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Record 1 of 36

Title: Sensitivity Enhancement by Introducing Altered Ground Conductors Around the Sensing Area of the Coplanar Meander-Interdigital Capacitor Structure Sensor

Author(s): Todi, S (Todi, Swati); Agarwal, P (Agarwal, Poonam)

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Abstract: In this paper, a systematic experimental study is presented to explore the impact of reduced parasitic capacitance on the sensitivity of the proposed contact-based LC Coplanar Sensor (LCCS), by manipulating its ground conductors. The LCCS is configured with a meander-IDC (Interdigital Capacitor) structure on a coplanar waveguide transmission line (CPW TL). To study the effect of reduced parasitic capacitance on the sensitivity, prototypes of two sensor designs are proposed: (a) LC Coplanar Sensor (LCCS), where conventional CPW TL grounds are present on either side of the signal conductor, (b) LC Coplanar Sensor with Altered Ground Conductors (LCCS-AGC), where the ground conductors around the sensing area of IDC are patterned circularly to reduce the parasitic capacitance. The proposed sensors are fabricated on an FR4 substrate, and the sensing area is configured using polydimethylsiloxane (PDMS) polymer to hold a liquid sample. RF experiments have been conducted with glucose solution samples, with a concentration range 0.0-0.5g/ml, within the 1-10 GHz frequency range. The experimental results exhibited sensitivity of LCCS is 9.311dB/g/ml, 193.943MHz/g/ml, 2.043dB/g/ml, and 140.57MHz/g/ml for S11\documentclass[12pt]{minimal} \usepackage{amsmath} \usepackage{wasysym} \usepackage{amsfonts} \usepackage{amssymb} \usepackage{amsbsy} \usepackage{mathrsfs} \usepackage{upgreek} \setlength{\oddsidemargin}{-69pt} \begin{document}$$S_{11}$$\end{document} and S21\documentclass[12pt]{minimal} \usepackage{amsmath} \usepackage{wasysym} \usepackage{amsfonts} \usepackage{amssymb} \usepackage{amsbsy} \usepackage{mathrsfs} \usepackage{upgreek} \setlength{\oddsidemargin}{-69pt} \begin{document}$$S_{21}$$\end{document}, with coefficients of linearity 0.981, 0.963, 0.993 and 0.759, respectively. In LCCS-AGC, the improved sensitivity is 10.444dB/g/ml, 288.143MHz/g/ml, 2.1316dB/g/ml, and 312.143 MHz/g/ml for S11\documentclass[12pt]{minimal} \usepackage{amsmath} \usepackage{wasysym} \usepackage{amsfonts} \usepackage{amssymb} \usepackage{amsbsy} \usepackage{mathrsfs} \usepackage{upgreek} \setlength{\oddsidemargin}{-69pt} \begin{document}$$S_{11}$$\end{document} and S21\documentclass[12pt]{minimal} \usepackage{amsmath} \usepackage{wasysym} \usepackage{amsfonts} \usepackage{amssymb} \usepackage{amsbsy} \usepackage{mathrsfs} \usepackage{upgreek} \setlength{\oddsidemargin}{-69pt} \begin{document}$$S_{21}$$\end{document}, with coefficients of linearity 0.986, 0.964, 0.998 and 0.980, respectively. The experimental findings reveal that the LCCS-AGC exhibits a significant enhancement in sensitivity.

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Title: FLGAT: A federated graph attention framework for privacy-preserving community detection

Author(s): Joshi, P (Joshi, Pratibha); Singh, B (Singh, Buddha)

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Abstract: Community detection plays a vital role in analysing real-world networks. However, traditional centralized community detection algorithms often violate data privacy constraints particularly when applied to sensitive or distributed data sources where aggregating raw graph data is either impractical or strictly prohibited. To address this challenge, the paper proposes a privacy-preserving community detection framework that is Federated Graph Attention Framework (FLGAT). In this framework, the global graph is partitioned into edge-disjoint subgraphs with a shared node set, each assigned to a distinct client in a federated environment. This ensures that raw graph data remains local to each client by preserving data privacy. Within each client, node embeddings are learned using a self-supervised GAT model trained with a hybrid loss function that combines contrastive InfoNCE loss with a modularity aware component. This encourages the embeddings to capture both semantic similarity and structural community. These local models are then collaboratively integrated using the Network Average Degree (NAD) weighted aggregation strategy, effectively integrating diverse local models based on graph structure quality. The globally learned embeddings are then utilized to construct a similarity graph that captures the relational patterns between nodes across the distributed network. Finally, the Louvain algorithm is applied to this similarity graph to detect communities by optimizing modularity. The FLGAT framework is assessed using three LFR benchmark networks and four real-world networks. It consistently outperforms existing approaches across key

metrics modularity (Q), Normalized Mutual Information (NMI), and Adjusted Rand Index (ARI) while strictly adhering to privacy-preserving principles.

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Title: Design, synthesis, and molecular docking of 1,4-naphthoquinone based glycoconjugates as chiral glycohybrids targeting lung cancer

Author(s): Singh, K (Singh, Kavita); Chhetri, K (Chhetri, Karan); Singh, R (Singh, Roshani); Khanna, A (Khanna, Ashish); Yadav, UCS (Yadav, Umesh Chand Singh); Sagar, R (Sagar, Ram)

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Abstract: Carbohydrate derivatives and 1,4-naphthoquinone analogues are crucial in many life-saving drugs, and their presence in numerous FDA-approved medications underscores their significance in drug design. In light of this, we have identified a mild and efficient copper-catalyzed click chemistry reaction conditions to synthesize two new series of 1,4-naphthoquinone based triazole-linked glycoconjugates as chiral glycohybrids, and evaluated their anticancer activity against non-small cell lung adenocarcinoma (A549) cell lines. A significant number of glycohybrids showed anticancer activity against A549 cells with IC50 in the micromolar range. It was observed that these glycohybrids caused cell death in A549 cells through the induction of apoptosis. Specifically, compounds 5c (IC50 = 5.17 mu M), from O-triazole-linked series; and 6d (IC50 = 7.89 mu M) from N-triazole-linked series were most effective anticancer molecules. These two compounds were found to inhibit the cell growth of resistant lung cancer cells H1922 (IC50 = 7.97 mu M for 5c and 6.94 mu M for 6d) and H1975 (IC50 = 9.74 mu M for 5c and 9.59 mu M for 6d) at sub-micromolar concentration. These active glycohybrids induced apoptosis by inhibiting the expression of anti-apoptotic protein Bcl2 and activating the expression of pro-apoptotic protein Bax leading to a significantly increased ratio of Bax/Bcl2 which suggests cell death through apoptosis. The detailed results obtained suggest that triazole-linked glycoconjugates synthesized by us using copper-catalyzed click chemistry reactions exhibit anti-cancer properties against lung cancer cells by inducing apoptotic cell death in-vitro. Additionally, molecular docking studies of these glycohybrids against EGFR (PDB ID:1M17) protein (overexpressed in non-small A549 lung cancer cells) revealed significant interactions between the protein and our synthesized glycohybrids (ligands) at the active site. Thus, the molecular docking studies with EGFR protein show that compound 5c, with a superior docking score of -6.78 kcal/mol, could be the most promising inhibitor of EGFR.

