structural balance in the existing signed social network g influence balance in the new signed network G(g), identifying conditions on the existing network that yield a structurally balanced new layer of the multiplex.

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Author(s): Dinesh (Dinesh)

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Abstract: Organic-inorganic hybrid perovskite single crystals have attracted a great deal of attention in the field of optoelectronics due to its exceptional optical, electrical, magnetic, and thermal capabilities. However, several hybrid perovskites are capable of exhibiting thermochromism but at the cost of metal toxicity. To overcome the limitation, we designed a lead-free copper chloride hybrid perovskite [CH3NH3]2CuCl4 which not only shows reversible thermochromism but also possesses excellent temperature-dependent optoelectrical properties. Significantly, the single crystal displays a reversible colour change from light yellow to red-brown along with a temperature change. In comparison with other hybrid thermochromic perovskites, temperature-dependent electrical properties of a single crystal were investigated by the 2-probe method in the frequency range of 20 Hz to 1 MHz. Dielectric relaxation and conduction mechanism in the single crystal have been revealed using Impedance Spectroscopy in correlation with the Modulus spectroscopy. In single crystals, the temperaturedependent relaxation process is specified by the movement of the peak of -Z " into a high-frequency regime when the temperature is raised. Second harmonic generation confirms the polar nature of the compound. Further, [CH3NH3]2CuCl4 compound was stable up to 200 degrees C, and a thermal anomaly was detected in the heating cycle at 84 degrees C. Therefore, our research offers a thorough evaluation and in-depth understanding of electrical and optical properties in the lead-free perovskite single crystals (SCs) that will assist in the practical application of these hybrid perovskites in smart windows.

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Abstract: Protein aggregation is main pathological hallmark of numerous neurodegenerative disorders. The characterization of protein aggregates is critical for understanding their role in disease progression as well as for developing therapeutic interventions. Thus, to study protein folding and aggregation, molecular crowding agents commonly being used to mimic the in vivo condition. Moreover, histological dyes such as Thioflavin T (ThT), 8-Anilino-1-naphthalenesulfonic acid (ANS), and Congo Red (CR) are prominent amyloid-sensitive dyes, each exhibiting distinct binding and fluorescence characteristics upon binding to amyloid fibrils. In this study, we investigated the effect of macromolecular crowding agents like Ethylene glycol (EG) and Polyethylene glycol (PEG) on binding and fluorescence properties of histological dyes. Various spectroscopic techniques revealed that there was increase and shift in the fluorescence of ThT and ANS with increasing concentration and molecular weight of PEGs and EG. Additionally, CR absorbance spectra showed structural changes in the dyes upon interaction with glycols. Further, microscopy showed altered morphology of dyes in the presence of these compounds. Moreover, molecular docking studies show that both PEGs and EG interact with the dye, thereby indicating that PEGs and EG potentially modulate the binding behavior of dyes to the protein aggregates. This study reveals that amyloid-sensitive dyes show non-specific binding with crowding agents, which can significantly impact the results when the protein is used for aggregation studies and lead to false positive results as well. Therefore, this study provides insight into interaction of dye with crowding agent, which suggests taking appropriate blanks for protein aggregation studies.

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Abstract: A memcapacitor emulator model has been proposed using a single multi-output operational transconductance amplifier (MO-OTA). The model has been simulated using Cadence Virtuoso 45nm GPDK technology. The experimental verification of the model has been carried out using the existing operational transconductance IC LM13700. The circuit exhibits desired characteristics up to a frequency of 4MHz and has a power consumption of 272.5 mu W. Using the proposed model, transient analysis and hysteresis curves have been plotted at different frequencies. The reliability of the proposed structure has been tested through Monte Carlo simulations. Process-voltage-temperature (PVT) variation testing has been performed to check the robustness of the proposed circuit. The proposed memcapacitor emulator model has been shown to have a diverse range of applications ranging from mathematical operations such as integration and differentiation to neuromorphic adaptive learning.

