AMITY UNIVERSITY

Proceedings of

3rd International Conference on Pharma Technology & Translational Development : Integrating Chemistry, Bioscience and Regulatory for Next- gen therapeutics

PTTDICBR 2026

25th – 26th February 2026

Organized By:

Amity Institute of Pharmacy,

Amity University Uttar Pradesh

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3rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory for Next-Gen Therapeutics, 2026

PTTDICBR 2026

25th-26th February 2026

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Proceedings of the 3rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory – For Next-Gen Therapeutics (25th–26th February 2026)

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Selected papers from the conference may appear as book chapters with established academic publishers, and the proceedings may also be made available through recognized indexing platforms.

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Name and designation
Dr. Navneet Sharma

Name of Institution
Amity Institute of Pharmacy
Amity University Noida, Uttar Pradesh

About Amity University

Amity University, a leading research and innovation-driven university, has been ranked among the top 3% of universities by QS and Times Higher Education, UK (the world's leading university rankings organizations). The university is also Asia's only not-for-profit university to be awarded US Regional Accreditation by WASC, USA, and QAA, UK, setting a new standard of academic excellence in India. Amity University has been ranked among the top universities globally, with a NIRF rank of 22nd (2025) for producing the most employable graduates in a survey conducted by Times Higher Education, UK, among 9,000 employees worldwide.

Amity University is the flagship institution of Amity Education Group, established over two decades ago. Today, Amity has over 2,00,000 brilliant students from pre-nursery to PhD levels, pursuing more than 600 programs in 90 diverse disciplines, ranging from Management to Psychology, as well as future-focused areas like Renewable Energy, Nuclear Science, and Nanotechnology.

The Group is driven by its vision of building a Global Knowledge Network, providing globally benchmarked education. Today, the Group comprises 11 Universities, 28 schools, and 16 international campuses across London, Singapore, Dubai, New York, San Francisco, Amsterdam, Mauritius, Abu Dhabi, Sharjah, Tashkent, South Africa, besides India.

Amity's relentless pursuit of excellence is reflected in its steadfast commitment to and contributions to cutting-edge research and innovation. For instance, Amity in the last four years has filed over 2,600 patents. It is also engaged in conducting over 400 high-end Government-funded as well as international research projects, including those funded by the Bill & Melinda Gates Foundation, USAID, and Leverhulme Trust, UK.

In the field of management, the university has developed over 3,500 case studies in the past years that have been bought across 110 countries by 2,300+ leading institutions and organizations like Harvard, Stanford, Oxford, McKinsey, and KPMG. Amity has instituted an extensive scholarship programme, benefiting over 25,000 students so far. These brilliant students have filed 100 patents and published over 1,100 Scopus-indexed research papers.

Today, the Amity community of outstanding students has exceeded over 150,000 alumni worldwide, who are successfully pursuing their careers in top organizations or pursuing further studies at leading institutions in top global universities like Stanford, Oxford, Harvard, and Columbia.

About Amity Institute of Pharmacy

Amity Institute of Pharmacy (AIP) is one of the premier pharmacy institutes in India with a NIRF ranking of 18th (as of 2025), offering UG, PG, and PhD programs. Currently, AIP offers a B. Pharm program with an intake of 100 and M. Pharm programs in Pharmaceutics, Pharmacology, Drug Regulatory Affairs, Pharmaceutical Chemistry, Pharmaceutical Analysis, Industrial Pharmacy, and Phyto-Pharmacy.

The Institute stands amongst the top institutes with NIRF ranking and has led in the top 25 institutions in the past five years. The Institute has received several research grants over the past five years from funding agencies like SERB, ICMR, AAYUSH, UPCST, ANRF and CCRUM.

AIP has more than 500 Scopus/WoS-listed research publications and 25 patents to its credit in the last five years in diverse research areas like novel drug delivery systems (NDDS), medicinal chemistry, neuropharmacology, phytopharmaceuticals, drug regulatory requirements, and pharmaceutical analysis, etc.

The thrust areas of research include NDDS for skin disorders and burns, drug discovery and development for cancer, diabetes, autoimmune diseases, neurodegenerative diseases like Alzheimer's and Parkinson's disease, and global regulatory framework for drugs, medical devices, etc.

Objectives of PTTDICBR 2026

- Integration of traditional scientific knowledge with modern pharmaceutical research and phytopharmaceutical development.
- Advancement of translational research in stem cells, tissue engineering, pharmacology, and system biology.
- Promotion of innovation in drug discovery, biologicals, and advanced formulation technologies.
- Strengthening of regulatory awareness, compliance practices, and global quality standards.
- Facilitation of industry–academia–research collaborations for impactful healthcare solutions.
- Emphasis on emergency healthcare, combat casualty management, and strategic medical preparedness.
- Encouragement of scientific exchange, mentorship, and research dissemination among young investigators and scholars.

Organizing Committee

Organising Technical Committee

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Food-
Hayyan Khan
Abhishek
Vansh
Manish

Transportation –
Uday
Aastha Tiwari
Jatin Sahoo

Message from Chief Patron

Dr. Ashok K. Chauhan

Hon'ble Founder President, Amity Education Group; Ritnand Balved Education Foundation & Chairman, AKC Group of Companies

It is a matter of great pride that **Amity Institute of Pharmacy (AIP), Amity University Uttar Pradesh (AUUP), Noida Campus**, is organizing the 3 rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory (PTTDICBR 2026) on Wednesday, 25th February and Thursday, 26th February 2026. The conference theme, focusing on recent advances in the areas covered in the conference which have influenced the trends and products in pharmaceutical industry across the globe, is most appropriate and of critical significance for contemporary healthcare research. Pharmaceutical technologies remain central to advancing modern healthcare by developing innovative drugs, vaccines, and therapeutic strategies and its convergence with translational research plays a pivotal role in bridging scientific discoveries with clinical applications, accelerating their impact on patient care. I warmly welcome the distinguished academicians, scientists, industry leaders, entrepreneurs, and young researchers from India and abroad who are participating in this conference. Their collective expertise and exchange of ideas will be highly inspiring, motivating and enriching for brilliant students, research scholars, Ph.D scholars, faculty members and other worthy participants and ignite in them, innovative ideas that translate into technologies and innovations for societal benefit. The conference will provide a platform for forging bonds and mutual cooperation, undertaking joint research projects and joint publications, for achieving long-term goals and contacts for mutual benefits. My sincere appreciation to Anusandhan National Research Foundation (ANRF), Defence Research and Development Organisation (DRDO) and Central Council for Research in Unani Medicine (CCRUM), Council of Science and Technology (CST), Uttar Pradesh for sponsoring the conference. I compliment Conference Convener -Dr. Havagiray R. Chitme, HoI, AIP, AUUP, Noida and co-conveners– Dr. Tanveer Naved, Dr. Viney Lather, Dr. Nitin Sharma, Dr. Vikesh Shukla, Dr. Rajeev Khrab, Dr. Ramanpreet Walia and Dr. Malika Pathak, Organising Secretary Dr. Navneet Sharma as well as all other members of the organizing committee, dedicated faculty members, Ph.D scholars, brilliant students and staff, for meticulously planning the event under the guidance of Dr. Balvinder Shukla, Vice Chancellor, AUUP. The most strategic and visionary leadership of Dr. Atul Chauhan Ji, Hon'ble Chancellor, AUUP & President, Ritnand Balved Education Foundation (RBEF), would lead to outcome based and result oriented success

of the event. I warmly welcome all participants and hope they have a memorable and enriching experience that not only contributes to the goals of PTTDICBR-2026 but also leave a profound impact on the fellow participants. It is a matter of great pride that Amity Institute of Pharmacy (AIP), Amity University Uttar Pradesh (AUUP), Noida Campus, is organizing the 3 rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory (PTTDICBR 2026) on Wednesday, 25th February and Thursday, 26th February 2026. The conference theme, focusing on recent advances in the areas covered in the conference which have influenced the trends and products in pharmaceutical industry across the globe, is most appropriate and of critical significance for contemporary healthcare research. Pharmaceutical technologies remain central to advancing modern healthcare by developing innovative drugs, vaccines, and therapeutic strategies and its convergence with translational research plays a pivotal role in bridging scientific discoveries with clinical applications, accelerating their impact on patient care. I warmly welcome the distinguished academicians, scientists, industry leaders, entrepreneurs, and young researchers from India and abroad who are participating in this conference. Their collective expertise and exchange of ideas will be highly inspiring, motivating and enriching for brilliant students, research scholars, Ph.D scholars, faculty members and other worthy participants and ignite in them, innovative ideas that translate into technologies and innovations for societal benefit. The conference will provide a platform for forging bonds and mutual cooperation, undertaking joint research projects and joint publications, for achieving long-term goals and contacts for mutual benefits. My sincere appreciation to Anusandhan National Research Foundation (ANRF), Defence Research and Development Organisation (DRDO) and Central Council for Research in Unani Medicine (CCRUM), Council of Science and Technology (CST), Uttar Pradesh for sponsoring the conference. I compliment Conference Convener -Dr. Havagiray R. Chitme, HoI, AIP, AUUP, Noida and co-conveners– Dr. Tanveer Naved, Dr. Viney Lather, Dr. Nitin Sharma, Dr. Vikesh Shukla, Dr. Rajeev Khrab, Dr. Ramanpreet Walia and Dr. Malika Pathak, Organising Secretary Dr. Navneet Sharma as well as all other members of the organizing committee, dedicated faculty members, Ph.D scholars, brilliant students and staff, for meticulously planning the event under the guidance of Dr. Balvinder Shukla, Vice Chancellor, AUUP. The most strategic and visionary leadership of Dr. Atul Chauhan Ji, Hon'ble Chancellor, AUUP & President, Ritnand Balved Education Foundation (RBEF), would lead to outcome based and result oriented success of the event. I warmly welcome all participants and hope they have a memorable and enriching experience that not only contributes to the goals of PTTDICBR-2026 but also leave a profound impact on the fellow participants.

(Dr. Ashok K. Chauhan)
Founder President
Ritnand Balved Education Foundation (RBEF)
(The Foundation of Amity Universities, Institutions & Amity Internation

Message from Patron

Dr. Atul Chauhan

Hon'ble Chancellor, Amity University Uttar Pradesh, Noida; President, Ritnand Balved Education Foundation; & CEO, AKC Group of Companies

On behalf of Amity University, Noida, it is my immense pleasure to welcome you to the 3rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory (PTTDICBR 2026), being organized by the Amity Institute of Pharmacy (AIP), Amity University Uttar Pradesh (AUUP), Noida Campus, from 25th-26th February 2026.

Amity Education Group is more than a network of world-class institutions; it is a vision-driven initiative committed to nurturing exceptional talent and future leaders. Established in 1986 under the Ritnand Balved Education Foundation, Amity was founded on the belief that India possesses the intelligence, creativity, and potential to excel globally. Our mission is to develop morally grounded, compassionate, and highly competent professionals who can contribute meaningfully to society. Today, Amity's industry-oriented and research-driven approach has earned global recognition, reflected in the accomplishments of our students, faculty, and distinguished alumni.

In alignment with this vision, PTTDICBR 2026 serves as a dynamic platform to promote interdisciplinary dialogue and translational research. The convergence of chemistry, biosciences, pharmaceutical technology, and regulatory sciences underscores the importance of collaborative innovation in addressing contemporary healthcare challenges. By fostering meaningful exchange between academia, industry, and regulatory experts, this conference aims to accelerate the translation of scientific discoveries into safe, effective, and globally relevant therapeutic solutions.

I sincerely acknowledge the dedicated efforts of the organizing committee, collaborators, and sponsors whose commitment has made this prestigious conference possible.

I extend my heartfelt best wishes for the grand success of PTTDICBR 2026

Message from Co-patron

Prof. (Dr.) Balvinder Shukla

Vice Chancellor, Amity University Uttar Pradesh

It is a matter of great pride that the Amity Institute of Pharmacy (AIP), Amity University Uttar Pradesh (AUUP), Noida Campus, is convening the 3rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory (PTTDICBR 2026), supported by the Drug Research Cluster, AUUP, on 25th–26th February at Amity University, Noida.

At a time when healthcare systems across the world are undergoing rapid transformation, the need for cohesive and interdisciplinary scientific engagement has never been greater. This conference reflects Amity's firm commitment to advancing scholarship that is rigorous, translational, and socially responsive. By bringing together experts in pharmaceutical technology, chemistry, biosciences, and regulatory science, PTTDICBR 2026 reinforces the importance of aligning discovery, development, and compliance within a unified framework.

The thoughtful integration of regulatory perspectives with scientific innovation ensures that research is not only path-breaking but also responsible and implementable. Such alignment is essential for translating laboratory excellence into safe, effective, and globally accepted therapeutic solutions. Platforms like this strengthen academic-industry dialogue and cultivate the collaborative spirit necessary for sustained progress in pharmaceutical and biopharmaceutical sciences.

I commend the organizing team for their clarity of vision and diligent efforts in shaping this significant international forum.

I am confident that PTTDICBR 2026 will inspire meaningful deliberations, foster enduring collaborations, and contribute constructively to the advancement of global healthcare.

Prof. (Dr.) Balvinder Shukla
Co-Patron, PTTDICBR 2026
Vice Chancellor, Amity University Uttar Pradesh

Message from Chief Advisor

Dr. W. Selvamurthy

President, Amity Science, Technology and Innovation Foundation (ASTIF), Amity University Uttar Pradesh

The 3rd International Conference on *Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory (PTTDICBR 2026)*, to be held on **25th–26th February 2026**, marks another important step in fostering meaningful academic engagement and scientific excellence. This initiative brings together students, researchers, post-doctoral fellows, and young investigators to engage in thoughtful dialogue and in-depth exploration of pharmaceutical technology and translational development.

The conference underscores the strategic convergence of chemistry, biosciences, and regulatory sciences, an intersection that is increasingly defining the future of contemporary drug discovery and development. In today's rapidly evolving research landscape, pharmacotherapy is being reshaped through interdisciplinary collaboration, innovative methodologies, and advanced technological interventions. Platforms such as PTTDICBR 2026 play a pivotal role in nurturing this integrated approach.

Designed as a dynamic forum for scholarly interaction, the conference will provide exposure to emerging domains including combinatorial chemistry, computational modelling, pharmaceutical technology, and translational research. It offers participants valuable perspectives on how coordinated scientific efforts can accelerate the transformation of laboratory findings into safe, effective clinical applications.

I sincerely commend the organizing committee for their vision, dedication, and meticulous planning in bringing together diverse expertise to create an event of such academic and professional significance.

I extend my best wishes for the grand success of the conference and for continued excellence in all future academic and research endeavours.

Message from Chairperson

Dr. B.C. Das

Chairman & Hargobind Khorana Chair Professor, Amity Institute of Molecular Medicine & Stem Cell Research (AIMMSCR), Amity University Uttar Pradesh

I am delighted to know that the Amity Institute of Pharmacy (AIP), Amity University Uttar Pradesh (AUUP), Noida campus, is organizing the 3rd International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bioscience and Regulatory (PTTDICBR 2026) **f**rom 25th-26th February 2026, at Amity University, Noida, Uttar Pradesh.

This conference offers an excellent opportunity to deepen understanding of pharma technology and translational development within the integrated domains of chemistry, biosciences, and regulatory science. I am confident that participants will gain valuable insights and meaningful exposure to emerging trends and innovations shaping modern pharmaceutical research.

Translational development plays a pivotal role in bridging the critical gap between laboratory discoveries and clinical applications. In today's interdisciplinary environment, it encompasses the optimization of bioprocessing strategies, formulation development, regulatory alignment, and manufacturing technologies to ensure product safety, quality, and therapeutic effectiveness. Advances in cell culture technologies, purification methodologies, and innovative delivery systems are transforming how biopharmaceuticals progress from concept to clinic.

I commend the organizing team for their dedicated efforts and extend my best wishes for an intellectually enriching and highly informative conference. I firmly believe that all participants, especially budding scientists, researchers, and students, will greatly benefit from the innovative ideas, expert deliberations, and collaborative learning fostered during this two-day international conference.