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Title: Taking Notes or Precedents? Legal Practice in Colonial India

Author(s): Sen, S (Sen, Sukhalata)

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Abstract: This paper examines the emergence of precedents amid the shifting legal discourse of the nineteenth century colonial India. It argues that the introduction of precedent was a deeply political project and not merely a juridical concern. It was shaped by the East India Company's pursuit of institutional legitimacy and its attempt to distinguish legal authority from overlapping political and social authorities. Yet precedent hardly became the stable category for the adjudication of law as originally envisioned. First, the Copyrights Act of 1867, which commercialised law reporting, simultaneously undermined the credibility of precedents. As a part of the broader codification project, the Indian Law Reporting Act of 1875 was conceived to centralise and monopolise the production of precedents under legislative control. However, such efforts were disrupted by the Ilbert Bill, which exposed both the inadequacy of prevailing precedents in India and the fragility of grounding imperial authority in the ideals of early liberalism.In its aftermath, Indian barristers and advocates responded by producing private law reports and commentaries which challenged the hegemony of official legal reporting. This private reporting not only undermined the authority of the Indian Law Reports but also contributed to the development of the law of precedent in India. In the final section, this paper argues that while these endeavours expanded the legal market, they also deepened the crisis of authenticity by further fragmenting the authority of precedents. Drawing on cases of copyright infringement involving law reports, it explores the argument that such reports were important instruments for legal education.

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Title: CHARACTERISATION OF DISTAL ACTIONS OF AUTOMORPHISMS ON THE SPACE OF ONE-PARAMETER SUBGROUPS OF LIE GROUPS

Author(s): Chatterjee, D (Chatterjee, Debamita); Shah, R (Shah, Riddhi)

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Abstract: For a connected Lie group G and an automorphism T of G, we consider the action of T on Sub $_G$, the compact space of closed subgroups of G endowed with the Chabauty topology. We study the action of T on Sub $<^>p_G$, the closure in Sub $_G$ of the set of closed one-parameter subgroups of G. We relate the distality of the T-action on Sub $<^>p_G$ with that of the T-action on G and characterise the same in terms of compactness of the closed subgroup generated by T in Aut (G) when T acts distally on the maximal central torus and G is not a vector group. We extend these results to the action of a subgroup of Aut (G) and equate the distal action of any closed subgroup ${\mathcal H}$ on Sub $<^>p_G$ with that of every element in ${\mathcal H}$. Moreover, we show that a connected Lie group G acts distally on Sub $<^>p_G$ by conjugation if and only if G is either compact or is isomorphic to a direct product of a compact group and a vector group. Some of our results generalise those of Shah and Yadav.

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Title: Structural analysis of M. tuberculosis EccC1 and its complex with EsxAB virulence factor using X-ray crystallography, molecular docking, and dynamics simulation techniques

Author(s): Saxena, AK (Saxena, Ajay K.); Chandra, A (Chandra, Anshuman); Srivastava, S (Srivastava, Swati); Kumar, R (Kumar, Ramesh)

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Abstract: M. tuberculosis ESX-1 system secretes virulence factors into host macrophages during infection, however, the mechanism of secretion is currently unknown. Here, we have determined the crystal structure of MtbEccCb1-D2 protein (Leu34-Ser313 residues, Mw similar to 31.4 kDa) in complex with ATP gamma S and Mg2+, which adopts a classical Ftsk/SpoEIII type fold. The EccCb1-D2 showed two melting temperatures, Tm1 at 37.64 +/- 0.08 degrees C and Tm2 at 65.85 +/- 0.12 degrees C, during the unfolding pathway. Modeled triangle EccC1 and triangle EccC1 + EsxAB hexamers showed a channel (similar to 34 & Aring;) involved in EsxAB (similar to 29 & Aring;) translocation toward the inner membrane. At the entrance gate of the channel, the LxxxMxF motif of the EsxB export arm binds to the substrate binding pocket of the EccCb1-D3 protein. Inside the channel, the PL-1 and PL-2 pore loops, close to the alpha 7-helix and the loop between beta 8-beta 9 strands in EccCa1-D1, EccCb1-D2, and EccCb1-D3 may be involved in EsxAB factor translocation. Stability, fluctuation, and compactness parameters in 100 ns dynamics simulation analysis showed the highest flexibility in Delta EccCa1, triangle EccC1, and triangle EccC1 + EsxAB hexamers and stability in Delta EccCb1 hexamer. Our EccCb1-D2 structure and dynamics simulation analysis on four modeled systems have revealed the mechanism involved in EsxAB translocation, a key target for the development of antivirulence inhibitors against M. tuberculosis.

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Abstract: Type 2 diabetes is a devastating metabolic disorder affecting millions of people worldwide. Deposition of amyloid formed by human islet amyloid polypeptide (IAPP) around pancreatic beta-cells is one of the possible causes of the disease. IAPP is a 37-residue peptide expressed by the pancreatic beta-cells and cosecreted with insulin, and its misfolding and aggregation into toxic amyloid fibrils are closely linked to beta-cell dysfunction. Herein, it is demonstrated that lacmoid effectively inhibits IAPP fibrillation and disaggregates preformed fibrils. Thioflavin T fluorescence in combination with morphological analysis by atomic force microscopy and transmission electron microscopy confirms complete inhibition and disaggregation of IAPP fibrillation at equimolar concentrations of lacmoid. Additionally, circular dichroism and Fourier transform infrared spectroscopy reveal significant changes in the secondary structure of IAPP during fibrillation in the presence of lacmoid. Cytotoxicity assay in U2OS cells show that lacmoid reduces IAPP fibril-induced toxicity. Molecular docking studies further reveal that the Asn14 residue of IAPP plays a critical role in its interaction with lacmoid. The findings collectively highlight the importance of lacmoid as an inhibitor of IAPP fibrillation which may have potential to develop as a drug candidate for the treatment of type 2 diabetes.

