E-SYMPOSIUM PROCEEDINGS

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COMPARATIVE ANALYSIS OF LIPOSOMES AND DENDRIMERS IN DRUG DELIVERY

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Abstract: Recent advances in nanomedicine have transformed drug delivery systems through the development of sophisticated nanocarriers operating at the 1-1000 nm scale. Among these, liposomes and dendrimers represent two distinct approaches that have shown remarkable potential in enhancing therapeutic efficacy while minimizing adverse effects. Liposomes, self-assembled phospholipid vesicles, have achieved significant clinical success, with over 15 FDA-approved formulations and numerous candidates in late-stage clinical trials. These biomimetic structures exhibit versatile drug loading capabilities, accommodating both hydrophilic and hydrophobic molecules with encapsulation efficiencies reaching 80-90% for optimized formulations. Their success is evidenced by products like Doxil® and Ambisome®, which have demonstrated superior pharmacokinetic profiles and reduced toxicity compared to conventional formulations. Dendrimers, conversely, represent precisely engineered branched polymers with controlled size distributions (typically 2-10 nm) and exceptional molecular weight uniformity (polydispersity indices < 1.05). Their highly organized structure enables multivalent drug conjugation, with loading capacities often exceeding 20% w/w. While dendrimer-based therapeutics are yet to achieve widespread clinical approval, promising results in preclinical studies, particularly with PAMAM and PPI architectures, demonstrate their potential for targeted drug delivery and enhanced cellular uptake. The complementary attributes of these platforms—liposomes' biocompatibility and dendrimers' structural precision—are driving innovations in nanotherapeutics, particularly in oncology and infectious disease treatment.

Keywords: Nanotherapeutics; Drug Delivery Systems; Liposomal Formulations; Dendritic Polymers; Targeted Therapy; Pharmaceutical Nanotechnology.

EXTRACTION TECHNIQUES FOR MEDICINAL AND AROMATIC PLANTS

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Abstract: To efficiently obtain valuable bioactive compounds from medicinal and aromatic plants (MAPs), it is crucial to have selective methods of extraction. Traditional methods of extraction such as maceration, percolation, hot continuous extraction (soxhlet extraction), and liquid-liquid extraction, though invaluable in history and in modern-day practice, serve a purpose. Green methods of extraction such as ultrasound-assisted, supercritical fluid, enzyme-assisted, microwave-assisted, phytonic, and accelerated solvent extraction also advance these fields. These novel methods of extraction work to improve efficiency in every regard. While being eco-friendly by lowering the quantity of solvents required and improving selectivity towards the targeted analytes, other methods may include digestion, decoction, pressurized liquid extraction (PLE), solid phase extraction (SPE). Choosing solvent(s) alongside temperature management, particle size control, and extraction duration, remain fundamental criteria while refining oil extraction techniques for use in the pharmaceutical, nutraceutical, and cosmetic industries. Common extraction methods for aromatic plants, such as steam distillation, solvent extraction, cold pressing, enfleurage, and CO2 extraction, along with others like hydrodistillation, expression, aim to obtain high-quality scented oils. The blending of older and newer techniques of extractions enables us to understand MAPS better, as well as embrace more of the emerging technologies and research in this space, and places great emphasis on the need to advance extractions.

Keywords: Soxhlation; Supercritical Fluid Extraction (SFE); Phytonic process; Microwave-Assisted Extraction (MAE); Conventional techniques; Ultrasound-Assisted Extraction (UAE); Enzyme-Assisted Extraction.

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OPTIMIZING DRUG THERAPY THROUGH SELECTIVE CYP450 INHIBITION

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Abstract: Cytochrome P450 (CYP450) enzymes, mainly expressed in the liver and small intestine, play a central role in xenobiotic biotransformation and drug metabolism. While these enzymes are essential for detoxification, excessive CYP450-mediated metabolism can compromise the therapeutic efficacy of many orally administered drugs by reducing their bioavailability. The use of CYP450 inhibitors, both synthetic and natural, presents an opportunity to enhance the oral bioavailability of poorly absorbed drugs and those with narrow therapeutic windows. These inhibitors function by attenuating first-pass metabolism, resulting in increased plasma concentrations and extended half-lives of substrate drugs. However, successful implementation of this approach requires careful consideration of potential toxicity, genetic polymorphisms affecting enzyme expression, and drug-drug interactions. Recent advances in selective inhibitor development, innovative drug delivery systems, and computational modeling offer promising pathways to optimize CYP450 inhibition strategies. While this approach could potentially reduce dosing requirements for expensive therapeutics, careful clinical management is essential to prevent adverse interactions and ensure patient safety.

, Associate Professor, Dr Neha Kanojia, Associate Professor

Keywords: CYP450 inhibition; Bioavailability enhancement; Drug metabolism; Pharmacokinetic optimization; First-pass effect.