Message from Convener

Dr. Havagiray R. Chitme Deputy Director
Amity Institute of Pharmacy, Amity University Uttar Pradesh

I am honoured to extend a warm welcome to the delegates and distinguished guests to the Amity University Noida campus on February 2026, for the two-day international conference titled "Pharma Technology & Translational Development: Integrating Chemistry, Bio-Science and Regulatory for Next-Gen Therapeutics 2026". The advent of high-throughput screening, combinatorial chemistry, and computational modelling has revolutionized the drug discovery pipeline, empowering researchers to interrogate vast chemical libraries and predict molecular interactions with unprecedented accuracy. By harnessing these cutting edge tools, we navigate the intricate relationship between chemical structure and biological function, unravelling the mysteries of disease pathogenesis and unlocking new avenues for therapeutic intervention. Pharmaceutical technology uses an assortment of techniques, including high-throughput screening, computational modelling, and structure-based drug design, to aid in the discovery and development of conventional biopharmaceuticals. For the purpose of establishing the regulatory environment and assisting the clinical translation of conventional biopharmaceuticals, both translational development and pharmaceutical technology are essential. In the realm of traditional biopharmaceuticals, pharmaceutical technology and translational development are fundamental pillars of chem-biology research that facilitate the discovery, development, production, and clinical translation of innovative medicines to address unmet medical needs. I extend my warmest welcome to all attendees, including delegates, students, and expert speakers. It gives me great pleasure to inform you that every member of the organizing committee contributed diligently to ensure the success of this occasion and your pleasant sojourn. I hope the participants' journey is intellectually and culturally enlightening. I wish PTTDICBR, 2026 a great success!

Message from the Organizing Secretary

Dr. Navneet Sharma
Assistant Professor
Amity Institute of Pharmacy, Amity University Uttar Pradesh

On behalf of the Amity Institute of Pharmacy, I am pleased to extend my heartfelt greetings to everyone taking part in the International Conference on Pharma Technology & Translational Development: Integrating Chemistry, Bio-Science and Regulatory for Next-Gen Therapeutics 2026. This event provides a platform to explore the learnings and practices of recent developments in traditional biopharmaceuticals, including new formulation techniques, improved manufacturing processes, and enhanced drug delivery methods. This involves bridging the gap between chemical and biological sciences and translating laboratory discoveries into clinical applications. Presentations and discussions will focus on emerging technologies impacting the field, such as artificial intelligence in drug discovery, high-throughput screening techniques, and novel analytical methods for characterizing biopharmaceuticals. I would like to thank everyone in attendance for their commitment to fostering knowledge and understanding among individuals of interest. I commend you on your efforts, and I wish you an enlightening and informative experience. Dr. Navneet Sharma Organizing Secretary, PTTDICBR 2026

SPEAKERS

Dr. RAJESH ARORA
Scientist G,
DIPAS, DRDO, DELHI

He is a Senior Scientist and Additional Director with the Government of India. His innovative contributions in the area of drug design and development and augmentation of medicinally useful secondary metabolites using biotechnological interventions have received wide international acclaim. Dr. Arora has steered numerous specialized training programmes on the prevention and management of disasters. He was actively involved in the training of Trainers and Responders during the Common Wealth Games 2010 and has received certified Multi-Agency Strategic Command Training. He was an expert member associated with the development of National Disaster Management Guidelines by the National Disaster Management Authority. Dr. Arora has been a Visiting Scientist in the EU, is a Marie Curie Fellow, a Fellow of the Royal Society of Chemistry, a Fellow of the Linnean Society of London, a Fellow of the Union of Scientists, Bulgaria, and is an alumnus of the US George C. Marshall Centre for Security Studies. Dr Arora's name is included in the Who's Who of the World, USA, Who's Who in Science and Engineering, and International Biography, UK. He is a recipient of several prestigious international and national fellowships and awards, including the DRDO Laboratory Scientist of the Year Award (2010) and DRDO Technology Group Awards (Awarded Twice). He serves on the Editorial Boards of more than twenty-five international journals and is a reviewer for over a hundred peer-reviewed journals. Dr Arora has more than 250 publications, 17 patents, and 14 books to his credit.

SPEAKERS

Dr. GALIB
Department of Rasashastra & Bhaishajya,
Kalpana, All India Institute of Ayurveda, New Delhi

Dr. Galib, MD (Ayurveda), PhD, is an eminent academician and researcher currently serving as Additional Professor in the Department of Rasa Shastra & Bhaishajya Kalpana at the All India Institute of Ayurveda (AIIA). With over 80 research publications, more than 1,900 citations, and an h-index of 22, he has made substantial contributions to Ayurvedic sciences. He also serves as Associate Editor for leading journals and holds memberships in several prestigious academic and research bodies across India. He completed his education from BRKR Government Ayurvedic College, Hyderabad, National Institute of Ayurveda, Jaipur, and IPGT & RA, Jamnagar, and has previously worked with CCRAS, Ministry of AYUSH, and Gujarat Ayurveda University. His excellence has been recognized with multiple awards, including the Young Scientist Award (2017) and the Sheikh Zayed International Award (2022), along with nine national-level Best Thesis Awards, reflecting his significant impact in Ayurveda research and academics.

SPEAKERS

Dr. SUJATA MOHANTY

Professor Stem Cell Facility (DBT-Centre of Excellence for Stem Cell Research), AIIMS, New Delhi

Dr. Sujata Mohanty is affiliated with the All India Institute of Medical Sciences, New Delhi, where she works at the Stem Cell Facility under the DBT-Centre of Excellence for Stem Cell Research. She is the Founder President of the Indian Society for Extracellular Vesicles and serves as a Member and Board Director of the International Society for Extracellular Vesicles, along with being an Exosome Committee Member of the International Society for Cell and Gene Therapy. She completed her Ph.D. from AIIMS, New Delhi in 1996 and pursued post-doctoral training at Mount Sinai Hospital, New York, USA in 1998. Her research career focuses on adult, embryonic, and induced pluripotent stem cells to advance stem cell biology, drug discovery, and translational research. She established a Good Manufacturing Practices (GMP) facility for the production of clinical-grade stem cells and has published over 280 research articles and book chapters, along with securing three patents. She has received multiple recognitions, including three awards from the International Society for Stem Cell Research (USA), an NIH Fellowship for training in Embryonic Stem Cell Culture at the University of Georgia, the AIIMS Excellence Awards (2012, 2014, 2015), the Bharat Jyoti Award from the India International Friendship Society (2013), an ICMR International Fellowship at Kyoto Prefectural University of Medicine, Japan (2014–2015), and the AIIMS International Fellowship Award (2025).

SPEAKERS

Dr. NITIN SHARMA
Head of department, Amity Institute of Pharmacy (Pharmaceutics)
Amity University, Utter Pradesh

Dr. Nitin Sharma is a distinguished pharmaceutical scientist and academic leader with over 18 years of experience in pharmaceutics, drug delivery, and translational research. He currently serves as Centre Head (Pharmaceutics) at Amity Institute of Pharmacy, Amity University, Noida. With a strong interdisciplinary foundation in pharmaceutics and biotechnology, Dr. Nitin Sharma specializes in the design and evaluation of novel drug delivery systems using advanced nuclear imaging techniques, including Gamma Scintigraphy, PET, and SPECT. His expertise focuses on generating real-time insights into drug and formulation behaviour in humans, enabling precise assessment of gastrointestinal transit, site-specific release, absorption, biodistribution, targeting efficiency, depot release, and safety profiling. His work also extends to topical, transdermal, injectable, cosmetic, and nutraceutical systems. Dr. Nitin Sharma has actively contributed to human clinical trials in collaboration with leading pharmaceutical companies, facilitating the successful translation of innovative technologies from academia to industry. He further strengthened his expertise in nuclear imaging–based pharmaceutical evaluation. His involvement in intellectual property rights (IPR) activities, including patent drafting and prosecution, underscores his commitment to innovation and commercialization. Dr. Nitin Sharma is passionate about integrating advanced imaging with drug delivery science to accelerate drug development, regulatory approval, and the creation of patient-centric therapeutic solutions.

SPEAKERS

Dr. Anil Kumar Sharma

Vice President, AIMIL Pharmaceuticals (India) Ltd.

Dr. Anil Kumar Sharma is an accomplished pharmaceutical professional associated with **AIMIL Pharmaceuticals (India) Ltd.**, a leading Indian healthcare organization dedicated to integrating traditional Ayurvedic wisdom with modern scientific research. AIMIL Pharmaceuticals, headquartered in New Delhi, is recognized among the top Indian pharmaceutical companies and holds a distinguished position in the AYUSH sector for its innovation-driven herbal healthcare solutions and global outreach.

With extensive experience in pharmaceutical sciences and healthcare innovation, Dr. Sharma has contributed to strengthening research-oriented approaches in Ayurveda-based drug development, clinical applications, and evidence-based herbal therapeutics. His professional work focuses on promoting scientifically validated natural medicines, fostering industry–academia collaboration, and advancing quality standards in pharmaceutical manufacturing and healthcare delivery.

At AIMIL Pharmaceuticals, Dr. Sharma plays an active role in supporting the organization's mission of developing safe, effective, and affordable healthcare solutions grounded in rigorous research and modern technology. The company operates through strong R&D capabilities, GMP-certified manufacturing facilities, and collaborations with premier national research organizations, contributing significantly to public health and integrative medicine.

Dr. Sharma's professional interests include pharmaceutical research, innovation in herbal drug development, translational healthcare practices, and the global advancement of Ayurveda as a scientifically accepted therapeutic system. Through academic engagement, professional

networking, and industry leadership, he continues to contribute toward bridging traditional medicine with contemporary pharmaceutical science.

SPEAKERS

PROF. MALLIKA PATHAK

Department of Chemistry
Miranda House,
University of Delhi

Professor Mallika Pathak is an academic and a researcher working at Miranda House, University of Delhi. Her research primarily focuses on Molecular modelling, Drug-molecular interactions and water remediation where she has contributed groundbreaking insights that have influenced both academia and industry. Her extensive body of work includes numerous peer-reviewed publications in high-impact journals, book chapters, collaborative research projects with global experts and patents. In recognition of her contributions, Professor Pathak has received several prestigious awards, including the 'Most Promising Innovation' from the University of Delhi in 2016 and Australian Leadership Award Fellow (ALAF) in 2013 for excellence in research and innovation and the 'Teaching Excellence Award for Innovation' in 2015 from the University of Delhi for academic leadership. She has also been a keynote speaker at numerous international conferences. Beyond research, Professor Pathak is deeply committed to mentoring young scholars and fostering interdisciplinary collaborations. She has played a vital role in shaping academic curricula and policy frameworks, ensuring the growth of research and education in her field. With her unwavering dedication to innovation and knowledge dissemination, Professor Mallika Pathak continues to inspire the next generation of scholars while making significant contributions to the advancement of chemistry.

SPEAKERS

Dr. HARSHA KHARKWAL

FRSC, Director, Amity Institute of Phytochemistry & Phytomedicine ,
Amity University , Uttar Pradesh

Prof. (Dr.) Harsha Kharkwal, FRSC, is a Professor and Director at the Amity Institute of Phytochemistry and Phytomedicine, Amity University, Noida, India. She is an accomplished researcher and academician with over 24 years of experience in research, teaching, and scientific innovation. Her expertise lies in natural product chemistry, applied carbohydrate chemistry, herbal product development, plant hydrocolloids, and novel polysaccharides for drug delivery. Prof. Kharkwal has made significant contributions to pharmaceutical and phytochemical sciences through an extensive body of scholarly work, including numerous peer-reviewed publications, book chapters, and edited volumes. She is also an inventor with multiple granted patents, reflecting her strong engagement in translational research and technology development. Her research focuses on the discovery, characterization, and application of bioactive natural compounds and biomaterials for therapeutic and industrial applications. A Fellow of the Royal Society of Chemistry (FRSC), Prof. Kharkwal is internationally recognized for her scientific contributions and interdisciplinary research initiatives. She has actively participated in and led funded research projects, collaborating with academic institutions, research organizations, and industry partners. Her work integrates fundamental science with practical innovation, particularly in drug delivery systems, nutraceuticals, and sustainable biomaterials. In addition to her research accomplishments, Prof. Kharkwal has been deeply involved in academic mentorship, having supervised doctoral scholars and guided young researchers. She continues to contribute to the scientific community through invited lectures, conference presentations, and professional service, promoting excellence in research, education, and innovation.

SPEAKERS

Dr. HEMANT KUMAR GAUTAM

Chief Scientist & Professor, Institute of Genomics and Integrative Biology
Academy of Scientificand Innovative Research,
Delhi University, Delhi.

Dr. Hemant K. Gautam obtained his Master's and Ph.D. degree in microbiology from the (I.R.R.I), New Delhi, India. He did post-doctorate from France and Israel. He is currently working as a Chief Scientist and Professor at Institute of Genomics and Integrative Biology, New-Delhi. He is associated with a number of Universities and members of various scientific and academic organizations. He is a recipient of SARC award, Bharat Excellence award, Biotechnology award, Israel Govt. Fellowship, UNESCO fellow & Intl. Project Reviewer RBUCE-UP, UniverSud, Paris. He is the chairman of the ASEAN India fellowship program and Biosafety expert from the Department of Biotechnology India. He has published more than 80 research papers, two books, and over 480 new sequences have been submitted to NCBI database. He has visited several countries, including France, Israel, Australia, Bulgaria, China, Thailand, Germany, USA, Singapore, Vietnam, and Ukraine. He has a distinguished background in the field of microbial biotechnology, natural products, and microbial genomics. Currently, he is working in the area of microbial biotechnology and microbial pathogenesis including antimicrobial resistance

SPEAKERS

Dr. CHANDRASHEKHARA

Radiodiagnosis IRCH,
AIIMS Delhi

Prof (Dr.) Chandrashekhara SH is a Professor in the Department of Radio-diagnosis at AIIMS, New Delhi. He completed his MBBS from Government Medical College, Mysore, followed by MD and DM from AIIMS, New Delhi. With extensive academic and clinical experience, his areas of interest include onco-radiology, cardiovascular and interventional radiology, and medical robotics. He has authored over 130 publications in indexed journals, contributed book chapters, and delivered numerous lectures at national and international conferences. Dr. Chandrashekhara has received several prestigious awards for research and academic excellence. He has played key roles in advancing interventional radiology, contributing to medical device innovation, and was actively involved in research collaborations, including work with IIT. His team notably developed telerobotic ultrasonography technology. He has also contributed significantly to institutional initiatives, including the National Cancer Institute at AIIMS Jhajjar and administrative responsibilities during the COVID pandemic.

SPEAKERS

Dr. SIDDHARTH PANDEY

Vice President, Datt Mediproducts Pvt. Ltd

Dr. Pandey has a research career spanning more than a decade now and has in-depth expertise. In Biomaterials, Stem cell, tissue engineering field and medical devices healthcare industry. He has been trained in the field of Biotechnology during his Bachelors and Master's degree. Dr. Pandey further went ahead with completing his doctoral thesis specializing in Stem cell Biology, Nanotechnology, Tissue engineering, Polymeric nanoparticles, Haematopoietic stem Cells, Mesenchymal stem cells and iPSCs. He has gained proficiency in diverse areas besides Stem cells biology, CAR T therapy and Biotechnology. Some of these accolades include obtaining extramural/ government funding for Research projects, collaborating with government and autonomous institutes for research Projects, patent writing, research articles writing and developing medical device manufacturing Plants & Animal House Facility as per GLP and AAALAC norms with approvals from Competent authorities. His commitment and dedication to the field has manifested in the form of successful Achievements that include grant projects worth more than Rs. 3.25 Cr funded by BIRAC, DST, Govt. of India and >08 in-house projects that have reached different stages from prototype Preparation to commercialization and clinical trials worldwide. His contributions to scientific World are readily available in public domain in the form of 16 patents, more than 09 original Articles published in internationally peer-reviewed journals. Additionally, he serves as a Reviewer for several international journals on regular basis. Besides his research inclinations, Dr. Pandey possesses through knowledge of clinical trial guidelines and regulatory Requirements applicable for developing novel biotechnological products and seeking marketing Approval from competent authorities. Also, he is well-versed with ISO 13485, ISO 9001 and ISO 17025 certification guidelines. Currently, Dr. Pandey is actively involved in creating

patient-friendly and state-of-the art novel Medical devices harnessing stem cells and their derivatives as pioneering new age healthcare Solutions. Being in the medical devices industry and serving healthcare sector for more than a Decade now, Dr. Pandey meticulously understands the necessity of concepts like feasibility, Affordability, accessibility, safety, efficacy and quality that constitute a successful product Development reaching from bench to bedside for providing quality healthcare solutions

SPEAKERS

Dr. SUBHAJIT GHOSH

PhD.Scientist, Department of
Brain Tumor Immunology,
German Cancer Research Centre
(DFKZ), Max Planck
Institute, Heidelberg,
Germany.