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Abstract: India's reliance on coal for development faces growing challenges amid climate change, necessitating coal phase-down, guided by the principles of just transition. This work builds towards the need for spatial analysis of energy justice by acknowledging the significance of space in driving a just socio-technical transition. Drawing on the primary household surveys in two coal mining regions of Chatra district (Jharkhand state) and Jharsuguda district (Odisha state) in India, this work maps the geographic footprint of coal mining using various socioeconomic indicators in a local context. Further, a comparative analysis of these two coal mining regions has examined the regional variations in coal dependency. The findings indicate that coal dependency is predominantly tied to livelihoods and is concentrated primarily within a 5-kilometre radius of coal mines, diminishing substantially beyond this range. The coal dependency is also higher for primary cooking fuel, higher income levels, and corporate social responsibility activities in this range. This study exposes the vulnerability of the coal mining region during the closure of coal mines by highlighting the low skill levels, low landholding patterns and low coverage of social security schemes like ration cards. It is demonstrated that notable regional disparities exist among coal mining regions regarding reliance on coal for livelihoods, cooking fuel, skill training, social security coverage and other indicators. These insights underscore the necessity of a bottom-up approach to guide a just energy transition, with a focus on adapting strategies to local contexts.

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Abstract: The ubiquitous ARV1 gene shows significant functional conservation across eukaryotes. Saccharomyces cerevisiae Arv1 is implicated in several cellular processes, including lipid/sterol homeostasis, morphogenesis, and drug resistance. Human and fungal ARV1 functionally complement S. cerevisiae ARV1, and arv1 Delta is rescued by the overexpression of some subunits of the GPI-N-acetylglucosaminyltransferase (GPI-GnT), which catalyzes the first GPI biosynthetic step. Human and Trypanosoma brucei Arv1 homologs co-immunoprecipitate with different GPI-GnT subunits. Based on these previous reports, we hypothesized a cross talk between Candida albicans ARV1 and the first step of GPI biosynthesis. Using super-resolution radial fluctuation (SRRF) analysis of co-localization data, co-immunoprecipitation assays, and acceptor-photobleaching FRET studies, we show that CaArv1 physically interacts with the GPI-GnT. It also regulates the expression of the GPI-GnT subunits via the epigenetic modulator, Rtt109. Overexpressing GPI19 (which encodes a GPI-GnT subunit whose expression is repressed in Caarv1 Delta/Delta) rescues its cell wall phenotype, sensitivity to azoles, and GPI-GnT activity without reversing the filamentation defect. A similar rescue is observed on downregulating GPI2 (encoding another GPI-GnT subunit, whose expression is upregulated in Caarv1 Delta/Delta). Thus, transcriptional control rather than physical interaction appears to be the primary mechanism by which CaArv1 controls GPI-GnT. Overexpressing RAS1 restores all phenotypes, including filamentation, without restoring

GPI-GnT activity. The filamentation defect of Caarv1 Delta/Delta is independent of the GPI-GnT. CaArv1 transcriptionally regulates hyphae-specific transcription factors downstream of cAMP-PKA signaling (Efg1, Flo8) and repressors (Tup1, Nrg1) to modulate filamentation. The cross talk between CaArv1 and GPI-GnT has important implications for the virulence of C. albicans.

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Abstract: This study introduces a novel approach for an Admission Control Manager (ACM) for allocating users requests in Fog-integrated Cloud (FiC), based on available physical resources while ensuring Quality of Service (QoS) and Quality of Experience (QoE). The proposed ACM leverages a hybrid model combining the Genetic Algorithm (GA) and Adaptive Neuro-Fuzzy Inference System (ANFIS), referred to as GA-ANFIS. The GA-ANFIS model operates in two distinct phases to address the resource provisioning challenges of the extended three-layer FiC architecture. In the first phase, GA is employed to optimize the initial parameters of the ANFIS, ensuring better learning and convergence. In the second phase, the optimized ANFIS model processes user request parameters for job classification to decide the FiC layers for processing. The model's effectiveness is evaluated using simulations on Google trace datasets, with performance assessed via metrics such as accuracy, execution time, and convergence rate. The results demonstrate significant improvements, including a 12.63% in accuracy and a 21.66% reduction in execution time compared to state-of-the-art models. These findings establish the potential of the GA-ANFIS model as an efficient ACM to address resource provisioning challenges in FiC.

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Abstract: BackgroundAs the share of the older population is set to rise from 8% in 2011 to 16% by 2036 in India, the increasing burden of NCDs and the increasing co-morbidities among the older population need greater policy focus to ensure a healthier aging process. Given the structural shifts in the age structure of the population and decreasing family sizes, contextual factors take an even more important role in shaping the health status of the elderly. Therefore, the present study aims to study the intersectional dynamics of demographic, socioeconomic, lifestyle, and contextual factors on the prevalence of co-morbidities among the older population.MethodsThe data from the Indian Human Development Survey, 2012 (IHDS-II), were used to analyze the prevalence of co-morbidity and its confounding factors in India. Univariate analysis for sample distribution, bivariate analysis for the distribution of disease by different predictors with a chi-square test, and logistic regression analyses were used to assess the adjusted association of multimorbidity with different background variables.ResultsOverall, around 7% of the older population in India suffers from co-morbidities. We observe that the prevalence of co-morbidities is significantly higher among non-poor (People belonging to a non-poor household category based on the consumption quintiles) older females living alone, non-poor older females living jointly, and among non-poor older males living alone. The odds of having comorbidity among female non-poor and living alone are higher as compared to the female poor living alone. When all the co-variates are included in a single model, we observe that older adults living in nuclear families and residing in the North, Central, and Southern regions of India along with other factors discussed above show higher odds of having co-morbidities.ConclusionsThe research findings suggest that directing increased investments towards addressing multiple health issues in the elderly population, with a particular focus on non-poor women and men living alone, could be a more effective strategy in combating multimorbidity among older individuals in India.