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Author Keywords: Memcapacitor; memristor; emulator; floating design; MO-OTA; decremental configuration; incremental configuration

KeyWords Plus: ELECTRONICALLY CONTROLLABLE MEMCAPACITOR; FLOATING MEMRISTOR EMULATOR; ELEMENTS; MUTATOR; DEVICES; DESIGN

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Title: Pathogen induces <i>MEDEA</i> gene in a parent-of-origin nonspecific manner and causes embryo lethality in <i>MEDEA</i> overexpressing plants

Author(s): Rani, S (Rani, Sonia); Roy, S (Roy, Shweta); Nandi, AK (Nandi, Ashis Kumar)

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Abstract: MEDEA (MEA) is an imprinted gene, and only the maternal copy is expressed in female gametophytes and developing endosperms. Upon pathogen inoculation, MEA ectopically expresses in vegetative tissues. MEA overexpressing plants are susceptible to pathogens. Unlike mea mutant plants, MEA overexpressing plants bear healthy seeds with fertile embryos. It was not known whether there is any parent-of-origin specificity in pathogen-induced MEA expression. Using F1 of inter-ecotype accessions of Arabidopsis lines, we show that ectopic expression is nonspecific to the parent-of-origin copy of the genome. We also report here that MEA overexpressing plants (p35S:MEA-HA), though constitutively accumulates MEA mRNA, protein accumulates only upon pathogen inoculation. Repeated foliar application of pathogens results in embryo abortion in p35S:MEA-HA plants but not in WT plants. Results suggest that pathogen-mediated immunity activation stabilizes MEA protein, which is lethal to embryonic development.

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Author Keywords: Embryo phenotype; MEA protein accumulation; MEDEA expression; Gabelstein; Root phenotype; SNP at MEA locus

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Author(s): Meena, Y (Meena, Yogendra); Anagha, P (Anagha, P.); Balasundaram, S (Balasundaram, S.)

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Ya-Fen Y., 2025, Neural Netw, V185
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Abstract: The Lagrangian dual of the 2-norm support vector regression (LSVR) solves a quadratic programming problem (QPP) in 2m variables subject to the non-negative variable conditions where m is the size of the training set. Applying the Karush-Kuhn-Tucker (KKT) necessary and sufficient optimality conditions, this work's novel problem formulation is only derived as a fixed point problem in m variables. This problem is solvable either in its original form, having the non-smooth "plus" function, or by considering its equivalent absolute value equation problem using functional iterative methods. A linear convergence rate of the proposed iterative methods is rigorously established under appropriate assumptions. It leads to the unique optimum solution. Numerical experiments performed on several synthetic and real-world benchmark datasets demonstrate that the proposed formulation solved by iterative methods shows similar or better generalization capability with a learning speed much faster than support vector regression (SVR), very close to least squares SVR (LS-SVR), and comparable with ULSVR which indicates its effectiveness and superiority.

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Title: Protein-tags and their fragments as potent inhibitors of enzymes: Structure of the ternary complex of phosphopantetheine adenylyltransferase from <i>Enterobacter</i> spp. with tag-peptides and phosphonoacetic acid at 2.20 Å resolution

Author(s): Ahmad, N (Ahmad, Nabeel); Kumar, V (Kumar, Virender); Goel, VK (Goel, Vijay K.); Sharma, P (Sharma, Pradeep); Sharma, S (Sharma, Sujata); Singh, TP (Singh, Tej P.)

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Abstract: Phosphopantetheine adenylyltransferase (PPAT) catalyzes the penultimate step of coenzyme A (CoA) biosynthesis pathway by transferring the adenylyl group from adenosine triphosphate (ATP) to 4 '-phosphopantetheine (PNS), yielding 3 '-dephosphocoenzyme A and pyrophosphate. In this study, the recombinant PPAT from Enterobacter spp. strain 638 (EbPPAT) was purified and co-crystallized with phosphonoacetic acid (PAE). The structure showed the presence of three homodimers A-B, C-D, and E-F in the asymmetric unit. The 14 extra N-terminal residues (Met-14 to Ser-1, 14-mer peptide) from the expression tag were observed in Molecules B and F. These tag-peptides occupied the PNS-binding sites of adjacent Molecules A and E, respectively. Additionally, a heptapeptide (Met-14 to Gly-8) was also observed in the PNS-binding site of Molecule C. Furthermore, two PAE molecules were present in the ATP-binding sites of Molecules B, D, and F, whereas a single PAE molecule was found in Molecules A, C, and E. This showed that tag-peptides blocked the PNS-binding site while PAE blocked the ATP-binding sites. Three peptides of the tag, including 14-mer (Met-14 to Ser-1), heptapeptide (Met-14 to Gly-8) and pentapeptide (Met-14 to Thr-10) were synthesized, and their binding affinities were estimated, which showed the K-D values of 5.5 x 10(-5), 1.8 x 10(-8), and 7.3 x 10(-9) M, respectively. PAE molecules bound to EbPPAT in the ATP-binding sites with a K-D of 4.77 x 10(-4) M. This is the first structure of PPAT with peptides bound in the substrate-binding sites, indicating a novel approach to design peptide inhibitors.