Dr. Subhajit Ghosh is an immunologist at the German Cancer Research Centre (DKFZ), Germany, with prior research training at Washington University School of Medicine, St. Louis, and the NCI–designated Stephenson Cancer Centre, USA. His research focuses on immune regulation in cancer, with particular emphasis on myeloid cell biology, T-cell activation and dysfunction, and immunomodulatory therapeutic strategies. He has conducted both translational and mechanistic studies in glioblastoma and triple-negative breast cancer. Dr. Ghosh's work aims to bridge fundamental immunology with clinical applications to advance immune-based therapies, and he is currently working toward establishing an independent research program in clinical and translational immunology.

Dr. MOHD. UROOJ
Research Officer (Pharmacology)
CCRUM- National Research Institute of Unani Medicine for Skin Disorders, Hyderabad

Dr. Mohd Urooj is working as Research Officer (Pharmacology) at National Research Institute of Unani Medicine for Skin Disorders, Hyderabad under CCRUM, Ministry of Ayush, Government of India He is involved in preclinical and clinical studies for validation of traditional Unani formulations. During his 11 years job tenure, he has participated in many professional meetings and conferences and made a niche for himself as an expert from CCRUM. An alumna of Jamia Hamdard he has an excellent academic & research record. He has also worked as Clinical Study Co-ordinator in Fortis Clinical Research Pvt. Ltd. Faridabad. Dr. Urooj earned his B.Pharm, M.Pharm (Pharmacology), and PhD in Pharmaceutical Medicine from Jamia Hamdard, New Delhi, in collaboration with the Ranbaxy Clinical Pharmacology Unit, Noida. He specializes in both preclinical and clinical trials. He has successfully conducted over 50 preclinical toxicity studies on Unani formulations, as well as various BA/BE studies for modern medicine, along with Phase I Clinical Trials at the Ranbaxy Clinical Pharmacology Unit, Fortis Hospital Noida, and Fortis Hospital Faridabad. He has authored multiple research articles in journals recognized both nationally and internationally.

SPEAKERS

Dr. PALLAVI AGARWAL

Professor, Amity Institute of Molecular Medicine & Stem Research, Amity University , Uttar Pradesh

Dr. Pallavi Agarwal is Professor at Amity Institute of Molecular Medicine and Stem Cell Research, Amity University Noida. She did her Ph.D. in Molecular Biology and Genetics from University of Cologne, Germany and worked as Postdoctoral Scientist at Gurdon Institute, University of Cambridge, UK for 4 years. After returning to India, she joined Amity University in 2016 and was awarded prestigious DBT- Ramalingaswami Fellowship. At the same time, she was awarded DST-early career research award and DBT-Biocare Women Scientist extramural grant to establish her research career in investigating epigenetic complexity of gene regulation. Her research interest is focused on understanding the role of histone methylation and acetylation, and gene amplification in causing drug and radiation resistance in various gynecological cancers including ovarian, breast and cervical cancer. Her laboratory uses computer aided molecular docking strategies, integrative genomic and epigenomics tools such as RNA-seq, ChIP-seq and cancer functional assays to identify novel molecular markers and cancer therapeutic targets. Her research lab aims to deliver holistic view of changing epigenetic landscape of chemo-radio resistance and cancer relapse, and also reveal potential therapeutic targets for better cancer treatment and management. She has received grants from Department of Atomic Energy-BRNS to work on epigenetic targeting of radioresistant breast cancer. Her lab is also funded by ICMR to develop urine-based better surveillance marker panels for urinary bladder cancer patients. She has published in reputed international journals such as Cell Death and Discovery, Cancer Letters, Phytotherapy research,

Chemico Biological Interactions, Cancer biomarkers, Journal of Biological Chemistry, Matrix biology, and others and also served as reviewer for reputed international journals such as Cancer letters, Neoplasia, Scientific Reports, Journal of Cell Science and Signaling. Currently, she is supervising 6 PhD students and teaching courses in genetics and cancer biology.

SPEAKERS

Dr. RAJENDER SINGH

President- Global Regulatory Affairs
Mankind Pharma Pvt Ltd.

Dr. Rajender Singh, PhD, RAC, is an accomplished regulatory affairs professional with over 30 years of extensive experience in the global generic pharmaceutical industry. He currently serves as President at Mankind Pharma, where he leads Regulatory Affairs for both API and drug products, as well as Pharmacovigilance activities. Prior to joining Mankind Pharma, he contributed more than 20 years in leadership roles within Ranbaxy's regulatory team, strengthening global regulatory operations and supporting strategic growth. He has a strong track record of supporting US business in both pre-GDUFA and post-GDUFA environments, providing strategic guidance from product identification through commercialization. Dr. Singh has led multi-country, multi-cultural teams and developed global submission strategies for a wide range of dosage forms, including oral, sterile, and complex products. His key expertise includes regulatory strategy development and achieving timely approvals for critical products, including day-1 launches, first-to-file opportunities, Para IV ANDAs, and differentiated 505(b)(2) NDAs. Dr. Singh possesses a deep understanding of scientific, regulatory, and business aspects, enabling him to effectively advise senior management on planning and implementing regulatory strategies. He has also contributed to resolving compliance and data integrity issues in close collaboration with quality assurance teams, including responses to FDA observations such as 483s and warning letters. His

cross-functional collaboration with R&D, QA, and manufacturing teams has supported successful product development and commercialization. In addition, he actively contributes to professional and academic communities through regulatory training and conference presentations. His core strengths include regulatory submissions, lifecycle management, compliance, inspection management, project leadership, and regulatory strategy, particularly for complex pharmaceutical products.

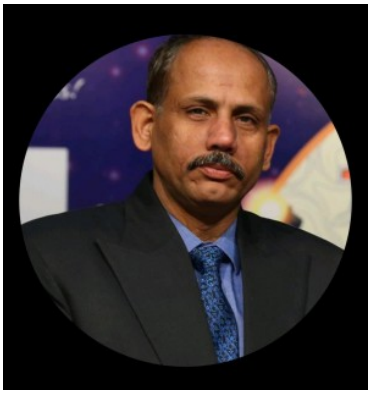
SPEAKERS

Dr. IMTIAZ BASADE

Senior Vice President – RAD,
Pharma Division at
Natco Pharma Limited

Mr. IMTIYAZ BASADE is Senior Vice-President - Regulatory Affairs at Natco Pharma Limited. He holds M. Pharm. (1989) from University Department of Chemical Technology, Bombay University, Mumbai. He completed his B. Pharm. (1987) from Department of Pharmaceutics, Institute of Technology, Banaras Hindu University, Varanasi. From 1989 to 1997, he was associated with Pfizer, Fulford (India) Limited, Lupin Laboratories Limited in GMP audits and Regulatory Affairs functions. From 1997 to 2007, he was associated with Dr. Reddy's Laboratories Limited, Ranbaxy Laboratories Limited, Wockhardt Limited and Orchid Chemicals and Pharmaceuticals Limited in senior management cadre in Regulatory Affairs functions of both API and Dosage forms. Prior to joining Natco, he worked as Senior Vice President – Regulatory Affairs with Mylan Laboratories Limited from 2007 to 2024. He has an extensive experience in Regulatory Affairs of APIs and Drug products (non-sterile, sterile and fermentation based). He has participated with pharmacopoeial bodies like IP, USP and EDQM for new monograph development.

SPEAKERS



Dr. SANDEEP ARORA

Dean, Pharmaceutical Sciences, Amity University, Mohali

Dr. Sandeep Arora is a highly accomplished academician and pharmaceutical scientist with over 27 years of professional experience, currently serving as the Professor and Dean of the Faculty of Pharmaceutical Sciences at Amity University, Punjab. With a robust background that bridges industry and academia, he has held significant leadership roles, including his tenure as Director and Dean at Chitkara University and executive positions at major firms like Glaxo India Ltd. and Nicholas Piramal India Ltd. His expertise spans strategic management, quality assurance, and regulatory consultancy, where he advises on cGMP, FDA, TGA, and EMEA guidelines for IND and NDA filings. An active researcher, Dr. Arora has dedicated over 12 years to the isolation and evaluation of antiinflammatory natural products, resulting in a prolific portfolio of 130 publications, 22 patents, 4 trademarks, and the authorship of influential books such as Pharmaceuticals: Issues for Industrial Management and Metastatic Diseases: Novel Approaches. Beyond his university role, he serves as the Managing Director of ARROWSANDS GROUP and holds advisory positions with Natural Solutions, Amulya Herbs, and Pharexcel Consulting. His international standing is further cemented by his role as an auditor for AQA, New Zealand, and his editorial contributions to prestigious journals like the International Journal of Inflammation.

SPEAKERS

Dr. MD. IMTAIYAZ HASSAN

Professor & Director
DDU Kaushal
Kendra (DDUKK)
Jamia Millia Islamia

Dr. Md. Imtaiyaz Hassan, Ph.D., FRSB, FRSC is a Professor at the Centre for Interdisciplinary Research in Basic Sciences and Director, DDU Kaushal Kendra, Jamia Millia Islamia, New Delhi. An accomplished structural and computational biologist, his research focuses on structure-based drug design, cancer therapeutics, and neurodegenerative diseases. He has published 600+ research articles with over 21,000 citations, holds an H-index of 71, and has led 22+ nationally funded research projects. A Fellow of the Royal Society of Chemistry and the Royal Society of Biology (UK), Dr. Hassan is also recognized among the top 2% of scientists worldwide for his outstanding contributions to biomedical research.

SPEAKERS

Dr. RAJEEV KHARAB
Professor, Pharmaceutical Chemistry, AIP, Amity University, Uttar Pradesh

Dr. Rajeev Kharab is a Professor of Pharmaceutical Chemistry at the Amity Institute of Pharmacy, Sector-125, Noida. He holds an M. Pharmacy (Pharmaceutical Chemistry) and Ph.D., with over 19 years of teaching and research experience. His research focuses on the design and synthesis of heterocyclic compounds for antimicrobial activity, with strong interests in drug design, structure–activity relationship studies, natural product chemistry, and advanced spectroscopic techniques. Dr. Kharab has published 40 research papers and is a member of the Association of Pharmaceutical Teachers of India. He has received several accolades, including a SERB-ITS international travel grant for presenting research in Germany and Best Poster Presentation and Research Excellence Awards at national conferences, recognizing his significant contributions to pharmaceutical education and research.

SPEAKERS

Mr. VIPUL KUMAR GUPTA

Vice President and Head of
Corporate Affairs and Policy,
Cipla

Mr. Vipul Kumar Gupta is a seasoned corporate affairs and regulatory leader with over 15 years of experience in India's pharmaceutical sector, currently serving as Vice President & Head Corporate Affairs and Policy at Cipla. He leads corporate affairs, policy advocacy, and regulatory strategy, driving engagement with key government ministries and regulatory authorities. Previously, he served as Head Regulatory Affairs at Takeda and Roche Products (India) Pvt. Ltd., where he oversaw regulatory approvals, compliance strategy, and stakeholder management across diverse therapeutic portfolios. He has also held leadership positions as Director Corporate Affairs at Cipla and General Manager at Cadila Pharmaceuticals Limited, playing a pivotal role in policy advocacy and representing industry perspectives before bodies such as MoHFW, CDSCO, NPPA, DBT, and FSSAI. Mr. Gupta possesses extensive expertise in regulatory filings and approvals, including INDs, NDAs, BLAs, biosimilars, biologics, medical devices, OTC products, and clinical trial applications, and has represented organizations in high-level regulatory forums such as SEC, NDAC, MDAC, and EC meetings. He began his career with technical and regulatory roles at Ranbaxy and Baxter India, building a strong scientific and compliance foundation. Known for his strategic insight, strong government relations, and ability to navigate complex regulatory landscapes, he brings a unique blend of scientific knowledge, regulatory depth, and policy leadership to the pharmaceutical industry.

SPEAKERS

Dr. SHITALKUMAR ZAMBAD (M. PHARM, PHD)

Founder Thincr Technologies India Pvt Ltd, Cofounder and CSO at Virtual Sense Global Technologies Pvt Ltd

Dr. Shitalkumar Zambad (M. Pharm, PhD) CSO, Pharma Innovator, and Drug Development Leader, is a distinguished scientist, academician, and entrepreneur known for his leadership in drug discovery, pioneering contributions to 3D-printing in pharmaceuticals, and the development of cutting-edge non-invasive medical technology. Current Focus: Non-Invasive Metabolic Tracking Dr. Zambad serves as a Co-founder and Chief Scientific Officer (CSO), spearheading the development of advanced health diagnostics at Virtual Sense Global Technologies Pvt Ltd.

Pioneering Contribution: He is a key figure in the development of a breath biomarker-based noninvasive wearable and handheld metabolic tracker.

Scientific Validation: The research underpinning this technology has been presented at prestigious international conferences, including the American Diabetes Association (ADA) 2025 and the European Respiratory Society (ERS) 2025. Pioneering 3D Printing of Pharmaceuticals in India As the Founder Director of Thincr Technologies India Private Limited, Dr. Zambad has been consistently working in the field of 3D-printed pharmaceuticals since 2016, establishing the company as an early leader in the domain in India.

Custom Hardware & Materials: His work involves developing proprietary 3D-printers and drug-loaded filaments for multiple active pharmaceutical ingredients, including telmisartan, dextromethorphan, ibuprofen, amlodipine, clarithromycin, azithromycin, and risperidone. 3D-

Pronted Formulation Development: He has demonstrated capabilities for complex formulations, such as: 3D-Printes Oral Films (including development of a research-scale 3D-printer for oral films supplied to Abbott Healthcare India). Double-Layered Oral Films (drug printing as a second matrix layer on a conventional film). Compartmentalized and Multi-layered Tablets - Azitromycin and Omeprazole, Clarithromycin and Omeprazole.

Notable Innovation: During the pandemic, his team developed 3D-printed masks coated with anti-viral agents (virucides). Industrial Drug Discovery & Development Career Dr. Zambad's entrepreneurial and academic work is built upon a strong foundation of industrial experience, notably his major pharmaceutical development career with Torrent Pharmaceuticals Pvt Ltd.

Leadership Role: He served as a leader in drug discovery, eventually heading the Pharmacology department when he left the organization.

Project Scope: He led several drug discovery projects that spanned the entire early development cycle, from the target validation stage up to the successful completion of the Phase 2 clinical development stage.

Therapeutic Areas: His expertise covers critical therapeutic domains, including Cardio-Metabolic disorders, Inflammatory Bowel Disease (IBD), and Chronic Obstructive Pulmonary Disease (COPD).

Key Achievement: One of the molecules he led, TRC150094, successfully completed its Phase 2 clinical trial when he transitioned from the organization to the entrepreneurial journey.

SPEAKERS

Mr. MANISH GAUR

Country Sales Lead – India, Structural Heart Therapy, Cardiovascular Division, Medtronic

Mr. Manish Gaur is IIFT (IB) alumnus and has 16+ years of rich experience in specialized devices segment in the medical industry. He is currently working as Country Sales Lead – India for Structural Heart Therapy of Medtronic in Cardio-Vascular Segment. Before taking up his current role, he was heading Asia pacific-Latin America expansion of Wrig Nanosystems and has also worked with Abbott/Eli Lilly in previous assignments. He has worked on the expansion of products in new geographies and has been dealing with supply chain issues of Import/Export.