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Abstract: In the present study, we investigate the structural properties and current-voltage (I-V) characteristics of an epitaxial multilayer composed of La0.67Sr0.33MnO3 (25 nm)/SrMnO3 (70 nm)/La0.67Sr0.33MnO3 (25 nm), grown on different substrates, i.e., SrTiO3(100), LaAlO3(100), and Si(100). The used substrates not only have different chemical compositions in line with the film materials but also have different lattice parameters, which would significantly tune the material chemistry and lattice strain at the interface. Our I-V measurements reveal distinct electrical behaviors depending on the substrate. The multilayers grown on oxide SrTiO3(100) and LaAlO3(100) substrates exhibit regular I-V with slight nonlinearity at low applied voltages. In contrast, I-V in a multilayer with the Si(100) substrate exhibits large asymmetry and notable resistive switching (RS) behavior at room temperature, where a resistance ratio of around 10 between the high-resistance state (HRS) and low-resistance state (LRS) is observed. While the observed I-V behavior is sensitive to substrate-induced interfacial disorder and formation of trap bands within the band gap of SrMnO3, the present results have potential applications in future memory and memristive devices.

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Title: Comparative Study of Double Gate Inverted-T Shaped, TFET for Extremely Low Power Logic and Analog Circuit in AI Chips

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Abstract: In this paper, a novel structure, double gate with inverted T-shaped TFET (DG-IT-TFET has been proposed and studied with and without charge plasma technique. We have further studied the DG-IT-TFET structures on three different substrate namely, Silicon-based, Germanium-based and hetero Silicon-Germanium based. In this novel structure we have used 15 nm gate thickness for both gates. Lateral length (L-T) has been optimized as 1 nm that gives vertical tunneling and enhanced the subthreshold slope (SS). The novel structure with dual gate provides flexibility over electrostatics control, improved ON current, lowers subthreshold swing and improves ON-current to OFF-current ratio. One has also studied and analyzes the digital and analog parameters of novel structure DG-IT-TFET with and without charge plasma. In this charge plasma concept, apply appropriate work function to both electrodes. Our comparative study shows that Si-DG-IT-TFET(without charge plasma) structure has most significant improvement in ON current of value 2.2 x 10(-4)A/mu m, very low leakage

current 6.8 x 10(-17)A/mu m, and very low SS with a value of (13.5 mV/dec). Si-DG-IT-TFET structure produces improved I-ON/I-OFF with the peak value of 10(12). Comparative results with charge plasma and without charge plasma of DG-IT-TFET structure listed are Tables 2 and 3. The Ge based DG-IT-TFET(without charge plasma) structure shows promising results for analog circuits. Thus our proposed DG-IT-TFET structure is good electrical characteristics. Thus this structure is most promising candidate for extremely low power digital and analog chips.

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Author(s): Khatri, A (Khatri, Aanchal); Mahima (Mahima, Punit); Kumar, P (Kumar, Punit); Ram, B (Ram, Balak); Dohare, U (Dohare, Upasana); Kumar, S (Kumar, Sushil)

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Abstract: Farm fire has become one of the major concerns in the agriculture economy. The sensor-based models and computer vision-based models are introduced in the contemporary literature for the detection of fire. However, these methods are ineffective in detecting and exhausting the fire in real time due to less smoke, different environmental condition and also suffer from low accuracy and high false alarm rate. This problem can be effectively solved if the fire is detected in the real time and correspondingly the exhaustion can be performed automatically at the same time. Therefore, in this paper, the smart farm management system (SFMS) using Internet of Things (IoT) and Deep Convolutional Neural network is proposed which took the benefit of IoT network model for monitoring the farm area and the sensed data is fed to MobinetV2 model for the detection of any fire incidence. In the case of fire, IoT network automatically activates the water sprinkler for the real time exhaustion of fire. Further, the web interface is linked with the SFMS for the notification, alerts about the status of farm. The simulation results have shown that the proposed model is robust in detecting fire or no fire with the accuracy of 99.9%, 99.82% and 99.7% in Green Farm with no fire, Fire in progress and Fire in the cloudy environment. The proposed model performed comparatively better than state of art approaches and effective in exhausting the fire.

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Abstract: BackgroundThe widespread usage of millimeter waves (MMW) in different spheres of the public domain necessitates to have a better understanding of any possible health impacts caused by them. The latest example of this is the global implementation of 5G technology.ObjectivesThe present investigation aimed to study the effects of 35.5 GHz frequency on reproductive parameters of male Wistar rats.MethodsThe study employed a randomized controlled design, with animals being assigned to control, sham-exposed, and exposed groups, with six animals in each group (n = 6). The experimental group was exposed to 35.5 GHz frequency for 2 h per day for 60 days. At the end of the exposure period, various sperm parameters such as sperm count, morphology, viability, and sperm mitochondrial activity were evaluated. The evaluation of oxidative stress was done by lipid peroxidation assay in testis homogenate. Superoxide dismutase, total sulfhydryl level, and total antioxidant capacity were assessed in testis homogenate. The DNA damage in the testis was assessed through the comet assay.ResultsThe results showed a significant decrease in sperm viability and count, as well as morphometric changes in testis histopathology. Lipid peroxidation testis was significantly elevated in the exposed group, while superoxide dismutase (SOD), total sulfhydryl level, and total antioxidant capacity were significantly decreased in the exposed group. The comet assay revealed a significant increase in DNA damage in the exposed group, indicating genotoxic effects.DiscussionThe observed changes in sperm parameters, testicular morphology, and oxidative stress markers highlight the potential for testicular tissue damage via oxidative mechanisms. These results underscore the need for further research to elucidate the biological implications of chronic MMW exposure.ConclusionChronic exposure to 35.5 GHz frequency may negatively impact male reproductive function and testicular tissue, primarily through mechanisms involving oxidative stress.

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Abstract: Room-temperature facile synthesis of CsNiCl3 is successfully achieved to tune its magnetic, optical, and electrochemical properties by the incorporation of Fe2+-ion in the lattice. To ensure phase purity, the synthesized CsNiCl3 is characterized using powder X-ray diffraction, followed by Rietveld refinement, Fourier transform infrared, Raman spectroscopy, and UV-vis diffuse reflectance measurements. To assess the uniformity of the Fe doping and its oxidation state, field emission scanning electron microscopy mapping and X-ray photoelectron spectroscopy are performed, confirming that Fe2+-ions are homogeneously distributed within the lattice. The field and temperature dependent magnetic studies on the doped CsNiCl3 reveal the presence of spin glass behavior at 52.7 K; the effect can be explained based on intermolecular interaction between nickel and ferrous ions and consequently reduction in spin frustration is observed, in contrast to the magnetic phase transitions observed in the undoped compound at 45.7 and 31.9 K. Moreover, photoluminescence studies indicate the emergence of red emission in CsNi1-xFexCl3 (x = 0.05, 0.10, and 0.15) with an increase in luminescence lifetime correlating with higher dopant concentration. Electrochemical analysis further reveals that the doped sample enhances ionic conductivity while decreasing diffusional resistance, suggesting potential applications in battery and sensor technologies.