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Title: Temporal gene expression profiling suggests stage-specific regulation of apocarotenoid biosynthesis genes during stigma development in <i>Crocus sativus</i> L.

Author(s): Gupta, K (Gupta, Khushboo); Rajkumar, MS (Rajkumar, Mohan Singh); Singh, V (Singh, Vaishali); Rani, P (Rani, Pooja); Wani, AA (Wani, Aijaz A.); Pareek, A (Pareek, Ashwani); Garg, R (Garg, Rohini); Jain, M (Jain, Mukesh)

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Abstract: Saffron (Crocus sativus L.) is a sterile triploid medicinal plant and is the world's most expensive cultivated herb. Its dried red stigmas accumulate important carotenoids, which produce apocarotenoids after oxidative cleavage. Saffron produces important apocarotenoids, crocin, picrocrocin and safranal, that provide color, flavor and aroma to it. To understand the expression pattern and stage specificity of apocarotenoid biosynthesis genes, we performed RNA sequencing at six different stages of stigma development (yellow, orange, red, two days before anthesis, at the day of anthesis and two days after anthesis) using Illumina platform. Differential expression analysis revealed preferential/specific expression of many genes at the different stages of stigma development. Functional annotation identified many genes encoding enzymes involved in different steps of apocarotenoid biosynthesis pathways expressed preferentially at red and later stages of stigma development. In addition, gene ontology enrichment analysis revealed several genes involved in primary/secondary metabolic processes and reproductive development pathways, exhibiting higher transcript abundance at the later stages of stigma development. Overall, the data and results presented in this study can serve as a rich resource for understanding the apocarotenoid biosynthesis in C. sativus during stigma development.

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Abstract: The invasion of host erythrocytes by Plasmodium falciparum is a fundamental step in its pathogenesis, relying on precisely regulated, transient interactions between parasite proteins and the host erythrocytes. Approximately 20% of eukaryotic proteins contain tandem repeat regions that majorly facilitate protein-protein interactions, with ankyrin (ANK) repeats being the most frequent, and are associated with various diseases. Despite significant advancements in understanding the importance of ANK repeats across various organisms, their roles within the phylum Apicomplexa, including P. falciparum, remain largely unexplored. This study focuses on the significance of ANK repeat proteins in P. falciparum growth and pathogenesis. Here, using in silico approaches, we deciphered the ANK repeat protein family in P. falciparum and elucidated the crystal structure of one of its members, PfANK_1. Co-immunoprecipitation assays revealed several potential interacting partners of PfANK_1, showing its involvement in the functioning of the PfClag9-PfRhopH complex. The stability and interactions of PfANK_1 within the complex were confirmed through multiple approaches, such as bio-layer interferometry (BLI), co-localization studies, and molecular dynamic simulations. Given the crucial role of the PfClag9-PfRhopH complex in erythrocyte invasion, PfANK_1 presents a promising druggable target. The structural analysis uncovered the binding interface and key interacting residues of PfANK_1 with the components of the PfClag9-PfRhopH complex. The work thus provides the first molecular and structural characterization of an ANK repeat protein in P. falciparum, offering new insights into the role of these proteins in the parasite life cycle and providing a potential platform for structure-function relationship-guided drug discovery.

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Abstract: Microbial exopolysaccharides (EPS) are increasingly recognized for their diverse applications, including their potential as edible coatings. This study aimed to optimize the production of EPS synthesized by Pseudomonas protegens ML15, characterize its properties, evaluate its biological activities, and assess its suitability as an edible coating. EPS production was optimized through response surface methodology (RSM). Key parameters, including incubation time, temperature, and pH, were systematically evaluated to identify the optimal conditions for maximizing EPS yield. This optimization led to a significant enhancement in EPS yield, with a 73.6% increase, compared to non-optimized conditions. Characterization of the EPS revealed substantial antioxidant and antifungal properties. Compositional analysis using GC-MS, NMR, and FTIR confirmed the presence of characteristic polysaccharide peaks and identified glucose, mannose, galactose, and xylose as the primary monosaccharides in the EPS. Additionally, structural analysis via SEM demonstrated the well-preserved morphological integrity of the EPS. In situ experiments indicated that tomatoes coated with EPS exhibited significant reductions in post-harvest gray mold rot caused by Botrytis cinerea, alongside improvements in quality parameters such as reduced weight loss, increased levels of ascorbic acid, citric acid, and phenolics, and enhanced antioxidant activity. Notably, the EPS coatings effectively preserved tomato quality under infection conditions, suggesting their potential as a valuable tool for protecting fruits from phytopathogenic fungi, extending shelf life, and maintaining post-harvest quality.