SPEAKERS

Dr. SATISH SARDANA

Director, Amity Institute of Pharmacy, Amity University, Gurgaon

With a distinguished career spanning forty-four years in teaching, research and administration in the Pharmaceutical Sciences, Dr. Satish Sardana brings forth a wealth of expertise characterized by effective leadership and a successful academic journey. He holds a Master's and PhD degree in Pharmaceutical Sciences. Currently he is serving as the Director at the Amity Institute of Pharmacy in Amity University Haryana, Gurugram. Dr. Sardana has demonstrated his commitment to advancing discourse and development in the field through the organization of various Seminars and Conferences. Beyond institutional roles, he actively engages as a Speaker,Chairperson, and Resource Person. He is a member of various academic bodies in different universities. His contributions have earned recognition with various awards.His scholarly endeavors include authoring five books, Ten patents, publishing around 100 articles in National and International Journals. Furthermore, Dr. Sardana has successfully mentored several Ph.D. and M. Pharm scholars. His current research interests are Herbal Drug Technology, Phytomedicine and Drug Delivery Systems. He is the life member of various professional organizations like APTI,

IPGA, IPA, IHPA, SPER and Society of Pharmacognosy. He is also actively engaged with accreditation processes like IQAC, NIRF, NBA, NAAC etc

SPEAKERS

Dr. TARUN VIRMANI

Professor & Principal of Pharmacy
Amity University, Greater Noida

Dr. Tarun Virmani is a distinguished professor and academic leader in pharmaceutical sciences at Amity University Greater Noida, Uttar Pradesh, India. He serves as Professor & Principal of Pharmacy at the Amity Institute of Pharmacy (AIP) where he has been teaching and mentoring students for nearly two decades. He holds advanced academic qualifications including M.Pharm and Ph.D. with specialization in pharmaceutics and controlled drug delivery systems. His teaching and research focus on pharmaceutics, physical pharmaceutics, biopharmaceutics, product development, nanotechnology, and controlled drug release – areas critical to modern pharmaceutical education and industry applications. Over his career, Dr. Virmani has authored around 80 published works in research journals and has actively participated in national and international academic forums. He is also professionally affiliated as a Life Time Member with the Association of Pharmaceutical Teachers in India (APTI)

SPEAKERS

Dr. VINEY LATHER

Medicinal Chemistry, Amity Institute of Pharmacy,
Amity University, Noida
Uttar Pradesh

(Prof). Dr. Viney Lather is a distinguished academician and researcher in the field of Pharmaceutical Sciences, currently associated with the Amity Institute of Pharmacy (AIP), Amity University. With over two decades of experience spanning academia, research, and industry, he has made significant contributions to education and scientific advancement. Academic Qualifications M.Pharm Ph.D. in Pharmaceutical Sciences His strong academic foundation has supported an extensive career dedicated to teaching, mentoring, and innovative research. Professional Experience Professor Lather brings more than 21 years of comprehensive experience in: v Academic teaching and curriculum development v Pharmaceutical research and innovation v Industrial exposure and practical pharmaceutical applications His interdisciplinary expertise bridges theoretical knowledge with practical industry-oriented insights, benefiting both students and research scholars. Research & Publications v 125+ Research Publications: v His research work has been widely published in reputed national and international journals, reflecting his active

engagement in advancing pharmaceutical sciences. v His scholarly contributions highlight his commitment to research excellence and scientific dissemination. Professional Affiliations Professor Lather is actively associated with leading professional bodies, including: v Life Member – APTI (Association of Pharmaceutical Teachers of India) v Life Member – IPGA (Indian Pharmaceutical Graduates' Association). These affiliations demonstrate his dedication to professional development and contribution to the pharmaceutical academic community. (Prof) Dr. Viney Lather continues to play a pivotal role in shaping future pharmacists and researchers through his academic leadership, research mentorship, and commitment to excellence in pharmaceutical sciences

SCHEDULE

Wednesday, 25th February 2026

TIME	PROGRAM
08:00 am - 09:30 am	Registration
08:00 am - 09:30 am	Breakfast
10:00 am - 12:30 pm	**Inauguration Function**
10:30 am- 10:35 am	Lighting of the Lamp with Chanting of Saraswati Vandana
10:35 am - 10:40 am	Welcome address by the Convener Dr. Havagiray R. Chitme, Deputy Director, AIP, AUUP, Noida
10:40 am - 10:50 am	Address by Chairperson PTTDICBR: Prof. (Dr.) B.C. Das, Dean – Health & Allied Sciences, AUUP, Noida, India
10:50 am - 11:00 am	Introduction to the Conference by Organizing Secretary: Dr. Navneet Sharma, Organizing Secretary, PTTDICBR
11:00 am – 11:10 am	Address by Co-Chairperson: Prof (Dr.) Chanderdeep Tandon,Pro-Vice-Chancellor, Co-Patron, Dean, Faculty of Biosciences & Biotechnology, AUUP, India
11:10 am - 11:20 am	Address by Chief Advisor: Dr. AK Singh, Senior Vice President Amity Foundation for Science, Technology & Innovation Alliances (AFSTIA)
11:20 am - 11:30 am	Address by Chief Advisor: Dr. W. Selvamurthy, President AFSTIA, AUUP, India
11:30 am - 11:40 am	Address by Co-Patron: Prof. (Dr.) Balvinder Shukla, Hon'ble Vice Chancellor, AUUP, Noida, India
11:40 am - 11:50 am	Address by Guest of Honour- Prof. Vaidya Rabi Narayan Acharya, Director General, Central Council for Research in Ayurvedic Sciences, New Delhi
11:50 am - 12:05 pm	Address by Chief Guest- Dr. Jitendra Kumar, Managing Director, BIRAC
12:05 pm – 12:25 pm	Words of wisdom and way forward by Dr. Ashok Chauhan, Hon'ble Founder President Amity Education dignitary
12:25 pm - 12:30 pm	Vote of Thanks by Dr. Tanveer Naved, Deputy Dean, Health & Allied Science, AUUP, Noida

Wednesday, 25th February 2026

Keynote Session	
12:30 pm – 01:00 pm	Keynote Address by Guest of Honour- Dr. Azadar Khan, Senior Vice President, Sun Pharma
01:00 pm - 02:00 pm	Lunch Break

Scientific Session - I

02:00 pm – 05:00 pm	Traditional Scientific Knowledge and Phytopharmaceuticals		
	Speakers	**Session Chairs**	**Oral /Poster Presentation & Evaluation**
02:00pm – 02:30pm	Dr. Rajesh Arora Scientist G, DIPAS, DRDO, Delhi	**Dr. Anil Sharma**, Vice President Ayouthveda, AIMIL Pharmaceuticals Delhi **Prof. (Dr.) Mallika Pathak,** Department of Chemistry Miranda House, University of Delhi **Prof. (Dr.) Harsha Kharkwal** FRSC, Director, Amity Institute of Phytochemistry & Phytomedicine Amity University, Uttar Pradesh	**Track 1: Traditional Scientific Knowledge & Phytoharmaceuticals** **Evaluators:** 1.Dr. Neelam Assistant Professor, Department of Phytochemistry, Sri Venkateswara College, DU, Delhi 2.Dr. Preeti Singh Assistant Professor, School of Pharmacy, Sharda University, Greater Noida. **Coordinator:** Dr. Anjali Bhat Scientific officer, Amity University, Noida
02:30 pm – 03:00 pm	Dr. Galib Associate Professor, Department of Rasashastra & Bhaishajya, Kalpana, All India Institute of Ayurveda		
03:00pm – 03:30 pm	Dr. Sujata Mohanty Professor, Stem Cell Facility(DBT-Centre of Excellence for Stem Cell Research), AIIMS, New Delhi		

02:00 pm – 05:00 pm	Traditional Scientific Knowledge and Phytopharmaceuticals	
	Speakers	**Oral /Poster Presentation & Evaluation**
03:30pm – 04:00 pm	Dr Nitin Sharma Professor, Head of Department (Pharmaceutics), Amity Institute of Pharmacy, Amity University	**Track 2: Stem Cells and System Biology** **Evaluators:** 1. Arun Kumar Assistant Professor, Department of Biotechnology, Central University of Himachal Pradesh 2.Shahzad Ahmad Assistant Professor, Department of Stem Cells & Medical Elementology, Jamia Hamdard **Coordinator:** Prof. (Dr.) Rupesh Gautam, (Pharmacology) AIP, Amity University, Noida, Uttar Pradesh **Track 3: Drug Discovery and Biologicals** **Evaluators:** 1.Prof. (Dr.) Rahul Kaushik College of Health Sciences and Research 2.Dr Syed Salman Ali Associate Professor, Lloyd Institute of Management and Technology 3.Dr Reeta Chaudhary Assistant Professor, Department of Medicinal Chemistry, Shivaji College, University of Delhi **Coordinator:** Dr. Rimpy Pahwa Assistant Professor (Industrial Pharmacy) AIP, Amity University, Noida, Uttar Pradesh
04:00pm – 05:00 pm	Tea & Snacks	

Thursday, 26th February 2026

Scientific Session - II

Stem Cells, Tissue Engineering and Pharmacology

10:00 am – 12:00 pm	Speakers	Session Chairs	Oral /Poster Presentation & Evaluation
10:00 am – 10:25 am	Dr. Hemant Gautam Chief Scientist & Professor, Institute of Genomics and Integrative Biology Academy of Scientific and Innovative Research, Delhi University, Delhi.	**Dr. Mohd Urooj**, Research Officer (Pharmacology), National Research Institute of Unani Medicine for Skin Disorders, Hyderabad, CCRUM, Ministry of Ayush **Prof. (Dr.) Pallavi Agarwal** Professor, Amity Institute of Molecular Medicine & Stem Cell Research Amity University, Uttar Pradesh	**Track 4: Phytopharmaceuticals & Regulatory Compliance & Practice** **Evaluators** 1.Dr. Veerender Sharma Research Officer (Chemistry), Central Council for Research in Unani Medicine (CCRUM), New Delhi - 110058 2.Dr. Shubham Yadav Specialist (Analytical Chemistry) & Head- Chemical Safety Group (CSG) **Coordinator**: Dr Saurabh Verma Assistant Professor-I (Pharmaceutics) AIP, Amity University, Noida Uttar Pradesh
10:25 am – 10:50 am	Dr Chandrashekhara S H Professor , Radiodiagnosis IRCH, AIIMS Delhi		
10:50 am – 11:15 am	Dr. Yogesh Verma Scientist F, Division of Clinical Research and Stem Cell Engineering, INMAS, DRDO, Delhi.		
11:15 am – 11:40 am	Dr. Siddharth Pandey Vice President, Datt Mediproducts Pvt. Ltd.		
11:40 am – 12:00 pm	Dr. Subhajit Ghosh, PhD. Scientist, Department of Brain Tumor Immunology, German Cancer Research Centre (DFKZ), Max Planck Institute, Heidelberg, Germany.		

Scientific Session - III

	Drug Discovery, Formulations, and Regulatory Compliance-I		
	Speakers	**Session Chairs**	**Oral /Poster Presentation & Evaluation**
12:00 pm – 12:30 pm	Dr Rajender Singh President- Global Regulatory Affairs Mankind Pharma Pvt Ltd.	**Prof. (Dr.) Sandeep Arora** Dean, Pharmaceutical Sciences, Amity University, Mohali **Dr. Md. Imtaiyaz, FRSC** Professor & Director DDU Kaushal Kendra (DDUKK) Jamia Millia Islamia **Prof. (Dr.) Rajeev Kharab** Pharmaceutical Chemistry, AIP, Amity University, Noida Uttar Pradesh	**Track 5: Emergency Healthcare and Combat Casualty Management** **Evaluators** 1.Dr. Nikita Sindhu MDS (Endodontists), PG Resident, Faculty of Dental Sciences, SGT University, Gurugram 2.Dr. Anoushka Khanna Senior Scientist, Indian Institute of Technology, Delhi **Coordinator**: Dr. Prakash Haloi, Assistant Professor (Pharmacology), AIP, Amity University, Noida Uttar Pradesh
12:30 pm – 01:00 pm	Mr. Imtiyaz Basade, Senior Vice President – RAD, Pharma Division at Natco Pharma Limited		
01:00pm– 02:00 pm	Lunch Break		

Scientific Session - IV		
02:00 pm – 03:00 pm	**Drug Discovery, Formulations, and Regulatory Compliance -II**	
	Speakers	**Session Chairs**
02:00pm – 02:30pm	Mr. Vipul K. Gupta, Vice President and Head of Corporate Affairs and Policy, Cipla	**Prof. (Dr) Satish Sardana** Director, Amity Institute of Pharmacy, Amity University, Gurgaon **Prof. (Dr) Tarun Virmani,** Professor & Principal of Pharmacy, Amity University, Greater Noida **Prof. (Dr.) Viney Lather,** Medicinal Chemistry, Amity Institute of Pharmacy, Amity University, Noida Uttar Pradesh
02:30 pm – 03:00 pm	Dr. Nidhi Sandal, Deputy Director, INMAS, DRDO, Delhi Dr Shitalkumar Zambad, Founder Thincr Technologies India Pvt Ltd, Cofounder and CSO at Virtual Sense Global Technologies Pvt Ltd	
03:00pm – 03:30 pm	Mr. Manish Gaur Country Sales Lead – India, Structural Heart Therapy, Cardiovascular Division, Medtronic	

03:30 pm - 5:30 pm	**Valedictory Session**
03:30 pm - 03:35 pm	Welcome Address by Dr. Havagiray R. Chitme, Deputy Director, AIP, AUUP, Noida
03:35 pm - 03:40 pm	Address by Chairperson PTTDICBR: Prof. (Dr.) B.C. Das, Dean – Health & Allied Sciences, AUUP, Noida, India
03:40 pm - 03:45 pm	Conference Report by Dr. Navneet Sharma
03:45 pm - 03:50 pm	Address by Dr. W. Selvamurthy, President ASTIF, AUUP, India
03:50 pm – 03:55 pm	Address by Prof. (Dr.) Balvinder Shukla, Hon'ble Vice Chancellor, AUUP, Noida, India
03:55 pm - 04:05 pm	Address by Chief Guest- Dr Vivekanand Kalaiselvan, Secretary-cum-scientific Director, Indian Pharnmacopoeia Commission
04:05 pm – 04:15 pm	Address by Guest of Honour-Dr. (Prof.) Man Mohan Mehndiratta, Principal-Director, Department of Neurology, BLK - Max Super Speciality Hospital
04:15 pm - 04:20 pm	Feedback from Participants
04:20 pm – 04:30 pm	Distribution Of Certificates
04:30 pm - 04:40 pm	Blessing by Hon'ble Founder President, Dr. Ashok K Chauhan, Amity University (Subject to Confirmation)
04:40 pm – 04:50 pm	Felicitation of Special Guests
04:50 pm - 05:00 pm	Vote of Thanks by Dr. Viney Lather, Professor, Medicinal Chemistry, Amity University, Noida
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Track I:
Traditional Scientific Knowledge and Ancient Wisdom

Antiallergic activity of *skimmia anquetilia* on ovalbumin induced allergic rhinitis, dermatitis, paw oedema and mast cell degranulation

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Abstract
This study was conducted to explore the potential antiallergic effects of Skimmia anquetilia (SA), focusing on its essential oil and hydroalcoholic extract using established experimental animal models. The primary objective was to assess whether this plant could offer protective benefits against common allergic conditions, particularly those resembling asthma, allergic rhinitis, and atopic dermatitis. To simulate allergic responses, mice were sensitized With ovalbumin (OA), a widely used allergen known to trigger reactions similar to human allergies. OA exposure resulted in characteristic symptoms, including skin inflammation, paw edema, mast cell degranulation, and nasal irritation, thereby providing a suitable platform to evaluate treatment effects. Different doses (100, 200, and 400 mg/kg/day) were administered to observe any dose-deper 'ant responses. In addition to the pharmacological evaluation, the essential oil was analyzed through GC-MS to determine its chemical composition. The analysis identified several prominent constituents, such as a-pinene, a-phellandrene, geijerene, 3-carene, and ß-ocimene, which are compounds often associated with biological activity. Following treatment, noticeable improvements were observed in the animals' overall condition. A reduction in nasal allergy-like symptoms, including sneezing, rubbing, and redness, was particularly evident. The essential oil also demonstrated an ability to lower eosinophil counts in bronchoalveolar fluid, suggesting a possible anti-inflammatory effect. Histological examinations further supported these findings, as both the essential oil and the extract appeared to mitigate OA-induced tissue alterations in the skin, s, and spleen. Treatment was also associated with reduced spleen enlargement and stabilization of platelet-related parameters. Comparatively, the essential oil produced more pronounced effects, especially in models representing atopic dermatitis and allergic rhinitis. Overall, the findings indicate that Skimmia anquetilia essential oil may possess promising antiallergic properties. However, further detailed investigations are necessary to clarify the specific active constituents and the mechanisms underlying these effects

Keywords: Skimmia *anquetilia*, Antiallergic activity, GC-MS (Gas chromatography-mass spectrometry)

Combating hepatic oxidative stress: therapeutic potential of pomegranate bioactives

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Abstract

Liver diseases account for more than two million deaths annually worldwide, with cirrhosis, viral hepatitis, and hepatocellular carcinoma ranking among the leading causes of global mortality and disability-adjusted life years. The progression of hepatic disorders is strongly driven by persistent oxidative stress, chronic inflammation, mitochondrial dysfunction, and dysregulated redox signaling. These interconnected mechanisms amplify hepatocellular injury, fibrosis, and tumorigenesis, emphasizing the urgent need for safe and effective therapeutic strategies targeting oxidative and inflammatory pathways. Pomegranate (Punica granatum), one of the earliest cultivated fruits dating back to 3000 BC, possesses remarkably high antioxidant capacity compared to other functional foods such as green tea and red wine. Its rich composition of bioactive polyphenols—including ellagitannins, punicalagin, anthocyanins, and flavonoids—confers potent free radical scavenging, anti-inflammatory, and cytoprotective properties. Despite its long-standing traditional use in managing various pathological conditions, including cardiovascular, metabolic, neurological, and hepatic disorders, the precise molecular mechanisms underlying its hepatoprotective effects require further elucidation.