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Abstract: Reproductive aging is an emerging global health concern, projected to become the third most significant health issue in the near future, according to the World Health Organization. This complex process is driven by molecular and cellular changes, including alterations in DNA, RNA, and protein expression. Among non-coding RNAs (ncRNAs), long non-coding RNAs (lncRNAs) have been increasingly recognized for their regulatory roles in spermatogenesis and their potential contributions to aging and testicular diseases. This review examines the functions of lncRNAs in testicular biology, focusing on their gene-regulatory roles, isoform diversity, subcellular localization, and interactions with key molecular components. While research has historically prioritized protein-coding genes, the extensive ncRNA landscape suggests a broader regulatory network influencing reproductive health. Many testis-specific lncRNAs exhibit conserved sequences, modular structures, and repeat-rich elements, which contribute to their functional significance. Dysregulation of these lncRNAs has been implicated in pathological conditions such as testicular cancer, highlighting their potential as biomarkers and therapeutic targets. Understanding the dynamic roles of lncRNAs in testicular function, aging, and disease is essential for advancing reproductive medicine. This study provides insights into the complex interplay between lncRNAs and reproductive aging, emphasizing their significance in testis-specific processes and associated disorders.

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Abstract: Rapidly emerging antimicrobial resistance (AMR) in Staphylococcus aureus is a global health issue that causes life-threatening infections in nosocomial and community-acquired settings. The prevalence of methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant S. aureus (VRSA) infections is higher in clinical practices, which causes a major hurdle in the treatment. The epidemiology of such systemic and invasive infections results in higher morbidity and mortality, especially in middle-income countries where hospitalization rates and improper drug use escalate the threat. Nanotechnology has gained more attention for preventing acute and chronic microbial infections. The present study aimed to synthesize silver nanoparticles (AgNPs) using the cell-free extract of B. subtilis and to examine their antimicrobial effect against MRSA. The synthesized AgNPs were characterized by spectroscopy (UV-VIS, FT-IR) and imaging spectroscopy (SEM, TEM), zeta potential, X-ray diffraction (XRD), and Energy Dispersive X-ray (EDX) analysis. The efficacy of AgNPs was examined with different Gram-negative and Gram-positive strains, including MRSA with 0.4 mg/mL MIC, and was significantly potent against other pathogens. The AgNPs also displayed bactericidal effects assessed by ROS production, macromolecule leakage, and biofilm formation inhibition, which was inhibited up to 82% at 1.6 mg/mL AgNPs concentration. Our findings suggest that green-synthesized AgNPs show a potent antimicrobial activity against a diverse range of bacterial pathogens by greatly reducing cell susceptibility via elevating ROS production, DNA, and protein leakage. AgNPs equally hamper biofilm inhibition, suggesting the emergence of drug-resistant infections in S. aureus. Further research is warranted to explore their potential in clinical applications.

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Abstract: Aluminum-based amorphous alloys and composites, which have tensile and compressive strengths approximately two to three times higher than those of crystalline Al alloys and composites, are very attractive for various potential industrial applications. However, the good glass formers in Al-based alloy systems are usually found away from the eutectic points in the phase diagram and thus exhibit poor glass-forming ability. Consequently, the glass-forming compositions require cooling rates of 104-106 K/s for synthesis via rapid quenching techniques, leading to dimensional restrictions in the micrometre to millimetre range. Synthesizing glassy powders and then consolidating them in the powder metallurgy (PM) route can improve the dimensions of these materials. Many researchers have made efforts to fabricate

high-dimensional Al-based metallic glasses and composites with improved mechanical properties by using different PM routes. These research efforts require further review to enhance the development of Al-based glassy alloy systems for various potential applications. Researchers working on the development of high-specific-strength materials would benefit from such reviews. This review paper provides an in-depth examination of different techniques for fabricating Al-based metallic glasses and composites, their crystallization behavior, and mechanical properties. Suggestions for future research are provided to further enhance these materials.

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Abstract: Climate change-driven heavy rainfall can lead to waterlogging stress, severely affecting plant growth and productivity. Melatonin, a key plant signaling molecule, has been recognized for its role in mitigating various abiotic stresses. In this study, we investigated the impact of melatonin application on alleviating waterlogging stress through morphological, physio-biochemical, and histochemical analyses in Solanum lycopersicum L. var. Pusa Ruby during the vegetative stage. Our results demonstrate that during waterlogging stress, melatonin-treated plants exhibited improved growth, including increased relative plant height, leaf area, leaf area index, root length, root fresh weight, root dry weight, and adventitious root formation. Under waterlogging stress, melatonin-treated plants exhibited increased physio-biochemical parameters, including relative water content, chlorophyll pigments, carotenoids, xanthophylls, and anthocyanins, while stress markers such as malondialdehyde and proline were reduced. Antioxidant enzyme assays further revealed that melatonin co-application enhanced the activity of superoxide dismutase, peroxidase, glutathione S-transferase, and catalase. Histochemical staining confirmed that melatonin alleviated oxidative damage by reducing lipid peroxidation, hydrogen peroxide accumulation, and superoxide radical levels under waterlogged conditions. These findings suggest that melatonin effectively alleviates waterlogging stress by enhancing plant growth, maintaining water balance, strengthening antioxidant defence mechanisms, improving water balance, and maintaining cellular homeostasis, thereby promoting plant resistance to waterlogging stress. This study highlights the potential of melatonin as a promising strategy to enhance crop adaptation to waterlogging stress under changing climatic conditions.

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Abstract: Iron (Fe) and zinc (Zn) are essential micronutrients critical for human health, yet their deficiencies are widespread, particularly in rice-dependent populations. Rice, a staple food for over half the global population, lacks sufficient bioavailable Fe and Zn in its grains, contributing to global malnutrition. This review delves into the molecular mechanisms governing Fe and Zn transport in rice, focusing on gene families such as IRT, YSL, ZIP, and HMA, which regulate uptake, translocation, and storage. These transporters exhibit intricate interactions and crosstalk, influenced by environmental factors and shared pathways, underscoring the complexity of Fe-Zn homeostasis. Biofortification, through genetic engineering and conventional breeding, emerges as a promising solution to address Fe and Zn deficiencies. Genetic strategies include overexpression of ferritin and nicotianamine synthase genes, alongside manipulation of metal transporter genes, to enhance micronutrient accumulation in rice grains. The advanced breeding approaches including marker-assisted selection and quantitative trait loci (QTL) mapping, complement genetic engineering, offering non-transgenic alternatives for micronutrient enhancement. The common challenges such as regulatory barriers, public perception, and trait stability under diverse conditions necessitate interdisciplinary collaboration and technological advancements.