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Title: Epigenetic targeting of MECOM/KRAS axis by JIB-04 impairs tumorigenesis and cisplatin resistance in MECOM-amplified ovarian cancer

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Abstract: Copy number gene amplification and associated overexpression of driver oncogenes are genetic events that contribute to cancer progression and drug resistance. MDS1 and EVI1 Complex locus (MECOM) gene is copy number amplified and overexpressed in aggressive epithelial ovarian cancers. The biological function and precise molecular mechanism of MECOM in the progression and drug resistance of ovarian cancer remain unclear. Here, we unravel MECOM as a regulator of KRAS and its downstream MAP Kinase signalling pathway, and also identify epigenetic inhibitor JIB-04 as a pharmacological agent targeting MECOM/KRAS axis. RNAi-mediated attenuation of MECOM in ovarian cancer cells harboring MECOM amplification reduced their proliferation, impaired colony formation, and impeded cellular migration. ChIP-qPCR analysis confirmed binding of MECOM to the KRAS promoter, suggesting direct regulation of the KRAS gene at the transcriptional level. Further, MECOM promoted cellular proliferation by regulating KRAS-mediated ERK/ZEB1 signalling cascade. The anti-tumorigenic effects due to MECOM loss were phenocopied by the treatment of ovarian cancer cells harboring MECOM amplification with JIB-04 epigenetic inhibitor targeting Jumonji domain histone demethylase enzymes. By ChIP-qPCR, we show that JIB-04 induced transcriptional changes of MECOM by altering H3K27me3 demethylation at its promoter region. We further report that ovarian cancer cells expressing high-MECOM levels exhibit cisplatin resistance, which could be effectively reversed upon pre-treatment with JIB-04. The therapeutic efficacy of JIB-04 was further demonstrated in mice bearing ovarian cancer cell xenografts, where JIB-04 slowed down the tumor growth in corroboration with diminishing MECOM expression. RNA-sequencing analysis identified potential cisplatin resistance gene, SUB1, being regulated by JIB-04-mediated modulation of MECOM expression. Altogether, these data suggest that epigenetic silencing of MECOM by JIB-04 mediated H3K27me3 modulation is an important mechanism in ovarian cancer and provide a new therapeutic target for the treatment of ovarian cancers harboring MECOM amplification.

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Abstract: -In this work, the length of the channel for vertical nanowire tunnel FET is modulated for performance enhancement and the channel length modulated (CLM) vertical nanowire tunnel field effect transistor (VNW-TFET) is proposed. As the channel length modulation effects quantization, our goal is to reduce its impact on gate capacitance, which can change the device's performance. To determine the device's performance, other factors are taken into consideration, such as the device's threshold voltage (Vt), sub-threshold swing (SS), on-off current ratio (ION/IOFF), and drain induced barrier lowering (DIBL). It is discovered that the CLM-VNW-TFET performs better than the traditional VNW-TFET when the channel length is 20 nm. Later on, the gate metal work function (phi MG) of the proposed device CLM-VNW-TFET is varied from 3.9 to 4.5eV and the impact of this variation is studied. The work-function variation effects of channel length modulated vertical nanowire tunnel FET are discussed for the first time. After investigation, it is found that the device CLM-VNW-TFET with phi MG of 3.9 eV produces best ON-current (ION), OFF-current (IOFF) and other parameters. The device exhibits ION of 3.52 x 10-6 A/mu m, IOFF of 7.30 x 10-17 A/mu m and high ION/IOFF as 4.83 x 1010.