PREDICTIVE BIOMARKERS FOR PRETERM BIRTH AND EARLY DETECTION TECHNIQUES

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Abstract: Preterm birth (PTB), defined as delivery before 37 weeks of gestation, is still a major cause of infant morbidity and mortality globally. Despite breakthroughs in maternal-fetal medicine, early detection and prevention of PTB remain major issues. Biomarkers have emerged as valuable methods for identifying high-risk women and intervening early to enhance pregnancy outcomes. This review discusses about the most recent advances in predicting biomarkers for PTB, such as inflammatory indicators, hormonal alterations, extracellular vesicles, proteomic, genomic, and metabolomic signatures. Recent research has shown that multi-omics techniques that include genomic, proteomic, and metabolomic data improve prediction accuracy dramatically. PTB risk is closely linked to inflammatory proteins including IL-6, TNF-α, and CRP, as well as hormonal indicators like scorticotropin-releasing hormone and oestriol. Furthermore, placental extracellular vesicles and microRNAs (miRNAs) give useful information on placental health and immunological responses that lead to premature labour. Machine learning methods that use biomarker-based datasets outperform traditional clinical assessments in terms of PTB risk prediction. Despite these advances, there are still hurdles in clinical validation, standardisation, and accessibility of biomarker-based testing. More research is required to use these findings in ordinary obstetric practice. Integrating biomarkers into prenatal care has the potential to transform PTB screening, provide targeted therapies, and increase newborn survival. This review discusses the importance of biomarkers in determining the future of obstetric treatment and lowering the worldwide burden of preterm delivery.

Keywords: Preterm birth; Predictive Biomarkers; Multi-omics; Neonatal Care; Maternal Care; PTB Risk Prediction.

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PREDICTIVE ANALYTICS FOR DRUG RESPONSE USING AI AND GENOMIC DATA

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Abstract: The variability in patient response to drug therapy poses a significant challenge in clinical practice, often leading to adverse drug reactions, treatment failure, or suboptimal outcomes. Recent advancements in artificial intelligence (AI) and genomics have paved the way for personalized medicine by enabling predictive analytics of individual drug responses. This work explains the integration of machine learning algorithms with genomic data to forecast drug efficacy and safety at an individual level. AI models are trained using large-scale genomic datasets, including gene expression profiles, single-nucleotide polymorphisms, and patient health records, to identify patterns and biomarkers associated with drug metabolism, resistance, and sensitivity. Supervised learning techniques such as random forests, support vector machines, and neural networks for classification and regression tasks related to pharmacogenomics. The predictive models are validated using independent datasets and clinical trial data to ensure accuracy and generalizability. Case studies in oncology and cardiovascular diseases highlight the practical application of these models in optimizing therapeutic strategies. This approach reduces clinical trial-and-error prescribing and enhances therapeutic outcomes by tailoring treatments to the patient's genetic makeup. AI-powered predictive analytics has immense potential to revolutionize drug development and therapeutic management by connecting genomics and clinical practice.

Keywords: Pharmacogenomics; Personalized Medicine; Machine Learning; Clinical Trial; Oncology.

SYNERGISTIC ANTIFUNGAL ACTIVITY OF *CROSSANDRA INFUNDIBULIFORMIS* EXTRACT IN COMBINATION WITH KETOCONAZOLE AGAINST *CANDIDA ALBICANS*

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Abstract: The increasing prevalence of fungal infections and rising resistance to conventional antifungal drugs like ketoconazole have created a need for alternative therapeutic approaches. Although *Crossandra infundibuliformis* is traditionally valued for its anti-inflammatory and antimicrobial effects, its antifungal capabilities are not well established. In this study, dried and powdered leaves were subjected to solvent extraction, followed by phytochemical screening to identify bioactive compounds with known antifungal properties. To examine the synergistic effect, different concentrations of the extract were combined with ketoconazole and evaluated using agar well diffusion and broth dilution assays. The combined treatment shows significant antifungal activity, showing larger zones of inhibition and a marked reduction in the minimum inhibitory concentration (MIC) compared to ketoconazole alone. These results indicate a synergistic interaction, where the plant extract potentially boosts the antifungal efficacy of ketoconazole by intensifying its action against fungal growth. This technique may offer several benefits, including overcoming resistance, lowering the required dose of synthetic drugs, and reducing side effects. The results indicate that plant-based compounds could serve as valuable adjuncts in antifungal therapy. However, further studies involving animal models and mechanistic analysis are necessary to confirm the therapeutic potential and safety of this combination. This research shows the potential of combining natural products with conventional medicine to create more effective and sustainable treatments for fungal infections.

Keywords: *Crossandra infundibuliformis*; Ketoconazole; Antifungal combinations; *Candida albicans*; Chemosensitization; Phytochemicals

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THE POWER OF NMR IN MOLECULE-BASED DRUG DEVELOPMENT

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Abstract: Nuclear Magnetic Resonance (NMR) spectroscopy is an indispensable analytical platform in contemporary drug discovery, offering unique capabilities for atomic-level characterization of molecular interactions. This has proven particularly valuable in fragment-based drug discovery (FBDD) and structure-based design (SBD), complementing traditional high-throughput screening (HTS) techniques. NMR provide distinct advantages in detecting and characterizing weak binding interactions (KD ~ mM-μM range) and elucidating protein-ligand complex structures with atomic resolution. Recent developments in NMR-based screening techniques, including saturation transfer difference (STD-NMR), water-LOGSY, and protein-observed methods such as HSQC, have enabled efficient hit identification and optimization. When integrated with surface plasmon resonance (SPR), these techniques offer comprehensive characterization of binding kinetics and thermodynamics. Modern applications extend to fragment growing, linking strategies, and structure-activity relationship studies, with particular success in targeting previously undruggable proteins and allosteric sites. Recent progress in cryoprobe technology, higher field magnets, and hybrid methods have significantly enhanced sensitivity and throughput although challenges persist regarding protein size limitations and sample requirements. This evolution has established NMR as a cornerstone technology in pharmaceutical research, facilitating the rational design and optimization of therapeutic candidates through direct observation of molecular interactions.

Keywords: Nuclear Magnetic Resonance Spectroscopy; Fragment-Based Drug Discovery; Structure-Based Design; Protein-Ligand Interactions; Drug Screening Methods; Biophysical Characterization.