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Abstract: We have synthesized two Preyssler-type polyoxometalate ({NaP5W30O110}14-)-based compounds [{CoII(C10H8N2)3}4{CoIII(C10H8N2)}0.74H4NaP5W30O110]<middle dot>24H2O (1) and [{CuII(C10H8N2)2}4(C10H10N2)3NaP5W30O110]<middle dot>6H2O (2) by solvothermal synthesis. The crystal structure of compound 1 consists of Preyssler polyoxometalate (POM) coordinated to {CoIII(2,2 '-bpy)} (bpy = 2,2 '-bipyridine, C10H8N2) complex and two uncoordinated {CoII(2,2 '-bpy)3} complexes. The molecular structure of compound 2 consists of four {CuII(2,2 '-bpy)2} complexes coordinated to terminal oxygens of Preyssler polyanion and three 2,2 '-bipyridinium cations. Compounds 1 and 2 have been characterized unambiguously by single-crystal X-ray crystallography including PXRD, FT-IR, TGA, and DRS spectroscopy. In this work, compounds 1 and 2 are used as photocatalysts in the degradation of environmentally hazardous methylene blue (MB) dye via UV light irradiation. Compound 2 outperforms compound 1 in catalytic efficiency for the degradation of MB dye, achieving 78.1% efficiency compared to 72.3% for compound 1. The redox activities of compounds 1 and 2 have been investigated by electrochemical studies. Interestingly, compounds 1 and 2 exhibit solid-state fluorescence at room temperature.

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Title: Nano-fillers Embedded Green Polyvinyl Alcohol/Starch Mixed Matrix Polymeric Thin Film to Enhance the Freshness of Vegetables

Author(s): Banerjee, P (Banerjee, Paulami); Samal, E (Samal, Ekambara); Mandal, MK (Mandal, Mrinal Kanti); Dubey, KK (Dubey, Kashyap Kumar); Chaudhuri, RG (Ghosh Chaudhuri, Rajib)

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Abstract: This work presents the synthesis of a biodegradable nano-bio-composite thin film using polyvinyl alcohol (PVA) and starch (ST) for food packaging. Traditional synthetic polymers create microplastics that are harmful to the environment. In contrast, biodegradable films provide a safer alternative. Using a solution casting method, we blended PVA and ST with glycerol (GL) to enhance flexibility, while incorporating titanium dioxide (TiO2) and graphitic carbon nitride (g-C3N4) as nano-fillers. Characterization techniques employed included FTIR, SEM, TGA, UV-vis, and degradation tests. The films containing nanomaterials showed a significant reduction in water vapor transmission rates, measuring 80.03 g/m2<middle dot>h for TiO2 and 78.65 g/m2<middle dot>h for g-C3N4, compared to 86.07 g/m2<middle dot>h for the PVA/ST/GL blend. This indicates improved food preservation capabilities. Furthermore, films with g-C3N4 exhibited enhanced degradation rates of 85.20% in microbial environments and 26.06% in soil, compared to those without nanomaterials. This approach not only addresses the issue of microplastic pollution but also supports biodiversity while extending the shelf life of vegetables by 10 - 12 days.

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Title: Meta's Strategic Evolution: How Metaverse and AI Are Shaping the Future of Technology

Author(s): Gupta, V (Gupta, Vishwas); Sharma, S (Sharma, Shikha)

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Abstract: This article investigates Meta's strategic transition toward the metaverse and artificial intelligence (AI). By examining the current state of the metaverse economy, this article identifies significant challenges and offers insights into the future potential of AI and immersive technologies to transform various sectors.

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Author(s): Balkrishna, A (Balkrishna, Acharya); Lochab, S (Lochab, Savita); Guin, S (Guin, Sandeep); Joshi, M (Joshi, Monali); Verma, S (Verma, Sudeep); Srivastava, J (Srivastava, Jyotish); Dev, R (Dev, Rishabh); Varshney, A (Varshney, Anurag)

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Abstract: Cellular senescence is a multifactorial, progressive phenomenon that disrupts biological homeostasis by increasing stress markers, causing morphological changes, and inducing inflammation, ultimately leading to irreversible cell cycle arrest. Natural plant-based bioactive products are frequently preferred over synthetic chemicals for their safety and efficacy. This study aims to assess the therapeutic effectiveness of a botanical formulation, Immunogrit, in mitigating stress-associated senescence markers in the skin. d-Galactose (D-Gal) has been used to induce senescence-associated stress markers in HaCaT human keratinocytes. Additionally, a thorough chemical characterization employing ultra-performance liquid chromatography-mass spectrometry coupled with quadrupole time-of-flight (UPLC/MS-QToF) and high-performance thin layer chromatography (HPTLC) was performed to generate a comprehensive phytochemical profile of Immunogrit. In HaCaT cells, d-Gal-induction increased oxidative and nitrosative stress with a perturbed expression of cell cycle biomarkers. Enhanced SA(3-galactosidase activity and subsequent downregulation of nuclear protein, LMNB1, further established the suitability of d-Gal-induced HaCaT cells as the relevant skin model for investigating senescence-associated interventions at the molecular levels. Treatment of Immunogrit with d-Gal induction, prevented the upregulation of p16, p21, and p53 levels; and maintained the basal SA-(3-galactosidase activity. This study also identified pAMPK and iNOS2 as the targets of d-Gal orchestrating oxidative and nitrosative stress. Immunogrit mitigated the d-Gal-modulated levels of pAMPK and iNOS2. Moreover, collagen degradation and upregulation of metalloprotease (MMP1 and MMP9) in d-Gal-induced HaCaT cells were ameliorated by Immunogrit treatment. Our findings highlight Immunogrit as a promising botanical therapy for alleviating the key cellular markers of

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Abstract: Elucidating the genetic basis of lipid metabolism in children is essential for early intervention in dyslipidemia and cardiovascular diseases. We performed a two-staged genome-wide association study (GWAS; N = 5412) and an independent exome-wide association study (ExWAS; N = 4750) on lipid parameters-HDL, LDL, Triglycerides (TG), Total Cholesterol (TC) in Indian school-going children - the largest single-cohort paediatric lipid study till date. GWAS identified robust associations at established loci, including CETP for HDL; CELSR2, and PSRC1 for LDL and TC, and GCKR, ZNF259, and TBL2 for TG. We also validated known associations at sub-GWAS significance in FADS2, GATAD2A, PRKCA, and QKI. Exome-based analyses further refined functional variants within these loci and revealed additional known loci in ALDH1A2 for HDL; APOE, APOC1, TM6SF2, CILP2, TOMM40, for LDL and TC; and APOA5, BUD13 for TG and novel loci in ATP8B3, MYH7B, GYS2, and RNF8 for TG. Conditional analysis revealed multiple independent signals at key loci. Gene-based GWAS pinpointed CETP and APOC1 as significant for HDL and LDL, respectively. Rare variant analysis identified significant contribution of loss-of-function missense variants in CETP, TM6SF2, and APOE, in regulating lipid profiles. Associations replicated with consistent directionality in European datasets and Indian adults, reinforcing conserved biology across ancestries and age groups. Functional enrichment analyses emphasized lipid-related pathways and differential expression in liver. These findings lay the foundation for ancestry-informed genetic risk prediction models to identify children at early risk for cardiovascular diseases.