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Abstract: In the search for low-carbon emission fuel, nations worldwide are looking to use green hydrogen to transition into a carbon-free economy along with traditional renewable energy technology. In the present scenario, hydrogen production costs are higher due to various factors; one such factor is determining the best location for hydrogen production. The site selection for hydrogen production is based on the multiple aspects of the infrastructure, workforce, market and storage. This communication aims to re-utilize the ignored infrastructure in the petroleum industry to produce new and renewable energy to kickstart the hydrogen economy in the future. The group gathering stations (GGSs) is the best co-location for hydrogen production as it has all the necessary infrastructure for economical hydrogen production and storage. GGS produces enough wastewater, excess waste energy, a spacious and safe environment for hydrogen production, and access to good infrastructure for injecting hydrogen into nearby gas grids and depleted reservoirs.

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Abstract: Plants in natural environments frequently encounter multiple abiotic stresses, which may occur individually, simultaneously, or sequentially, significantly impacting crop productivity. The transcriptional response to these stresses varies across genotypes, and understanding these variations at the molecular level is critical for improving stress resilience. In a previous study, we identified two contrasting rice genotypes, Lomello (highly stress-tolerant) and C57-5043 (highly stress-sensitive), from a screen of similar to 400 genotypes for abiotic stress tolerance. Here, we performed time-course transcriptomic profiling to dissect the molecular basis of their differential stress responses under varying severity levels (mild, moderate, and severe) of high temperature (HT), drought (D), submergence (S), combined heat and drought stress (HTD), and post-submergence drought (PSD). Our results reveal that transcriptional responses are highly context-dependent, with distinct expression patterns emerging under individual, combined, and sequential stress conditions. Notably, while submergence induced significant transcriptomic changes within the first few days, subsequent drought exposure, particularly at higher severity levels, did not elicit a strong transcriptional response, likely due to transcriptional silencing resulting from physiological damage. Comparative analysis between genotypes showed that Lomello exhibits constitutively higher expression of genes involved in phytoalexin biosynthesis, even in the absence of stress, potentially conferring a preemptive defense advantage. Furthermore, Lomello demonstrated a robust induction of genes associated with reactive oxygen species (ROS) scavenging, abscisic acid (ABA) biosynthesis and signaling, and secondary metabolite production in response to stress, followed by a rapid reversion to near-baseline expression levels during recovery. These findings suggest that Lomello's superior stress tolerance is driven by enhanced secondary metabolite accumulation, efficient ROS detoxification, and a stronger recovery response. This study provides novel insights into genotype-specific transcriptional strategies for stress resilience, offering potential targets for breeding climate-resilient rice varieties.

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Abstract: Metal contamination in water resources and associated risks to human health are common and concerning issues in mining areas. Keeping this in mind, 27 (twenty-seven) groundwater samples (GW) and 12 (twelve) surface water (SW) samples were collected from different locations in the Sohagpur coal mining area to determine the concentration of metals (Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, Sr, V and Zn) to assess the probable risk (ingestion and dermal) on child and adult male and female populace in the area. The results show that the Fe, Mn, and Al concentrations exceeded the Indian drinking water standards in nearly 59%, 56% and 48% of the GW samples, and Ni and Se concentrations exceeded the standards in about 26% of the GW samples. However, in the case of SW samples, only Mn and Fe exceeded the recommended limits in a few locations. The hazard index (HI), which is based on the combined risk of metals, suggested considerable hazards to the child population due to ingestion of the metals through groundwater, with a HI value of 1.5. However, the dermal risk due to metals in the surface water was within the acceptable limits. The principal component analysis (PCA) suggests that concentrations of metals in the GW and SW are probably due to the area's lithological, vehicular emission and coal mining activities. The present study suggests that continuous monitoring and implementation of remediation strategies are necessary to mitigate metal contamination in the coal mining area. Furthermore, public awareness and proper environmental rules and regulations should be implemented to prevent contamination of the area's water resources and reduce the risks to the health of the local population.