In the present study, we systematically evaluated the hepatoprotective efficacy of pomegranate polyphenols in multiple murine models of liver injury, including methotrexate-induced hepatotoxicity, arsenic exposure, and tumor-associated hepatic stress. Pomegranate supplementation significantly reduced serum biomarkers of liver injury (ALT, AST, ALP), attenuated lipid peroxidation, suppressed pro-inflammatory cytokines, and restored endogenous antioxidant defenses such as glutathione levels and antioxidant enzyme activity. Histopathological analyses further demonstrated substantial recovery of hepatic architecture, reduced necrosis, and decreased inflammatory infiltration. Mechanistically, pomegranate polyphenols exerted differential modulation of critical redox-sensitive transcription factors. Suppression of NF-κB–mediated inflammatory signaling and activation of Nrf2-driven antioxidant responses were central to the observed protective effects. Furthermore, regulation of the ROS–Nrf2/GSH axis and the ROS–Nrf2–p53–miR-34a signaling cascade played pivotal roles in mitigating oxidative damage and apoptosis. Collectively, these findings provide comprehensive mechanistic insight into the redox-modulatory and anti-inflammatory actions of pomegranate polyphenols and support their potential translational application as adjunct therapeutic agents in the prevention and management of liver diseases.

Keywords: Oxidative stress; inflammation; pomegranate; Nrf2; NF-κB, Signaling, Redox

Development & evaluation of curcumin-thymoquinone loaded nlcs gel for enhanced dermal delivery in psoriasis

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Abstract
Chronic inflammatory skin disorders such as psoriasis present significant therapeutic challenges due to their complex immunopathology, dysregulated keratinocyte proliferation, impaired epidermal barrier function, and limited drug penetration across the stratum corneum. Although topical therapy remains the preferred and most patient-compliant treatment approach, conventional formulations often fail to provide adequate drug localization, physicochemical stability, controlled release, and sustained therapeutic response. These limitations frequently result in reduced efficacy and the need for repeated applications, which may compromise patient adherence. Recent advances in lipid-based nanocarriers offer promising strategies to enhance dermal drug delivery by improving solubility, enhancing skin retention, protecting labile bioactives, and enabling controlled release at the target site. The present study focuses on the development and optimization of a multifunctional nanostructured lipid carrier (NLC) system incorporated into a semisolid dermal formulation for improved cutaneous delivery. The formulation strategy employs synergistic phytoconstituents, curcumin and thymoquinone, recognized for their potent anti-inflammatory, antioxidant, and immunomodulatory activities, to facilitate modulation of inflammatory signaling pathways and restoration of skin homeostasis. Optimization of the carrier system was performed based on critical quality attributes including particle size distribution, zeta potential, entrapment efficiency, and rheological characteristics of the final preparation. Comprehensive in vitro and ex vivo evaluations were conducted to assess release kinetics, permeation behavior, and skin retention potential. Stability, spreadability, and dermal compatibility studies further confirmed suitability for topical application. Overall, the developed nanostructured lipid system demonstrated enhanced delivery performance, prolonged local residence time, and potential to improve therapeutic outcomes in psoriasis management.

Keywords: Psoriasis; Nanostructured lipid carriers; Curcumin; Thymoquinone; Skin permeation enhancement; Topical nanocarrier therapy

Development of mucoadhesive sustained release tablet of curcumin for gastric wound healing management

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Abstract

Different formulation of mucoadhesive gastroretentive tablets were prepared using varying amount of HPMC K15M, HPC, Carbopol 974, Eudragit RL-100, Carbopol 974, CMC, chitosan and Gum Karaya. The formulated tablets were subjected for post- compression evaluation such as friability, hardness, weight variation, thickness, uniformity of drug content, *In vitro* swelling study, *In vitro* mucoadhesive strength and In vitro dissolution study. The findings revealed that, in both models, curcumin greatly inhibited ulcer index and percent inhibition. In the pyloric ligation model the curcumin reduced to a small degree gastric length, pH, overall acidity and free acidity. The 10 mg/kg curcumin showed a more important antiulcer effect ($p<0.001$) followed by 5 mg/kg curcumin. The fractional antiulcer function was almost equal to that of normal reference ranitidine (50mg/kg b.w. p.o.). In both models control groups showed increased index of ulcer and reduced inhibition of percentage. Additional evidence for the antiulcer efficacy of curcumin 10 mg / kg was provided by histopathological analysis of the parts taken from both pyloric ligation model and ethanol mediated ulcer models. The pathomorphological differences observed in the control group were epithelial degeneration, hemorrhage, edematous tissue presentation with inflammatory exudates, whereas the groups treated with regular medication ranitidine and fractions displayed substantial epithelial recovery, hemorrhage avoidance, and edema with usual glandular tissue architecture. Curcumin gastroretentive tablets effect on experimentally induced ulcer has been studied in rats. The Curcumin tablets (5 and 10mg/kg) blocked models of ulcer caused by pylorus and ethanol in a dose-dependent manner. The various degrees of inhibitions ($p<0.01$) is statistically important. The curcumin effect was comparable with that of the normal medications used. Thus, prepared Curcumin tablets demonstrated a good antiulcer activity which supports the antiulcer effect.

Key words: Mucoadhesive, Gastroretentive tablets, Curcumin, Gastric ulcer, Antiulcer effect

Eco-engineered nanofibrous wound dressings from water hyacinth waste

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Abstract

Current synthetic wound dressings dominate 75.4% of the market but face growing competition from natural alternatives due to sustainability concerns and high manufacturing costs that limit accessibility in low-income regions. The conversion of invasive aquatic biomass into high-value biomaterials offers a sustainable strategy for biomedical applications. In the present study,

cellulose extracted from water hyacinth *(Eichhornia crassipes)* was chemically modified into carboxymethyl cellulose (CMC) and subsequently processed into nanofibrous wound dressings by electrospinning. UV-vis analysis to quantify acid-soluble lignin content post-extraction. Due to the inherent electrospinning challenges posed by pure CMC, a systematic optimization of CMC/PVA/PCL blends was undertaken, resulting in uniform nanofibrous mats with high porosity and mechanical flexibility. Morphological features were examined by field emission scanning electron microscopy (FESEM), and tensile properties were assessed using universal testing machines (UTM). The scaffolds were characterized through Fourier-transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD) to elucidate intermolecular interactions. Drug release kinetics from the nanofibers were analyzed employing various mathematical models to elucidate the release mechanisms. Further, the anti-microbial and cytocompatibility were analyzed with well diffusion methods, MTT assay, and hemolysis tests. These integrated assessments provided a comprehensive understanding of the developed nanofibrous mat's structural, mechanical, biological, and environmental performance, positioning them as promising, eco-friendly alternatives to synthetic wound dressings derived from sustainable biomass resources.

Keywords: Tensile, Nanofibres, Porosity, Biomedical, Biomass

Exploring The Integration Of Atharva Veda Principles In Modern Psychotherapy Practices

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Abstract
Our paper explores ancient Indian knowledge that is similar to and can be integrated into modern psychotherapy practices. We use the Atharva Veda as our primary reference due to its focus on the mind (manas) and its immense focus on abnormal behavior. Unlike texts that emphasize ritual or philosophy alone, the Atharva Veda brings attention to the inner world of the individual, offering tools for restoring balance and wholeness. We used methods like literature review and case study to explore the current applicability of this knowledge into modern psychological practices. We found that ancient knowledge like Agni-hotra (fire offerings), Soma libations, Apamrityu and ancient herbal practices like calming herbs such as lavender and basil, cleansing herbs such as sage and tulsi and restorative herbs like ashwagandha and ginseng can be applied to modern psychological and clinical practices in the form of mindfulness-based stress reduction (MBSR), mindfulness and meditative therapy and biofeedback or behavioral conditioning. Our implementation of ancient Indian practices into the modernized clinical setup has been substantiated with a clinical case study showcasing the usefulness of this ancient knowledge in

treating psychological problems like generalized anxiety disorder, sleep issues and panic attacks. By restoring symbolic structure and cultural familiarity to the healing process, the intervention achieved what conventional therapy alone could not, which is emotional integration and psychological resonance. We also realized that there will be certain challenges in attempting to implement this knowledge in clinical setups because of scepticism from clinicians unfamiliar with Vedic approaches or hesitant to incorporate spiritual content into their practice, the need to make sure it is non-religious in nature to maintain neutrality in the clinical setup and the lack of empirical support and clinical trials to standardize these practices and make them a part of psychotherapeutic interventions. In conclusion, we remain hopeful that more research is conducted on these methods to validate their utility and allow them to be studied and applied into medical and clinical organizations to have better patient outcomes in terms of mental as well as physical health.

Keywords: Psychotherapy, Atharva Veda, mental well-being, emotional regulation, Vedic approaches, ancient wisdom

Flaxseed mucilage hydrogels for controlled *calendula officinalis* release: *in vitro and in vivo study*

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Abstract
Mucilage, a type of biopolymer, exists in all parts of plants and can be intracellular or extracellular. These colourless and odourless secretions possess emerging commercial applications in the fields of biomaterials, agriculture, cosmetics, and pharmaceuticals due to their inherent properties of being non-toxic and biodegradable. In order to exploit their potential, the mucilage can be further modified with synthetic polymers for various other applications, one of which is drug delivery. This paper presents a study on the modification of flax seed mucilage with acrylic acid (*FLX: AA*) and a cross-linker, ethylene glycol dimethacrylate, by free radical polymerization. The semi-synthetic hydrogels thus synthesized were characterized for their stimuli-responsive properties in water, saline solution, and glucose solution and in solutions of varying pH of 2, 4, 7, and 8. In addition to this, protein absorption and blood compatibility tests were used to evaluate the polymer's biocompatibility. FTIR, SEM, XRD, and TGA tools were employed to characterize the synthesized hydrogels. The hydrogels showing the best swelling were selected for both *in vitro* and *in vivo* studies. The encapsulation efficiency was found to be 61.65% after 24 hours of exposure to the flower extract of Calendula officinalis for carrying out an in vitro study. An *in vivo* study on animals was performed by following

the excision model. The continuous monitoring of the wound has shown significant improvement in wound contraction, epithelization time, and wound index. In this model, antioxidant activity, total protein, and hydroxyproline levels in the healing tissue samples were higher than in the control samples. The results supported that calendula extract (CE) encapsulated hydrogels (CE^{+}FLX: AA) promoted faster healing than without encapsulation (CE^{-}FLX: AA) hydrogels and then that of the control sample.

Keywords: Biopolymer, flaxseed, *Calendula officinalis, in vitro, in vivo*

Formulation And Evaluation Of Neem And Tea Tree Oil-Based Herbal Antimicrobial Suppositories

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Abstract

The increasing concern over antibiotic resistance and adverse effects of synthetic agents has encouraged the development of herbal-based alternatives. This study focuses on the formulation and evaluation of herbal antimicrobial suppositories using Neem (*Azadirachta indica*) oil and Tea Tree (*Melaleuca alternifolia*) oil, prepared individually and in combination. Both oils possess strong antibacterial, antifungal, and anti-inflammatory properties, making them suitable for local antimicrobial therapy.

Formulations were developed based on methods reported in previous research on herbal suppositories. Three types of suppositories were prepared using a suitable fatty base to ensure uniformity, stability, and acceptable melting behaviour. The prepared formulations were evaluated for appearance, weight variation, melting point, hardness, disintegration time, and content uniformity as per standard pharmacopeial guidelines.

In vitro antimicrobial activity was assessed against Staphylococcus aureus, Escherichia coli, and Candida albicans. All formulations exhibited noticeable antimicrobial activity, with the combination of neem and tea tree oil showing the most significant inhibitory effect, suggesting a synergistic action of the two oils. Stability studies indicated no significant change in physical characteristics or oil content during the test period.

The study concludes that neem and tea tree oil-based suppositories represent a promising natural approach for treating localised infections. The combined formulation demonstrated superior efficacy, supporting its potential for further *in vivo* and clinical evaluation.

Keywords: Neem oil, Tea tree oil, Herbal suppository, Antimicrobial activity, Synergistic effect, Natural formulation

Herbal oral care for plaque-induced gingivitis management: a review of mechanisms, clinical efficacy, and global regulatory frameworks

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Abstract
Background This review aims to evaluate the mechanisms, clinical efficacy, and regulatory frameworks of herbal oral care products in managing plaque-induced gingivitis, highlighting their therapeutic potential and market challenges across key global regions. *Methods* Employing a narrative synthesis approach, we comprehensively reviewed literature from PubMed, Scopus, and Google Scholar (January 2019-November 2025), supplemented by regulatory documents from the United States, European Union, India, and United Kingdom. Thematic analysis focused on three interconnected domains: mechanistic pathways, clinical outcomes, and regulatory classifications. *Results and Discussion* The review synthesized evidence from randomized controlled trials, systematic reviews and regulatory guidelines, encompassing herbal compounds such as green tea catechins, pomegranate flavonoids, turmeric curcumin, neem alkaloids, and polyherbal formulations like triphala. Clinical data indicate these botanicals exhibit antimicrobial, anti-inflammatory, antioxidant, and anti-biofilm activities, achieving plaque and gingival index reductions comparable to chlorhexidine with fewer side effects. Regulatory frameworks vary significantly: the US classifies most herbal products as dietary supplements with post-market oversight, whereas the EU and UK utilize traditional herbal registration pathways balancing traditional use with safety requirements. India's AYUSH system integrates classical texts with modern clinical trial mandates. Challenges include compositional variability, inconsistent clinical evidence quality, safety monitoring gaps, and regulatory heterogeneity, which impact product standardization, market access, and equitable oral healthcare delivery. *Conclusion* Herbal oral care products demonstrate promising adjunctive or alternative roles in plaque-induced gingivitis management, supported by multifaceted mechanisms and favorable tolerability. However, advancing their integration into mainstream oral healthcare requires harmonized regulatory approaches, rigorous standardized clinical trials, enhanced quality control, and innovative delivery systems to optimize efficacy, safety, and global accessibility.

Keywords*:* Herbal oral care products, Plaque-induced gingivitis, Regulatory frameworks, Global regulations, AYUSH, Botanical drug regulation.

Hormonal dysregulation and psychiatric disorders: exploring the neuroendocrine mechanisms

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Abstract
Hormones are vital biochemical messengers that regulate organ system activity at the cellular level and preserve physiological homeostasis. Reproductive hormones are crucial for sexual differentiation, menstrual cycle management, ovulation, pregnancy, and lactation in women. Due to feedback between the hypothalamus, pituitary gland, ovary, and other endocrine organs like the placenta and adrenal cortex, the hypothalamic pituitary ovarian (HPO) axis tightly controls these hormonal interactions. One condition that falls under the area of endocrine metabolic disorders is polycystic ovarian syndrome (PCOS). Hyperandrogenism, which is linked to insulin resistance, inflammation, and ovarian dysfunction, is the disorder's defining feature. The pathophysiology of PCOS is significantly influenced by a number of important inflammatory mediators and molecular biomarkers, including vascular endothelial growth factor (VEGF), interleukin-8 (IL 8), interleukin-1β (IL-1β), sex hormone-binding globulin (SHBG), leptin, and vascular cell adhesion molecule-1 (VCAM-1). While IL-8 causes inflammation and follicular halt during the development phase, elevated VEGF levels are linked to reproductive dysfunctions. Furthermore, IL-1β links obesity to ovarian dysfunction and impairs oocyte development. Furthermore, low SHBG levels exacerbate hyperandrogenism, whereas leptin raises inflammation and insulin resistance. Additionally, early phases of atherosclerotic alterations are associated with VCAM-1. Patients with PCOS may also experience psychological problems including stress and depression, which are exacerbated by the disorder and hormonal and metabolic dysregulations. A thorough, multidimensional therapeutic approach is needed to manage PCOS, from lifestyle modifications to the start of pharmaceutical interventions like metformin and combined oral contraceptives, as well as herbal medications and their current state of research. These days, herbal medications are frequently used to treat PCOS since they are more effective and less hazardous.