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Abstract: The application of Bovine Serum Albumin (BSA) nanoparticles in the medical field has gained substantial attention due to their biocompatibility and multifunctionality as drug delivery systems. Cordyceps militaris, known for its exceptional therapeutic properties, shows promise as a potent agent against multidrug-resistant (MDR) bacteria. This study aimed to develop Cordyceps militaris extract-loaded BSA-chitosan nanoparticles (BECNPs) and cordycepin loaded BSA-chitosan nanoparticles (BCCNPs) to address MDR bacterial infections. BSA nanoparticles were synthesized and characterized using microscopic analyses revealed spherical nanoparticles with an average size of similar to 12 nm for BECNPs and similar to 28 nm for BCCNPs. GC-MS analysis of the 50 % methanol extract of Cordyceps militaris identified 47 active compounds, with cordycepin (5.22 %) being the major bioactive component. LC-MS confirmed the presence of cordycepin, recognized mainly for its anti-tumor activity, in the extract. The CME and cordycepin loading efficiency were found to be 52.56 % and 62.07 % respectively and the zeta potential of BECNPs and BCCNPs was recorded at +21.45 +/- 1.45 and +23.59 +/- 1.93 respectively. The antimicrobial activity of BECNPs and BCCNPs was evaluated against two MDR Gram-positive bacteria (Staphylococcus epidermidis and Enterococcus faecalis) and two Gram-negative bacteria (Acinetobacter baumannii and Enterobacter cloacae). MIC, MBC, and zone of inhibition assays demonstrated effective antibacterial activity, with the highest inhibition zone (19.7 +/- 0.38 mm) observed for E. cloacae. Additionally, biofilm inhibition and growth curve assays revealed significant disruption of biofilm formation and bacterial growth dynamics. These results highlight the potential of Cordyceps militaris extract-loaded BSA-chitosan nanoparticles as innovative antimicrobial agents and versatile drug delivery systems for biomedical application.

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Abstract: In the interconnected world of IoT, the ability to precisely pinpoint the location of nodes is a fundamental cornerstone. Without accurate node localization (NL) in Sensor Networks, the data collected by sensors often lacks context and irrelevance because of the absence of information about the sensor nodes' locations. Node localization in IoT states the method of defining the physical position of IoT devices or nodes within a network or environment. The accuracy of sensor node positioning plays a major role in determining the overall performance of Sensor Networks. Received Signal Strength Indicator (RSSI) is indeed a profitable approach for assessing the position of a non-anchor node in sensor node localization systems. In this article, the Coati Optimization Algorithm (COA) and its modified forms are practiced to enhance the localization accuracy of nodes localized. To improve the accuracy and randomness of the coati optimization algorithm, two approaches, chaotic map and levy flight are applied on COA and named these algorithms as C-COA and LF-COA. The proposed fitness function not only focused on the current value of distance but also take care of the past average distance. The result evaluation and performance analysis of COA, C-COA and LF-COA shows that LF-COA performs better that the rest of two algorithms, COA, C-COA.

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Abstract: This study evaluates the efficacy of garbage enzyme (GE) in bioremediation to reduce pollutants in sewage drains that discharge into the natural streams and rivers. Garbage enzyme is prepared with help of brown sugar, fruit, vegetable wastes, and water in the proportion 1:3:10 (by weight), which is then applied to the samples collected from various drainage sites in Jaunpur district, Uttar Pradesh, India. Different concentrations of GE (ranging from 0% to 20%) are mixed with sewage to assess pollution reduction. Different parameters, that is, pH, dissolved oxygen (DO), total suspended solids (TSS), total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and CD have been measured on 3rd, 5th, 7th, 10th, 15th, and 20th days. It has been observed in the study that significant percentage reduction in BOD, COD, TSS, and TDS of 80.6%, 62.9%, 74.29%, and 43.9%, respectively, while an increase in DO is 67.8% on 20th day of experiment with 20% GE addition. The result of the study reveals that there is highest reduction occurring on the 20th day with a 20% GE concentration. It has been observed that the GE possesses protease, amylase, and lipase activity. Meaning GE contains microorganisms that breakdown carbohydrates, fats, and proteins and it hydrolyzes these complex organic molecules into simpler compounds, making them more readily biodegradable and that is the reason for substantial reduction in the pollutants. Moreover, in this study it has been observed that there is a notable decrease in foul odor emanating from the samples. Time-dependent fluctuations in pH, TDS, DO, BOD, COD, and temperature are documented, with their correlations examined. This investigation underscores GE's potential in pollution

mitigation, particularly in sewage systems, and offers valuable insights for sustainable environmental management practices aimed at conserving natural water bodies. Further tests are required to check the efficiency of treatment with GE dosage higher than 20%.

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Abstract: Wireless assistive technologies (ATs) are an effective means in Internet of Things (IoT) enabled healthcare systems for individuals with severe disability to communicate their intentions. Tongue drive system (TDS) is a wearable, nonintrusive, and wireless assistive technology (AT) that enables the disabled individuals to control and access the nearby smart devices (ex. mobile phone, laptop, computers etc.) through a set of tongue gestures. TDS become particularly important to employ the pervasive connectivity of wireless assistive devices. This article presents different forms of TDS and the state-of-art antenna design based on their TDS configuration and different design aspects. The development and opportunities for intraoral TDS (iTDS) antennas is covered in both single band and multiple band performance. In addition, a prospective insight into the implementation challenges and future directions of TDS is reported.