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Abstract: The escalating prevalence of antibiotic-resistant infections and implant-related complications caused by biofilm-forming pathogens from the ESKAPE group, as identified by the World Health Organization (WHO), underscores the urgent need for innovative anti-biofilm strategies. Their occurrence on medical implants & prosthetic devices, as well as nosocomial infections in co-morbid patients, has become a global concern in the healthcare sector. In response, we investigated the efficacy of as-synthesized ZnS quantum dots (ZnS QD) and novel Au@ZnS nanoconjugates (Au@ZnS NC) against a spectrum of ESKAPE pathogens. The present study aimed to elucidate their antibacterial and anti-biofilm efficacy, focusing on Acinetobacter baumannii, Enterobacter cloacae, Staphylococcus epidermidis, Enterococcus faecium, Proteus mirabilis, Pseudomonas aeruginosa, Enterococcus faecalis, Staphylococcus aureus and Enterobacter aerogenes pathogens. The novel synthesis and application of ZnS QD and Au@ZnS core-shell NC demonstrate exceptional anti-biofilm efficacy, stability, and solubility in aqueous environments. Utilizing minimum inhibitory concentration (MIC) assays, tube dilution, and biofilm formation assay, we noticed a significant reduction in biofilm formation and extracellular polymeric substances (EPS) production upon treatment with Au@ZnS NC, even at low concentrations. Further investigations, including cell permeability assay, reactive oxygen species analysis, and comet analysis, demonstrated that the Au@ZnS NC induced oxidative stress, destabilizing cell structure, macromolecule destruction, and DNA strand breakage. Notably, Au@ZnS nanoconjugates effectively inhibited biofilm formation within 24 h across all tested strains, outperforming ZnS quantum dots. This research highlights the potential of Au@ZnS nanoconjugates to revolutionize infection control on medical devices and implants, offering a promising solution to the global healthcare challenge posed by biofilm-forming pathogens as we also observed minimal bacterial colonization on Au@ZnS treated urinary catheters.

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Abstract: Emerging resistance to current antibiotics is a global threat to human health. Therefore, comprehending the mechanism behind antibiotic resistance holds paramount importance. In the pursuit of finding new antibacterial agents, our group has developed a small molecule, PPEF (2 '-(4-ethoxyphenyl)-5-(4-propylpiperazin-1-yl)-1H,1 ' H-2,5 '-bibenzo(d)imidazole), having bisbenzimidazole as a pharmacophore, targeting bacterial type IA topoisomerase, a novel drug target in bacteria. We examined the emergence of mutations leading to PPEF resistance in laboratory-evolved Staphylococcus aureus strains. The growth curve revealed that S. aureus 25923 PPEF-resistant (SA-PR) and methicillin-resistant S. aureus 43300 PPEF-resistant (MRSA-PR) attained stationary phase earlier than their respective reference strains. RNA sequencing analysis revealed that atpD (ATP synthase gene) was downregulated by 2 log2-fold in both SA-PR and MRSA-PR strains, whereas there was 10 to 13 log2-fold downregulation of mecR1 (methicillin resistance-inducing gene), ble (bleomycin resistance-inducing gene), blaZ (beta-lactamase), pbp (penicillin-binding protein gene), ermA (rRNA adenine methyltransferase gene), and kdpB (potassium-transporting ATPase) in the MRSA-PR strain. Quantitative reverse-transcriptase PCR data confirmed these results. Additionally, MRSA-PR showed a 5 log2-fold upregulation of comG and a 9 log2-fold downregulation of topB, indicating increased genomic variability and stress adaptation contributing to resistance. Genomic sequencing revealed deletions of resistance genes, including aac(6')-aph(2"), aadD, mecA, and blaZ in MRSA-PR, resulting in a gain in resistance and a diminishing returns epistasis pattern in PPEF-evolved S. aureus strains. This led to the development of an evolved MRSA-PR strain susceptible to oxacillin, ciprofloxacin, gentamicin, and imipenem. Our findings indicate that adaptation to PPEF has increased antibiotic susceptibility, thereby changing the clinical outcomes of infections.IMPORTANCEThis study investigates how Staphylococcus aureus bacteria, including methicillin-resistant Staphylococcus aureus

(MRSA) strain, develop resistance to a new candidate antibacterial compound, PPEF (2 '-(4-ethoxyphenyl)-5-(4-propylpiperazin-1-yl)-1H,1 ' H-2,5 '-bibenzo(d)imidazole). The research found that resistant strains grew slower and showed significant changes in the activity of genes related to antibiotic resistance. Some resistance genes were deleted in the resistant MRSA strain, making it more sensitive to other antibiotics like oxacillin and ciprofloxacin. These findings highlight how resistance to PPEF leads to increased sensitivity to conventional antibiotics. This suggests that developing combination therapies of PPEF with other antibiotics could optimize treatment regimens and slow resistance evolution. This study also indicates that the antibiotic regimens could be designed to force resistant bacteria into evolutionary trade-offs, where they lose resistance to widely used antibiotics while gaining resistance to a new compound like PPEF.