Keywords: PCOS, interleukin-8, Hyperandrogenism, VCAM-1, Depression, Insulin resistance

Pre-extraction drying modality interaction on chemical integrity and potential of plant-based customer essential oils: translational perspectives.

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Abstract
The growing need in essential oils produced out of medical and fragrant plants has increased the scholarly focus on their phytochemical and pharmaceutical development. A notable chemical diversity of these oils is distinguished by nutrient, volatile monoterpenes and sesquiterpenes, the stability of which and pharmacological properties, finally determining therapeutic potency. Even though drying is an essential part of preparing oil before it can be extracted, this process is often overlooked, though its impact on oil integrity, standardization, and functional applicability is significant. This study fundamentally evaluates the effects of three dissimilar drying regimens, namely, fresh, sun-dried, and shade-dried, on the different chemical makeup and bioactivity of the leaf essential oils. Plant samples will be carefully chosen and exposed to hydrodistillation that is rigorously standardized and afterward, extensive profiling of the products through gas chromatography heavy-weight spectrometry (GCMS) and high-performance thin-layer chromatography (HPTLC). Repetitive chromatographic fingerprinting under different drying conditions will examine the compositional stability of different drying conditions, and temperature, sunlight exposure, and oxidative stress will be expected to influence the qualitative and quantitative distribution of volatile constituents. In particular, beta pinene (2-pinene) or D-limonene will be focused on. Inhibition of volatilization could enhance α pinene retention thus reinforcing its bronchodilator effects, but shade-drying may do a better job in preserving D-limonene, which is known to have antimicrobial effects via membrane destabilization. Functional activities of antioxidants and antibacterials will be measured on routine in in vitro environment in order to instill correlations amid chemical composition and biological efficiency.
In the end, this study attempts to optimize the drying processes in an attempt to increase the quality and therapeutic efficacy of the essential oils and consequently the wider goal of optimizing natural product based therapeutics.

Keywords: Essential Oils, Drying Modalities, GC-MS, HPTLC, -Pinene, D-Limonene, Antioxidant Capacity, Antibacterial Capacity.

Network Pharmacology Based Study Of *Cissus Quadrangularis* For Osteoarthritis

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Abstract
Introduction: Osteoarthritis (OA) is a chronic, progressive joint disorder characterized by synovitis, cartilage degeneration, subchondral bone sclerosis, joint space narrowing, pain, and irreversible functional loss, affecting over 500 million people worldwide. Long-term adverse effects of anti-inflammatory agents demand a natural source with potential benefits and less

adverse effects. The current study explored *Cissus quadrangularis* (CQ), a traditional medicinal plant known for its bone-healing and anti-inflammatory properties. In this work, molecular mechanisms of drug was investigated using an integrated *in silico* network pharmacology approach. *Methodology:* 17 phytochemicals were identified from the IMPPAT and Knapsack databases. Structural data were sourced from PubChem, and pharmacokinetic properties (DL ≥ 0.18; BA ≥ 0.3) were assessed using Molsoft and SwissADME. A compound–gene–disease network was constructed in Cytoscape (v3.10.4), revealing the multi-component, multi-target effects of CQ. *Result:* 5 active compounds—beta-sitosterol, alpha-carotene, alpha-amyrenone, Quadrangularin A, and selected triterpenoids—met the screening criteria. Potential targets were predicted using SuperPred and analyzed through STRING for protein–protein interaction (PPI) networks. OA-related genes were collected from GeneCards, OMIM, and DisGeNET. A total of 774 compound-associated targets and 620 OA-related targets were identified, with 228 overlapping genes. These shared targets were primarily involved in inflammatory signaling and extracellular matrix degradation pathways. Compound–target frequency analysis showed that δ-amyrone and α-amyrenone had the highest interactions, sharing 62 and 61 common targets, respectively. From the five selected compounds, 68 shared targets were obtained after duplicate removal. PPI analysis identified 10 key hub genes: TNF, PPARG, ESR1, MAPK3, PPARA, PGR, NR3C1, AR, PTGS1, and MDM2. *Conclusion:* This study suggests that *Cissus quadrangularis* may help manage osteoarthritis by acting on multiple targets linked to inflammation and tissue damage. The results support its potential benefits and the need for further experimental studies. *Future Prospects:* Further molecular docking need to be carried out to confirm strong binding affinities between active compounds and key targets, supporting CQ's therapeutic potential in OA management.

Keywords: Osteoarthritis, Molecular docking, Cytoscape, Signaling

One Health And Antimicrobial Resistance

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Abstract

Drug-resistant bacterial infections represent an escalating global public health emergency, threatening the effective prevention and treatment of infectious diseases in both human and animal populations. The emergence and dissemination of multidrug-resistant pathogens are driven by extensive antimicrobial use and misuse across healthcare, veterinary medicine, agriculture, and environmental systems. Addressing this complex crisis requires coordinated, multisectoral interventions grounded in the One Health framework, which recognises the interconnectedness of human, animal, and environmental health. The National Antimicrobial Resistance Monitoring

System (NARMS) exemplifies an integrated surveillance model designed to assess the impact of antimicrobial use in food animal production on human health. Through collaboration among federal and state agencies, NARMS systematically monitors antimicrobial resistance in enteric bacteria from humans, retail meat, and food animals. Its adaptive surveillance strategies, including expanded sampling frameworks, inclusion of new bacterial species, and application of whole genome sequencing, provide critical data on resistance trends, transmission pathways, and genetic determinants. These data inform science-based regulatory actions, antimicrobial stewardship initiatives, and food safety policies. Environmental factors further amplify the spread of resistance through wastewater contamination, inadequate sanitation, agricultural runoff, and improper waste management, contributing to the expansion of the environmental resistome. In both developed and developing regions, insufficient surveillance infrastructure, limited harmonized standards, and over-the-counter access to antibiotics exacerbate resistance propagation. Evidence suggests that interventions such as banning antibiotics for growth promotion in food animals, strengthening infection prevention and control measures, improving hygiene and sanitation, expanding surveillance to include antimicrobial consumption data, and promoting responsible prescribing practices are essential to preserving drug efficacy. Global cooperation, public education, and sustained investment in surveillance, stewardship, and alternative therapeutic strategies are imperative. A coordinated One Health response offers the most viable pathway to mitigate antimicrobial resistance and safeguard the effectiveness of existing antimicrobials for future generations.

Keywords: Antimicrobial resistance: Drug Resistant, One Health, Surveillance, Antibiotic stewardship, Drug discovery, Global health.

Phytometabolites-based anticancer therapeutics

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Abstract

Cancer is a global deadly multistage disease characterized by uncontrolled cell growth, angiogenesis, metastasis, and resistance to apoptosis. Conventional therapies are effective but their systematic toxicity, drug resistance, poor selectivity forced to go for alternative approaches.

Phytometabolites or Secondary plant metabolites and their derivatives have been the best alternative in individual and in combination with conventional drug regimen, not only due to their chemical diversity, less systematic toxicity, multitargeted effective mechanism , easier availability (paclitaxel ,vincristine),but also their advanced nanodrug formulations like Phytosomes, Liposomes NLCs which improved stability, Target specificity ,therapeutic

efficacy beyond their low water Solubility, fast metabolism and poor bioavailability (Embeline SLN, Curcumin SLN) are approved anticancer medicines.

Many Phytometabolites involve in programed cell death, inhibition of angiogenesis, stress oxidative, decrease metabolism, stimulates apoptosis and regulate genetic signaling pathways [EGFR, STATs, PL3K etc] and used as cancer drug.
The combination therapy has shown Synergistic anticancer effect and decreased systematic toxicity with better nutritional support
This chapter may contain

- Normal cell proliferation genetic regulation and signally feedback process.
- Irregularity in natural physiological Phenomena causing cancer.
- Phytometabolites/ phytochemical category and their Mechanism of action
- Plants and Herbal formulations effective in cancer treatment in detail
- Utilization of AI in screening for integrated system of medicines, understanding mechanism, drug interaction etc.
- Future prospect of Customized Phytometabolites or integrated therapeutic resimen.

Keywords: Phytometabolites, Cancer therapy, drug resistance, conventional therapy, angiogenesis, apoptosis, nanodrug deli Target very systems, Targeted therapy.

Preventive management of gastrointestinal inflammation using standardized *zingiber officinale* fractions

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Abstract

Gastrointestinal inflammation is common factor in major digestive disorders. Most of anti-inflammatory drugs lead to side effects pertaining to IBD condition. This creates demand for safer treatment options. This demand can be fulfilled by phytopharmaceuticals which can also be called as modern class of herbal medicines. With the help of scientific validation, quality control and regulation, phytopharmaceuticals can be upgraded. One of the herbal medicines that can be used for GI inflammation is ginger (*Zingiber officinale)*. Ginger is commonly used in Indian houses for digestive disorders. Ginger is widely used medicinal plant known for its digestive and anti-inflammatory benefits, but its clinical application is limited by variability in chemical composition of crude extracts. Present studies focuses on the preventive management of gastrointestinal inflammation using standardized fractions of *Zingiber officinale* developed according to phytopharmaceutical principles. The bioactive compounds are gingerols, phenolic constituents, sesquiterpenes and furanodienone. Experimentally, it has been found that Furanodienone is very

effective in controlling gut inflammation by activating xenobiotic nuclear receptor pregnane X . Pregnane X receptor plays important role in regulating gastrointestinal inflammation and maintaining intestinal barrier integrity. Standardized fractions of *Zingiber officinale* exhibits antioxidant and anti-inflammatory activity by lowering pro-inflammatory cytokines and supporting endogenous protective enzymes. If gut inflammation is treated at early stage, these components may help in prevention of gut inflammation rather than only managing symptoms. This type of approach helps in promoting and consolidating phytopharmaceutical application. It can be summed up that standardized *Zingiber officinale* fraction offer safe, effective and preventive biochemical approach for GI inflammation in day-to-day clinical care.

Keywords: *Zingiber officinale*, Ginger, Gastrointestinal Inflammation, Phytopharmaceuticals, Preventive Management, Furanodienone, PXR, Standardization

Role Of Gut Microbiota In Pathogenesis Of Rheumatoid Arthritis

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Abstract
Rheumatoid arthritis (RA) is an autoimmune disease characterized by chronic synovial inflammation and progressive joint damage. Autoimmune disease may proceed through a pathogenic mechanism in which the gut microbiota and their metabolites can regulate the immune function. Several studies demonstrated various alterations in gut microbiota in RA patients suggesting its potential role in pathogenesis of the disease. Increased abundance of *Prevotella copri* is most frequently observed in untreated RA has been associated with enhanced TH-17 mediated inflammatory responses, it acts by stimulating intestinal dendritic cells, which further produce IL-6 which leads to systemic inflammation and joint damage. The aim of this study was to analyse the reports suggesting the role of gut microbiota and explore its potential role in pathogenesis of Rheumatoid Arthritis in order to gain insights into the potential influence of the gut microbiota on the onset and progression of the disease .An extensive literature survey was done from internet database sources like PubMed, Medline, Scopus, Web of Science, Google Scholar, etc., with appropriate keywords such as Rheumatoid Arthritis gut microbiota , metabolomics, immune dysregulation, analysis of gut microbiota, pathogenesis of Rheumatoid Arthritis**.**. There are some evidences that showed increase abundance of *Prevotella copri*, Collinsella and *Eggerthella*. Some *Prevotella copri* antigen exhibit molecular mimicry which triggers autoimmune response ,whereas other species *like Collinsella, Eggerthella* and *Lactobacillus* in RA patients had shown increase in the gut permeability which allows endotoxins to reach to systemic circulation , eventually promote pro inflammatory cytokines such

as IL-6 and TNF-α which leads to TH-17 immune responses and which leads to joint inflammation. These report highlights the potential role of the gut microbiome in disease development.

Keywords: Rheumatoid Arthritis, gut microbiota, metabolomics, microbiome, Pathogenesis of Rheumatoid Arthritis

Role of herbal medicines in the supportive management of celiac disease

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Abstract
Celiac disease is a long-term immune-related disorder in which the body reacts abnormally to gluten intake. It mainly affects individuals who have a genetic tendency, especially those carrying HLA-DQ2 or HLA-DQ8 genes. Gluten, a protein present in wheat, barley and rye, acts as the main triggering factor for this condition. This review discusses the role of herbal medication in the management of celiac disease. This disease is distinguished by intestinal inflammation, villous atrophy, and malabsorption of nutrients. At present, a strict lifelong gluten-free diet is the only effectual treatment. Although complete compliance is difficult, some patients experience consistent symptoms and intestinal damage. This has fostered research into supportive treatment strategies aimed at gut healing and immune modulation. Various plant-derived bioactive compounds—such as naturally occurring active compounds like phenols, carotenoids, curcumin, black seed, and cocoa—have been reported to demonstrate anti-inflammatory, free radical scavengers, and immunoregulatory properties. These natural agents may help to lower oxidative stress and reduce inflammatory mediators, inhibit Nuclear factor kappa B cascade, helps to improve the integrity of the intestinal lining, and furthermore, certain specific traditional herbal remedies used in intestinal inflammation. Based on existing clinical, experimental, and in vitro studies, natural resources demonstrate potential as supportive treatment options with a gluten-free diet. While they do not substitute dietary gluten restriction, their use as supportive adjuvants may improve gut healing, reduce disease-related inflammation, and enhance overall quality of life in patients with celiac disease. Further well-designed clinical trials are required to establish their safety, efficacy, and therapeutic relevance.

Keywords: Intestinal inflammation, gut healing, villous atrophy, free radical scavengers, Nutrient malabsorption, Herbal medicine

Therapeutic Implications And Future Prospective In The Treatment Of Neuropsychiatric Disorder

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Abstract

Neurotransmitter dysregulation is particularly deficiencies in serotonin, norepinephrine, and dopamine. The monoamine hypothesis has guided pharmacological treatments and research toward integrating this model with inflammation, oxidative stress, and epigenetics for personalized therapies. Ketamine's rapid efficacy is linked to glutamate–GABA normalization, highlighting the importance of restoring neural balance. Neuropeptides play a key role in modulating emotional systems, while neuroendocrine mechanisms connect environmental stressors to mood disorders. The immune–inflammatory framework shifts the view of depression from a simple neurotransmitter imbalance to a complex disorder influenced by cytokines and neuroinflammation. Oxidative and nitrosative stress underpin depression's biological mechanisms, revealing prospects for novel biomarkers and antioxidant therapies. The interaction of oxidative stress and neuroinflammation forms a significant axis in depression, suggesting that targeting this nexus may lead to innovative antidepressant strategies. Future therapies should target the redox–inflammatory balance, enhance neuroplasticity via MAPK signalling, and incorporate gut microbiota interventions for better treatment outcomes. Future Therapies for antidepressants should also target other forms of practices such as yoga and meditation for control and treatment of depression. Practices such as deep breathing onsets the parasympathetic nervous system in our body, stimulates the vagus nerve shifting the body from fight or flight to a calmer state, thus reducing anxiety and depression. Meditation on the other hand calms the amygdala, the fear centre of the brain, thus reducing its size and activity, strengthening its connection to prefrontal cortex for better emotional regulation. Meditation also boosts the production of neurotransmitters like serotonin and Gaba shifting the mind to a relaxed state. Diet and Vitamins levels in the body also significantly affects the depression influencing the chemistry of the brain, inflammation and gut health. Deficiencies in vitamins such as vitamin B6, B9, B12, Vitamin D, Omega 3s, zinc and magnesium are linked to depression, whereas a Mediterranean diet, that are low in processed item supports mental health by providing essential nutrients, reducing inflammation and promoting the upregulation of neurotransmitters such as serotonin and Gaba.