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Abstract: Mcl-1, a member of the Bcl-2 family, is a crucial regulator of apoptosis, frequently overexpressed in various cancers, including lung, breast, pancreatic, cervical, ovarian cancers, leukemia, and lymphoma. Its anti-apoptotic function allows tumor cells to evade cell death and contributes to drug resistance, making it an essential target for anticancer drug development. This study aimed to discover potent antileukemic compounds targeting Mcl-1. We selected diverse molecules from the BindingDB database to construct a structure-based pharmacophore model, which facilitated the virtual screening of 407,270 compounds from the COCONUT database. An epharmacophore model was developed using the co-crystallized inhibitor, followed by QSAR modeling to estimate IC50 values and filter compounds with predicted values below the median. The top hits underwent molecular docking and MMGBSA binding energy calculations against Mcl-1, resulting in the selection of two promising candidates for further ADMET analysis. DFT calculations assessed their electronic properties, confirming favorable reactivity profiles of the screened compounds. Predictions for physicochemical and ADMET properties aligned with expected bioactivity and safety. Molecular dynamics simulations further validated their strong binding affinity and stability, positioning them as potential Mcl-1 inhibitors. Our comprehensive computational approach highlights these compounds as promising antileukemic agents, with future in vivo and in vitro validation recommended for further confirmation.

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Abstract: Background Breast cancer is one of the most common types of cancer in the world, and triple-negative breast cancer (TNBC) is an extremely aggressive subtype. This study aimed to investigate the efficacy and mechanisms of miR-24-2 against TNBC. Methods MDA-MB-231 (TNBC), HEK293T and HEK293 cells were used for various assays including cell viability and proliferation, cell migration, and invasion. RT-PCR, immunoblotting, acridine orange-ethidium bromide and DCFDA assays, tumour xenograft, H&E and IHC methods were employed in the study. Results miR-24-2 overexpression induced cell death and inhibited clonogenic potential. It also reduced the expression of Slug, Twist1, and Vimentin and inhibited cell invasion and migration. miR-24-2 enhanced apoptosis, ROS production, and expression of pH2A.X (S139) while decreased Chk1, Chk2, and Rad51. miR-24-2 inhibited survival signaling by downregulating Akt, Erk1/2, Bcl-2, and cytochrome c (mitochondrial), and enhancing Bax, cytochrome c (cytosolic), and cleaved-caspase 3. miR-24-2 binds to the coding sequence (CDS) of Akt which was validated at mRNA and protein expression levels. Further, miR-24-2 strongly reduced TNBC tumour volume (58 %, $p < 0.01$) and weight (54 %, $p < 0.001$) during 20 days. Tumour immunohistochemistry showed that miR-24-2 decreased proliferation and increased apoptosis. Moreover, increased Bax/Bcl-2 ratio and decreased expression of Akt, PCNA, Chk1, Chk2, and Rad51 by miR-24-2 were found in tumours, validating the findings of in vitro and in vivo tumour models. Conclusion Overall, this study finds that miR-24-2 directly targets Akt and plays a significant role in TNBC as a key mechanism for its growth, survival, and progression.

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Abstract: Head and neck squamous cell carcinoma (HNSCC) is one of the most prevalent and fatal cancers in India. Silibinin, a naturally occurring small molecule from milk thistle (Silybum marianum), is gaining attention as a potent anticancer agent against various cancers; however, its impact on HNSCC and the associated molecular mechanisms are largely unknown. We checked the effect of silibinin on proliferation, cell viability, and DNA damage in HNSCC cells, and employed immunoblotting to detect the underlined molecular mechanism. Also, we validated silibinin ' s anticancer efficacy and associated molecular changes in the xenograft mouse model. Silibinin inhibited cell proliferation and viability in HNSCC cells, and enhanced G1-S phase arrest by increasing p53 expression and inhibiting p27Kip1, p21Cip1, Cyclin D1-CDK4/6, and Cyclin E-CDK2 complexes. Silibinin-induced DNA damage and apoptosis in HNSCC cells were evidenced by comet assay, expression of p-H2AX, Bax, Bcl-2, and cleavage of caspase 3 and PARP proteins. Moreover, silibinin also impaired DNA repair pathways, ATM-Chk2, ATR-Chk1, DNA-PK, Ku70/80 and Rad51, and activated JNK contributing to DNA damage. The strong inhibition of EGFR-mediated Erk1/2, AKT and STAT3 signaling by silibinin was identified. Silibinin augmented PD98059 and LY294002-induced cell death and inhibition of pSTAT3. Silibinin inhibited Cal33 tumor growth in athymic mice model without any adverse effects. Our study revealed anticancer efficacy of silibinin in suppressing cell viability and proliferation, promoting DNA damage, apoptosis and cell cycle arrest in HNSCC. Further, oral silibinin inhibited Cal33 tumor xenograft growth. Hence, silibinin could have promising therapeutic efficacy for HNSCC.

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Abstract: This paper reviews Gaussian pulse generator design techniques developed over the past two decades for ultra-wideband (UWB) impulse radar system. The most popular methods for creating Gaussian pulses using discrete parts like step recovery diodes, avalanche transistors, tunnel diodes, and nonlinear transmission lines have been covered in this manuscript. A comparative analysis of these methods have also been presented to help designers understand the underlying principles and select the most suitable technique based on specific application requirements.

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Abstract: CRISPR-Cas systems have been explored for targeted genome editing of several organisms. It is rapid, cost-effective, specific, and versatile technology. It requires expression of multidomain single Cas9 protein and single guide RNA (sgRNA) that targets desired nucleic acids in the presence of a protospacer adjacent motif (PAM). This generates a double-stranded break that is repaired by either non-homologous end joining or a homology-directed repair pathway. Currently, several Cas protein variants have been discovered and being used for several biotechnological applications. This review highlights the recent progress of CRISPR-Cas systems for genome editing of mainly human pathogenic microorganisms for their controlling infections.

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Abstract: In this perspective paper, we analyse the challenges and opportunities of hydrology in the urban context and propose solutions for innovation and sustainability by leveraging advancements across technology, society, and governance for resilient cities. Technological breakthroughs, such as smart sensors and artificial intelligence, can enhance the efficiency and resilience of real-time water monitoring and predictions. Public awareness and community engagement can foster behavioural change and empower residents to actively participate in urban water governance through initiatives like rainwater harvesting and participatory planning. Additionally, big data and remote sensing provide cities with the insights needed for adaptive, data-driven decision-making. Together, these developments represent a paradigm shift from reactive problem-solving to proactive, integrated solutions that prioritise equity, environmental health, and urban resilience. Finally, the paper highlights the differences in progress between the Global North and the Global South and proposes research priorities for the future of urban hydrology.

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