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Abstract: Microbial fuel cells (MFCs) have emerged as a promising technology to convert biomass and organic waste into electricity, offering an eco-friendly and sustainable alternative to fossil fuels. Recent innovations in nanotechnology have significantly enhanced the performance and efficiency of MFCs by improving electron transfer rates, expanding surface areas, and optimizing the properties of anode and cathode materials. This review provides a detailed assessment of the fundamental and functional components of MFCs. These components include the anode, which facilitates the oxidation of organic matter, and the cathode, where the reduction of oxygen or other electron acceptors occurs. Another critical component is the proton exchange membrane (PEM), which allows the transfer of protons from the anode to the cathode while preventing oxygen from diffusing into the anode chamber. In addition to discussing these key elements, the article explores the role of various microorganisms involved in MFCs. These microorganisms, which include both naturally occurring species and genetically engineered strains, play a vital role in facilitating extracellular electron transfer (EET), a process that enables the conversion of chemical energy stored in organic compounds into electrical energy. We analyze different biomass pretreatment strategies, such as physical, chemical, and biological approaches, that enhance the breakdown of lignocellulosic biomass to improve energy output. Furthermore, the review highlights optimization techniques for improving biomass-powered MFC performance, such as electrode modification, pH control, and organic loading rate management. The application potential of MFCs is extensively discussed, covering bioremediation, wastewater treatment, biosensors, and power generation, with a particular focus on MFC-based biosensors for environmental monitoring and medical diagnostics. Despite their immense potential, challenges such as low power output, biofouling, and high operational costs hinder large-scale commercialization. To address these issues, we propose innovative strategies, including the integration of nanomaterials, electroactive microorganisms, and advanced membrane designs, to enhance the efficiency and reliability of MFCs. We conclude that nanotechnology-enabled MFCs, combined with engineered microbes and optimized system designs, hold immense potential for revolutionizing sustainable energy generation and biosensing applications, paving the way for a cleaner and more efficient future.

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Abstract: This study presents the energy balance dynamics of a mature Pine (Pinus roxburghii) ecosystem of the Indian Himalaya using multiple year (March 2020 to December 2022) eddy covariance-based measurements. Efforts are made to quantify the inter-annual dynamics of surface energy balance at seasonal and annual time scales. The impact of drought conditions, induced by soil moisture and vapor pressure deficit, on energy partitioning of the ecosystem is quantified using Bowen ratio (beta) and evaporative fraction (EF). The energy balance closure is assessed for three seasons (i.e., pre-monsoon, monsoon, and post-monsoon) of each observation year. We find that the closure fraction (CF) of the site is more than 80% on an annual scale. Higher CF is observed during pre-monsoon (similar to 80%) and monsoon (similar to 90%) seasons due to the onset and duration of the growing season. The available energy partitioned into latent heat flux is larger than the sensible heat flux for the ecosystem, signifying that evapotranspiration is one of the dominant components of water and energy budgets. The evaporative cooling at the site takes place during the monsoon season through higher EF; however, the Pine ecosystems sustained the dry pre-monsoon season with higher beta values. We find that the soil moisture-induced drought at the site resulted in higher partitioning of the available energy to sensible heat flux, effectively promoting the drought stress condition. However, it is to be noted that a better comprehension could be made for Pine forest behavior under environmental stress if such studies are further replicated.

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Abstract: Recently, air pollution has emerged as a critical environmental challenge, posing significant risks to human health and ecosystems. This study presents a comprehensive spatiotemporal assessment of six major air pollutants (PM2.(5), NO2, SO2, O-3, CO, NH3) across seven cities of Western Uttar Pradesh (WUP), India (2019-2022), using Geospatial techniques. The findings reveal significant seasonal and spatial variability driven by anthropogenic emissions and meteorological factors. PM2.(5) levels peaked during winter, ranging from 140 to 181 mu g m-3 in Ghaziabad and NOIDA, exceeding the CPCB annual standard by over 9-13 times. NO2 concentrations also peaked in winter, surpassing 80 mu g m-3 in industrial areas, while SO2 exhibited summer maxima exceeding 25 mu g m-3 in Bulandshahr and Agra. O-3 levels were highest during summer and post-monsoon, increasing from 38.03 mu g m-3 to 51.20 mu g m-3 in Muzaffarnagar over the study period. CO concentrations remained high in winter, reaching 1.54 mg m-3 in NOIDA, and NH3 showed post-monsoon peaks exceeding 35 mu g m-3 in agricultural regions. Correlation analysis showed strong associations between PM2.(5) and NO2 (r = 0.80), and NH3 (r = 0.67), indicating dominant emission sources from vehicular, industrial, and agricultural activities. Random forest regression identified temperature Relative Importance Scores (RIS 0.258) and relative humidity (RIS = 0.242) as key predictors for PM2.(5), with the model explaining 69.1% of its variability (R2 = 0.691). Air Quality Index (AQI) analysis revealed that Ghaziabad and Baghpat experienced 60.64% and 40.86% of days in the 'Severe' category, respectively, highlighting critical air quality deterioration. These findings emphasize the urgent need for season-specific and location-sensitive air pollution mitigation strategies that integrate emission control and meteorological influences to improve public health and environmental sustainability in WUP, aligning with Sustainable Development Goals 3 and 11.