Keywords: Neurotransmitter, Vitamin D, MAPK signaling, Neuropeptides

Tinospora cordifolia in Rheumatoid Arthritis: Pharmacological Evidence

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Abstract
A common autoimmune-mediated disease, the Rheumatoid Arthritis (RA) is characterized by persistent inflammation of the synovium, especially in the tiny joints of the hands and feet, though it can affect any synovial joint. Autoantibodies (rheumatoid factor and/or anti-cyclic citrullinated peptide antibodies) and elevated inflammatory markers are widespread. Currently, long-term usage of anti-rheumatic medications can result in the adverse effects, underscoring the need for safer and more efficient treatments. Nowadays herbal plants are being used for the curing of rheumatoid arthritis because of their safer uses and less toxicity. An essential Ayurvedic plant for inflammatory and immunological conditions is *Tinospora cordifolia* commonly known as Guduchi whose family is Menispermaceae. It is a big, deciduous climbing vine with many long, twining branches that grow widely. diterpenoid lactones, alkaloids, steroids, glycosides and aliphatics are the active components of this plant. Extract from *Tinospora cordifolia* reduced bone and cartilage deterioration as well as arthritic inflammation. Pro-inflammatory cytokines such IL-1β, TNF-α, IL-6, and IL-17 were reduced as a result of TCE's anti-inflammatory action. Administering the T. cordifolia extract (TCE) significantly reduced the clinical and pathological characteristics of Rheumatoid Arthritis in animal models such as adjuvant-induced arthritis (AIA) and collagen-induced arthritis (CIA). Treatment with TCE decreased paw edema, joint inflammation, and the histological indicators of bone and cartilage degradation, suggesting therapeutic promise in reducing the severity of the condition. We need well designed clinical trials and standardization of extracts which is important to show its potency and safety for long - term therapeutic use. *Tinospora cordifolia* is a promising herbal drug for the control of rheumatoid arthritis.

Keywords: Rheumatoid Arthritis, Herbal Plants, *Tinospora cordifolia*, Pro-Inflammatory Cytokines

Using *caenorhabditis elegans* for *in vivo* screening of Parkinson's disease therapeutics

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Abstract
Parkinson's disease (PD) is a progressive neurodegenerative disorder marked by dopaminergic neuronal loss, α-synuclein aggregation, mitochondrial dysfunction, and oxidative stress. Despite

extensive preclinical research, effective disease-modifying therapies remain limited, underscoring the need for rapid, cost-effective, and biologically relevant in vivo screening platforms. *Caenorhabditis elegans* has emerged as a valuable model organism for PD research and early-stage therapeutic discovery. *C. elegans* offers distinct advantages, including a fully mapped nervous system, conserved dopaminergic pathways, genetic manipulability, short life cycle, and compatibility with high-throughput screening. Multiple PD models have been established in *C. elegans*, including chemically induced dopaminergic neurodegeneration using 6-hydroxydopamine (6-OHDA), transgenic α-synuclein overexpression models, and mitochondrial toxin–based paradigms. These models enable systematic evaluation of candidate therapeutics in a whole-organism context. A wide range of in vivo phenotypic assays are available to assess therapeutic efficacy, including dopaminergic neuron integrity using fluorescent reporter strains, locomotion and thrashing behaviour, basal slowing response, lifespan analysis, oxidative stress resistance, mitochondrial function, and α-synuclein aggregation. Collectively, these endpoints provide mechanistic and functional insights into neuroprotection and disease modulation. This study highlights the deployment of *C. elegans* as a preliminary in vivo validation platform for PD therapeutic discovery, with particular emphasis on phytopharmaceutical screening. Owing to their chemical diversity and multitarget potential, phytoconstituents can be efficiently evaluated in *C. elegans* PD models to identify neuroprotective candidates prior to validation in higher-order animal systems. Thus, C. elegans serves as an effective bridge between in vitro assays and mammalian studies, accelerating the prioritization of phytopharmaceutical leads for PD management.

Keywords: *Caenorhabditis elegans*, Parkinson's disease, *In vivo* screening, Neurodegeneration, Phytopharmaceuticals

Yogic intervention vs Conventional Physiotherapy For Neck Pain In Prolonged Computer Users: A Scoping Review

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Abstract
Background: Neck pain is a leading contributor to disability and is particularly prevalent among people who work long hours at a computer. Contemporary management commonly involves conventional physiotherapy-progressive strengthening, motor control training, manual therapy, education, and ergonomic modification-and yogic practices that combine asana, pranayama, and relaxation/meditation. yet, their relative roles for office-based populations have not been comprehensively mapped. *Objective:* To identify, collate, and compare the evidence on yogic interventions and conventional physiotherapy for adults with neck pain-focusing on prolonged

computer users-and to summarize effects on pain, disability, and health-related quality of life (QoL) alongside adherence and safety. *Methods:* Using the JBI scoping review framework and PRISMA-ScR reporting standards, we searched MEDLINE/PubMed, Cochrane Library, Scopus, Embase, PEDro, and Google Scholar from inception to January 21, 2026. We included randomized and nonrandomized studies, systematic reviews/meta-analyses, clinical practice guidelines, and workplace trials evaluating yoga or physiotherapy for neck pain. Data were charted for populations, intervention characteristics, comparators, outcomes (pain, Neck Disability Index [NDI], QoL), adherence, and adverse events; formal risk-of-bias appraisal was not required for this design. *Results:* Three evidence streams emerged. (1) Yoga: Randomized trials and syntheses show short-term reductions in pain and disability and improvements in mood and QoL, with sustained profits more likely when practice continues. (2) Physiotherapy: Regular support exists for cervico-scapulothoracic strengthening and merged strengthening-motor control programs to decreased pain and disability. (3) Workplace interventions: Joining targeted strengthening to ergonomic optimization exceeds ergonomics only in the short term; durability relies on adherence. *Conclusions:* Both conventional physiotherapy and yoga therapy produce meaningful short-term improvements in pain and function among scree users. The strongest office-specific evidence aids exercise plus ergonomics, while yoga offers comparable benefitted in broader chronic neck pain cohorts. Face to face trials in computer-using populations are needed to refine efficacy, dosing, and maintenance tactics.

Keywords: Computer users, Neck pain, Yogic intervention, Quality of Life, Conventional Physiotherapy.

Track II:
Stem Cells and System Biology

Advancing Precision Medicine through Stem Cell-Mediated Drug Delivery Systems

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Abstract
The clinical utility of many potent pharmacological agents is often constrained by poor pharmacokinetic profiles, including rapid systemic clearance and off-target toxicity. Conventional synthetic carriers frequently struggle to navigate the body's complex biological checkpoints, such as the blood-brain barrier or the immunosuppressive microenvironments of solid tumors. Stem cell-mediated delivery represents a sophisticated departure from these passive systems, utilizing the intrinsic biological "intelligence" of cells—particularly Mesenchymal Stem Cells (MSCs)—to serve as active, targeted transporters.
This targeted approach relies on the natural tropism of stem cells, which allows them to migrate toward chemoattractant gradients (such as the CXCR4-SDF-1α axis) released by injured or neoplastic tissues. By engineering these cells to carry diverse payloads—ranging from small-molecule chemotherapeutics to viral vectors and RNA-based therapies—we can achieve a localized therapeutic concentration that was previously unattainable. Current research is increasingly focused on the transition from whole-cell transplants to the use of stem cell-derived extracellular vesicles (EVs) or exosomes. These nano-scale vesicles retain the homing capabilities and low immunogenicity of their parent cells while offering a more stable, "off-the-shelf" pharmacological product that bypasses many of the safety concerns associated with live-cell integration.
Despite these advancements, the path to clinical translation faces significant hurdles in Chemistry, Manufacturing, and Controls (CMC). Challenges such as ensuring batch-to-batch consistency, defining precise dosing protocols, and navigating the regulatory landscape for "living" medicines remain central to the discourse. This presentation evaluates the current state of stem cell bioengineering and discusses how bridging the gap between cell biology and material science is essential for the next generation of precision medicine.

Keywords: Mesenchymal Stem Cells, Targeted Drug Delivery, Stem Cell–Derived Exosomes, CXCR4–SDF-1α Axis, Precision Medicine, Tumor Microenvironment, RNA-Based Therapeutics

Biologicals Approaches in Orthopedics : The Future of Tissue Healing

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Abstract

In the past, Orthopedics was usually all about "cutting, shaping & inserting the materials". But now it is going towards a new advancement; it is no longer about replacement, it is about regrowing itself.For this, we need to know about the concept of tissue healing.The main factors needed for tissue healing are cells, growth factor, scaffold, and mechanical stability.

Bioengineering plays a huge part in the tissue healing process as we bioengineer the biological substances through various molecular and cellular mechanisms that increase the tissue healing.Biological substances like platelet-rich plasma, bone marrow aspirate concentrate, bone morphogenic stem cells, growth factors, autologous chondrocyte, etc. are used.First, we need to create new bone or cartilage for replacement, as we use BMP to stimulate categorization of the normal stem cells.Second, formation of blood vessels is important for blood supply and helps to increase the process. We inject PRP to increase growth factors to form blood vessels.Third, we use MSC (Mesenchymal stem cells) for the body's immune system to act as a repairer instead of cleaning the inflammatory debris.Fourth, the body doesn't know by itself that it has to do repair and work at where it is, so the biological release chemicals that work to attract the stem cells from other parts of the body to the affected site.Fifth, a physical form is needed so the stem cells can grab on to a physical structure. We use Demineralized Bone Matrix to create a base structure.

This is the future of orthopedics; instead of replacement, we can use natural tools that can nurture and grow now in their own incredible way. Biologicals dosen't just heal fractures they join a huge gap of surgery and natural healing as it further continues on 3D printing and gene therapy.

Keywords: Regenerative Orthopedics, Tissue Engineering, Mesenchymal Stem Cells, Platelet-Rich Plasma, Bone Morphogenetic Proteins, Angiogenesis, Demineralized Bone Matrix, 3D Bioprinting

Cancer Stem Cells in Tumour Pathophysiology - Metabolic Plasticity, Microenvironmental Niches, And Next Generation Therapeutic Targeting

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Abstract

Introduction: Cancer stem cells (CSCs) represent a tumour-initiating subpopulation responsible for intra-tumour heterogeneity, metastatic progression, and post-therapy relapse. Emerging evidence indicates that CSC persistence is sustained by metabolic plasticity and microenvironment-mediated protection. Recent studies demonstrate that fatty acid oxidation (FAO) maintains tumorigenic potential and chemoresistance in pancreatic CSCs, whereas dependence on oxidative phosphorylation (OXPHOS) constitutes a metabolic vulnerability in therapy-resistant metastatic breast cancer. Single-cell transcriptomic and spatial profiling further

reveal distinct stem-like programs enriched within fibroblast-rich and perivascular niche environments. This review synthesizes recent experimental evidence on metabolic and microenvironmental mechanisms regulating CSC survival and highlights emerging translational therapeutic vulnerabilities.
Methods: Original studies published between 2022 and 2025 were systematically evaluated, including patient-derived xenograft models, mechanistic metabolic intervention experiments, lipid metabolism–targeting studies, and single-cell spatial atlases characterizing CSC–niche interactions across solid and hematologic malignancies.
Results: Evidence demonstrates that CSCs dynamically switch between glycolysis and mitochondrial OXPHOS to survive therapeutic stress. In metastatic breast cancer xenografts, pharmacologic OXPHOS inhibition suppressed therapy-resistant tumour growth. In pancreatic cancer models, FAO blockade reduced CSC-mediated tumour initiation and reversed chemoresistance. In acute myeloid leukemia, targeting fatty acid desaturase pathways resensitized leukemic stem cells to venetoclax-based regimens. Spatial single-cell atlases in colorectal cancer and cholangiocarcinoma identified stem-like clusters localized within stromal niches that promote immune evasion and metabolic rescue. Additionally, mitochondrial transfer within the tumour microenvironment has emerged as a mechanism sustaining resistant stem-like states.
Conclusion: Recent experimental data establish metabolic rewiring and niche-mediated support as central determinants of CSC survival and therapeutic relapse. Translational priorities include the development of selective OXPHOS and FAO inhibitors, disruption of stromal-mediated metabolic rescue pathways, and biomarker-guided combination strategies to achieve durable CSC eradication.

Keywords: Cancer stem cells; Tumour microenvironment; Oxidative phosphorylation; Fatty acid oxidation; Therapeutic resistance

Cellular Signaling Process involving Son of Sevenless (SOS) homolog

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Abstract
Cellular signaling is a fundamental process that regulates the cell growth, differentiation, proliferation, migration and survival, it enables cell to respond to external stimuli such as growth factors, hormones, nutrients and stress, The Son of Sevenless (SOS) family of proteins, mainly SOS1 and SOS2, act as guanine nucleotide exchange factors (GEFs) that activate RAS by promoting the conversion of GDP-bound RAS into its active GTP-bound form. This activation initiates the RAS–RAF–MEK–ERK (MAPK) signaling cascade, a critical pathway controlling numerous physiological processes. SOS proteins are recruited to activated receptor tyrosine

kinases through adaptor proteins such as Grb2 and are further regulated by allosteric binding of RAS-GTP, enabling precise amplification of cellular signals. SOS-mediated signaling plays essential roles in multiple systems, including cardiovascular, nervous, immune, respiratory, skin, and reproductive systems, where it influences development, tissue homeostasis, and stress responses. Dysregulation of SOS activity, either through gain-of-function mutations or overexpression, leads to abnormal RAS–MAPK signaling and is associated with developmental disorders such as Noonan syndrome and Cardio-Facio-Cutaneous syndrome. Recent advances in structural biology have enabled the development of small-molecule inhibitors that disrupt the SOS–RAS interaction, offering a promising therapeutic strategy for RASopathies which were previously considered undruggable. Emerging approaches, including PROTAC-mediated SOS1 degradation and combination therapies with KRAS inhibitors, aim to overcome resistance mechanisms and improve clinical outcomes. Overall, SOS proteins serve as critical regulators of signal transduction, linking extracellular cues to intracellular responses. Understanding their structure, regulation, and pathological roles provides valuable insights for molecular pharmacology and the development of targeted cancer therapies.

Keywords: Cellular Signaling, Son of Seveless (SOS), RAS Activation, MAPK pathway, RASopathies

Chronopharmacology in Precision Therapeutics: Optimizing Drug Efficacy Through Circadian Rhythm Modulation

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Abstract
Chronopharmacology has emerged as a specialized field of study which focuses on understanding the influence of circadian rhythms on the pharmacokinetics/pharmacodynamics of pharmaceuticals for the purpose of enhancing the efficacy of therapeutic outcome. The human body has its own internal biological clock, which consists of a complex system of central and peripheral oscillators. The suprachiasmatic nucleus acts as the master coordinator of the circadian system. The biological timing system regulates a various physiological process, including hormone secretion, blood pressure control, gastric motility, enzyme activity in the liver, and kidney function. These bodily functions have a natural circadian rhythm. These bodily functions can significantly influence the pharmacokinetics of a drug. With the accumulation of clinical evidence, the administration of drugs in according to the circadian rhythm has been found to enhance the efficacy of therapy while minimizing the adverse effects of drugs. For example, the administration of antihypertensive agents at night has been found to effectively control blood pressure by targeting the peak blood pressure levels in the early hours of the morning. Similarly, the

administration of statins in the evening has been found to enhance the efficacy of therapy for cholesterol reduction by targeting the peak activity of cholesterol synthesis in the body at night. The potential of chronomodulated chemotherapy has been found to enhance the efficacy of therapy for cancer. The advancements in chronotherapeutic drug delivery systems have substantiated the potential of chronopharmacology in the clinical management of diseases. These systems have been designed to deliver drugs at a set time to meet the body's needs. Despite the promising findings, there are several limitations to the application of chronopharmacology in clinical practice. The limitations include the individual variations in the circadian rhythm, the need for evidence based clinical validation of the application of chronopharmacology in the clinical management of diseases, and the need for patients to adhere to the time specific drug administration schedules.