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Abstract: Determining ice thickness is essential for assessing the freshwater reserves stored in the form of ice. In the present study, we conducted assessments to quantify the ice thickness of glaciers within the Chandra-Bhaga Basin, western Himalaya, India utilizing the GlabTop2 model. To evaluate the accuracy of the model, we utilized in-situ Ground Penetrating Radar (GPR) data obtained from the Patsio, Hamtah, and Chhota Shigri glaciers within the basin. For each glacier, we generated corresponding Digital Elevation Models using ASTER L1A V003 stereopairs datasets, aligning them with the year of the GPR survey conducted on the respective glaciers. Our analysis uncovered a bias ranging from - 39 to 35 m in the ice thickness evaluations generated by the GlabTop2 model. Ice thickness varied from 0 to 576 m, with a total ice reserve estimated at 112.5 +/- 35 km3. These results provide valuable insights into the distribution and extent of ice reserves within the region, highlighting the applicability of the GlabTop2 model at the basin scale. This contributes to a comprehensive understanding of freshwater resources and their potential impacts on the local environment.

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Abstract: In order to calculate the prospects for new transition-metal rich and rare-earth free permanent magnets, we have investigated the electronic and magnetic properties of Fe2P and related Mn- or/and Si-substituted compounds using full potential linearized augmented plane wave (FPLAPW) method under generalized gradient approximation (GGA) exchange-correlation (XC) functional. In agreement with the experiment, our calculated total magnetic moment and magnetocrystalline anisotropy (MCA) for Fe2P are found to be 3.03 mu B/f.u. and 538 mu eV/f.u. (2.58 MJ/m3), respectively. We find that the substitution of Mn or/and Si in Fe2P not only enhances the magnetization but also boosts the maximum energy product by preserving the hard magnetic behavior. Our theoretical predictions provide useful insights to enhance magnetization with tolerable loss of MCA for Mn or/and Si substituted Fe2P. Thus, we propose rare-earth free prospective candidates for permanent magnets through Fe2P based compounds.

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Abstract: As nations transition toward sustainable energy systems, biomass has become a vital component of global energy portfolios. Derived from organic materials such as wood, agricultural residues, forestry byproducts, and organic waste, biomass is a renewable energy source with significant environmental and economic benefits. Responsible biomass energy production can improve waste management, reduce emissions of greenhouse gases, and mitigate environmental pollution. However, as the diversity of biomass-derived fuels increases, robust quality assessment methods are essential to ensure their efficiency, safety, and minimal environmental impact. Reflected light microscopy (RLM) is one such technique with the potential to complement conventional physico-chemical analyses by enabling a rapid identification of material constituents and impurities. To refine this methodology and evaluate the reproducibility of solid biomass component identification using RLM, an interlaboratory study (ILS) was conducted. The study involved the recognition of 58 components across 45 photomicrographs, with the participation of 65 scientists and students from 25 countries. The participants faced high difficulty identifying some of the marked components, and as a result, the percentage of correct answers ranged from 19.0 % to 98.3 %, with an average correct identification rate of 62.7 %. The most challenging aspects of the identification process included distinguishing between woody and non-woody (agro) biomass, accurately identifying petroleum-derived materials, and differentiating agro biomass from inorganic matter. The results suggest that while RLM is an important tool for characterizing solid biomass, further development of methodology guidelines and training are necessary to enhance its effectiveness. Future research should prioritize preparing detailed, image-rich, microscopic morphological descriptions of biomass fuel components, which could improve the accuracy and reliability of using RLM in biomass fuel characterization.

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