Keywords: Chronopharmacology; Circadian Rhythm; Chronotherapeutics; Precision Medicine; Pharmacokinetics; Pulsatile Drug Delivery

Disease Modelling And Drug Discovery Using Stem Cells

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Abstract
Neurological disorders are among the most intriguing but difficult fields in biomedical studies due to limited availability of human neural tissue and the weak capability of traditional animal models or immortalized cell culture systems to reflect realistic human disease conditions. These limitations have hindered the pace of progress in understanding the mechanisms behind such disorders or seeking an effective cure. The invention of human induced pluripotent stem cell technology has given scientists a new route for the study of such disorders by providing the means to derive patient-specific neural cells in culture.
hiPSCs, derived from somatic cells through a reprogramming approach, demonstrate an ability for self-renewal and differentiation into various neural cell types. This has enabled scientists to develop "disease-in-a-dish" models with a high degree of similarity to human neurological disorders, both at a cellular and molecular level. There has been a high degree of success in the use of hiPSCs in models over the last decade in unraveling a wide range of issues related to human neurological disorders.
Additional recent advances such as directed differentiation protocols, three-dimensional culture systems, brain organoids, and organ-on-chip technologies have made such systems even more physiologically relevant.
Such platforms help in drug screening, toxicity studies, target validation, as well as drug repurposing in a way that obviates the use of animal studies. However, several issues remain to be

tackled in this area, including high costs, technical difficulties, ethical issues, and issues involving reproducibility and scalability.
Despite all these limitations, continuous developments in stem cell biology, bioengineering, automation, and data analysis are enhancing the reliability of hiPSC-based research approaches. In summary, research approaches involving stem cells in disease modeling have provided a link between existing preclinical research results and clinical outcomes in humans, which provides hope for advancing neurological research as well as drug discovery.

Keywords: Human induced pluripotent stem cells (hiPSCs), neurological disorders, disease modelling, brain organoids, organ-on-chip technology, in vitro models, drug discovery, translational research.

Dissolving Microneedles at the Forefront of Next Generation Transdermal Drug Delivery Systems targeting localized immunomodulation in Rheumatoid Arthritis

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Abstract
Rheumatoid arthritis (RA) is a chronic, systemic inflammatory autoimmune condition characterised by pannus formation and persistent synovitis leading to progressive damage of bone and cartilage. The classical therapies include the administration of NSAIDs, corticosteroids, and DMARDs. These therapies potentially inhibit the impact of RA symptoms and slow disease progression but are often associated with systemic side effects, poor bioavailability, and the need for frequent administration. Recently, microneedles (MNs) have emerged as an innovative technology, an essential component of the transdermal drug delivery system (TDDS) for RA therapy. Especially, dissolving microneedles (DMNs) with higher bioavailability, biodegradability, and ease of use have shown promising results. DMNs are minimally invasive transdermal delivery systems that enable painless penetration through the outer skin barrier and the direct release of the drug into the dermal layer. These MNs are generally synthesised using various fabrication techniques (such as the two-step casting method and photopolymerization). They are made from biodegradable polymers (such as hyaluronic acid and chitosan), which dissolve after insertion and enable controlled, sustained drug release into the body while bypassing first-pass metabolism. Beyond traditional TDDS, incorporation of photodynamic therapy (PDT) into DMNs systems provides spatial and temporal control over therapeutic activation. In this approach, photosensitising agents (such as chlorin e6) are encapsulated into microneedles and delivered to the inflamed tissue which upon light exposure activates drug molecules and reactive oxygen species (ROS), producing a localised effect that helps suppress inflammatory pathways and hyperactive synovial cells while reducing target effects. Overall, DMNs integrated with PDT

offer an innovative, patient-friendly strategy with the potential to enhance targeted immunosuppression and improve long-term RA management.

Keywords: Rheumatoid arthritis, Dissolving microneedles, Transdermal drug delivery system, Photodynamic therapy, Reactive oxygen species (ROS)

Evolution of Stem Cell Regulation in India (2007-2019)

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Abstract
The regulation of stem cell research and therapy in India has undergone significant transformation between 2007 and 2019, reflecting the country's effort to balance scientific innovation with ethical responsibility and patient safety. In 2007, the Indian Council of Medical Research (ICMR) and the Department of Biotechnology (DBT) jointly issued the first "Guidelines for Stem Cell Research and Therapy." These guidelines were largely advisory in nature and aimed to establish ethical standards, oversight mechanisms, and institutional review processes for stem cell research. However, the rapid commercialization of unproven stem cell therapies and the emergence of private clinics offering experimental interventions exposed gaps in regulatory enforcement. In response, the guidelines were revised in 2013 to strengthen ethical review, define permissible and restricted research categories, and clarify the status of investigational stem cell–based interventions. Despite these improvements, challenges persisted due to the non-statutory nature of the guidelines. A major shift occurred in 2017 with the release of the "National Guidelines for Stem Cell Research," which explicitly categorized stem cell–based products as drugs, bringing them under the regulatory purview of the Central Drugs Standard Control Organization (CDSCO). This alignment integrated stem cell–based products into the existing drug regulatory framework governed by the Drugs and Cosmetics Act, 1940. By 2019, regulatory oversight was further reinforced through amendments to the New Drugs and Clinical Trials Rules, enhancing clinical trial requirements and post-approval monitoring for cell-based therapies. Overall, the period from 2007 to 2019 represents a gradual evolution from advisory ethical guidance to a more structured, legally enforceable regulatory regime. This transition reflects India's commitment to ensuring scientific rigor, ethical compliance, and patient protection in the rapidly advancing field of regenerative medicine.

Keywords: Cell-Based Therapy, Clinical Trials, Ethical Oversight, Regenerative Medicine, Regulatory Framework

Exosomes as Biological Nanocarriers for Targeted Brain Tumor Drug Delivery

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Abstract

Background: Brain tumor, particularly glioblastoma multiforme (GBM), represent a leading cause of cancer related mortality in neuro-oncology, with median survival under 15 months despite multimodal therapies. Therapeutic failure of conventional treatments are largely attributed to the restrictive nature of the blood–brain barrier (BBB), pronounced intratumoral heterogeneity, immune evasion, and the rapid development of therapeutic resistance. In this context, exosomes, nano-sized extracellular vesicles (30-150 nm) secreted by tumor and stromal cells emerge as promising mediators in the tumor microenvironment. Enriched with bioactive cargos such as proteins, lipids, miRNAs, and mRNAs, exosomes facilitate intercellular communication, modulating tumor progression, invasion, and immune evasion.

Aim: This review evaluates the multifaceted applications of exosomes in brain tumor management, encompassing liquid biopsy-based diagnostics, targeted drug delivery, and prognostic biomarkers, to bridge gaps between preclinical promise and clinical translation.

Methods: A comprehensive literature search conducted across PubMed, Scopus, Web of Science, and Google Scholar, focusing on studies involving exosome isolation, characterization, and functional assays in glioma models.

Results: Emerging evidence indicates that circulating exosomal biomarkers such as miR-21, EGFRvIII, and IDH1 mutations demonstrate high diagnostic accuracy, often exceeding 90% sensitivity in cerebrospinal fluid and plasma samples. Moreover, engineered exosomes exhibit intrinsic BBB-penetrating ability, enabling efficient delivery of chemotherapeutics, siRNA, and immunomodulatory agents while minimizing systemic toxicity. Additionally, exosome-mediated immune modulation enhances anti-tumor responses, including improved sensitivity to anti-PD-1 immunotherapy.

Conclusion: Exosomes are emerging as a transformative platform acting as theranostic, offering precision diagnostics and BBB-penetrant therapeutics. Despite promising preclinical and early clinical findings, challenges related to large-scale production, purification standardization, cargo loading efficiency, and regulatory validation remain critical barriers to translation.

Keywords: Exosomes, brain tumor, glioblastoma, liquid biopsy, drug delivery, blood-brain barrier, biomarkers, nanotheranostics.

From Molecular Insights to Clinical Translation: Addressing Translational Gaps and Advancing Regulatory Readiness of Stem Cell Therapy in Neurodegenerative diseases

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Abstract
Neurodegenerative disorders, such as Huntington's disease, Parkinson's disease, and amyotrophic lateral sclerosis, represent a growing global health challenge, with limited disease-modifying treatments currently available. Stem cell-based therapies have emerged as a viable treatment modality, providing options for neuroprotection, neuronal replacement, and pathological microenvironment modification. Despite extensive preclinical evidence for functional recovery and increased longevity in animal models, successful clinical translation remains a hurdle. This work considers the translational pathway comprising molecular mechanisms, preclinical validation, and early-phase clinical research. It also considers how new regulatory frameworks affect the development, approval, and post-marketing supervision of stem cell-based medicines. The main translational challenges include the inability to predict the source and characteristics of cells, the variability in animal models, problems with drug development that is potent, scalable, and genetically stable, and toxicology concerns such as tumorigenicity and immunological compatibility. Clinical trial design also presents unique challenges for advanced pharmaceuticals, including the need for adaptive methodologies, extended safety surveillance, and harmonized global regulatory standards. To promote innovation while ensuring patient safety, regulatory agencies including the FDA, EMA, and PMDA have established accelerated pathways along with risk-based classifications: RMAT, ATMP, Sakigake. Such improvements emphasize the critical role of regulatory science in translating laboratory discoveries into clinically meaningful therapeutic outcomes.
This study highlights how translational research, development of regulations, and technical advances together shape the future of the use of stem cells to treat neurodegenerative diseases. It is important to understand these interrelated pathways in order to translate early molecular findings into treatments that are relevant clinically and lifesaving.

Keywords: Stem cell therapy; neurodegenerative diseases; clinical translation; regulatory science; ATMP; RMAT designation; translational challenges; advanced therapies.

FXR and PPAR Agonists as Emerging Therapeutic Strategies for Steatotic Liver Disease

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Abstract

Introduction: Metabolic dysfunction–associated steatotic liver disease (MASLD), formerly termed non-alcoholic fatty liver disease (NAFLD), and its progressive inflammatory phenotype, metabolic dysfunction–associated steatohepatitis (MASH), represent a major and rapidly escalating global health concern. Closely linked to obesity, insulin resistance, type 2 diabetes mellitus, and dyslipidemia, MASLD/MASH is now a leading cause of advanced liver disease, including cirrhosis and hepatocellular carcinoma, while also conferring substantial cardiovascular risk. Current management strategies rely predominantly on lifestyle modification, which is often insufficient to halt disease progression, and no universally approved pharmacological therapy is available, underscoring a significant unmet clinical need. Nuclear receptors have emerged as central regulators of hepatic lipid metabolism and metabolic homeostasis. In particular, the Farnesoid X Receptor (FXR) and Peroxisome Proliferator-Activated Receptors (PPARs) orchestrate key pathways governing bile acid signaling, fatty acid oxidation, glucose metabolism, inflammation, and fibrogenesis. The aim is to critically evaluate emerging pharmacological strategies targeting FXR and PPAR pathways and to assess their therapeutic potential in the management of MASLD/MASH.

Methods: A systematic literature search was performed using PubMed, Scopus, ScienceDirect, and Google Scholar for studies published up to 2025. Search terms included MASLD/MASH, FXR, PPARs, hepatic lipid metabolism, and nuclear receptor agonists. Preclinical and clinical studies were screened for scientific quality, mechanistic relevance, and clinical significance.

Results: Accumulating evidence demonstrates that FXR and PPAR-α, -γ, and -δ agonists improve hepatic steatosis, insulin sensitivity, inflammatory signaling, and fibrosis across experimental models and clinical trials. Several agents have shown histological benefit, though variability in efficacy and safety profiles persists.

Conclusion: Targeting FXR and PPAR signaling represents a promising disease-modifying strategy for MASLD/MASH. Integrated modulation of these nuclear receptors, accounting for pathway crosstalk and patient heterogeneity, may enable precision-based and combination therapies, advancing pharmacological management of this complex metabolic liver disease.

Keywords: Steatotic, steatohepatitis, Farnesoid, Peroxisome, fibrosis, cirrhosis, hepatocellular, carcinoma

Hypoxia-Induced Erythropoietic and Cardiometabolic Adaptations in High-Altitude Athletes: Pharmacological Modulation and Translational Insights

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Abstract

Introduction: Hypobaric hypoxia encountered during high-altitude exposure elicits coordinated erythropoietic and cardiometabolic adaptations that enhance systemic oxygen transport and metabolic efficiency in endurance-trained athletes. These responses are primarily mediated by hypoxia-inducible factor (HIF)-dependent transcriptional networks regulating erythropoietin production, iron metabolism, angiogenesis, mitochondrial bioenergetics, and endothelial function. Despite recognized performance benefits, hypoxic adaptation shows marked inter-individual variability and may pose risks such as hemorheological disturbances, oxidative stress, cardiovascular strain, and iron dysregulation. This study examines hypoxia-induced erythropoietic and cardiometabolic adaptations in high-altitude athletes, emphasizing pharmacological modulation, mechanistic pathways, and translational relevance for optimizing performance while ensuring physiological safety.

Methods: A comprehensive narrative review of peer-reviewed literature published between 2022 and 2025 was conducted using PubMed, Scopus, and Web of Science databases. Original experimental studies, randomized controlled trials, and meta-analyses were included. Focus areas comprised intermittent hypoxic training (IHT), live-high train-low (LHTL) strategies, regulation of erythropoiesis through the EPO–hepcidin–iron axis, cardiometabolic remodelling, and pharmacological adjuncts such as carbonic anhydrase inhibitors, antioxidants, and hypoxia-mimetic agents.

Results: Evidence indicates that structured hypoxic exposure increases haemoglobin mass, improves erythrocyte deformability, and enhances oxygen delivery capacity via HIF-1α activation and suppression of hepcidin-mediated iron sequestration. Cardiometabolic adaptations include improved mitochondrial efficiency, optimized substrate utilization, enhanced lactate clearance, and augmented endothelial nitric oxide signalling. Pharmacological agents like acetazolamide reduce hypoxia-induced ventilatory and cerebrovascular stress without negating erythropoietic benefits, whereas HIF-prolyl hydroxylase inhibitors induce robust erythropoiesis but raise ethical and anti-doping concerns. Meta-analyses report consistent moderate improvements in haematological parameters and aerobic performance.

Conclusion: Hypoxia-induced erythropoietic and cardiometabolic adaptations constitute a tightly regulated physiological continuum that can be strategically optimized through evidence-based pharmacological modulation. Integrating hypoxic conditioning with targeted pharmacotherapy offers a translational framework to enhance athletic performance while minimizing cardiometabolic and haematological risks.

Keywords: Hypobaric hypoxia; Erythropoiesis; HIF signalling; Cardiometabolic adaptation; High-altitude athletes; Pharmacological modulation; Translational physiology.

Impact Of Stem Cell Therapy On Huntington's Disease

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Abstract
Huntington's disease (HD) is a serious and rare condition of the nervous system, It is a neurological disorder characterized by a reduced number of medium-spiny neurons in the brain. Currently, we don't have any known medications to cure it today, though fetal neural transplantations were attempted both in preclinical and clinical investigations, their effectiveness is less than satisfactory. Recently, with stem cell biology's rapid advancements, research indicates that utilizing stem cell-based therapy for HD could be an exciting possibility, Due to their unique ability to differentiate into a variety of cells, self-renew, and grow, stem cells have become an area of interest for treating various complex and unresolved neurodegenerative disorders. Nanotechnology has come as a new approach with great potential for treating HD with fewer side effects. Nanoparticles (NPs) can act as nano vehicles for delivering therapeutic agents, including siRNAs, stem cells, neurotrophic factors, and different drugs. furthermore, NPs can be used as an alternative method based on their reactive oxygen species-scavenging and antioxidant properties that protect neuronal cells. Some NPs also exhibit the ability to interfere with the protein aggregation of mutant Huntingtin protein during neurodegenerative processes. Now if we talk about stem cells, Three types of stem cells have previously been involved with neurological animal models; they include embryonic stem cells, mesenchymal stem cells of bone marrow, and neural stem cells. However, due to their ability to differentiate into neurons or glial vascular systems after administration via intracerebral or intravenous transplants, most investigators in experimental studies on HD have preferred neural stem cells as they also promote functional recovery.

Keywords: Huntington's Disease, Neural Stem Cells, Nanoparticles, Stem Cell Therapy, Mutant Huntingtin Protein, Neurodegeneration

In silico-based approaches for developing polymeric Nanocarriers for the Colorectal Cancer Therapy

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Abstract
Colorectal cancer remains the leading cause of death worldwide due to the conventional treatment methods, the action of which is being limited by non-specific targeting and poor bioavailability, causing systemic toxicity. To overcome this, polymeric nanoparticles were developed to provide better targeted delivery. Conventional formulation was designed based on the trial-and-error method, which consumed significant time, money and resources. To address these problems,

rational designing strategies were developed which generally focus on integrating in silico bioinformatics to optimize the polymeric form, using the computational tools such as Schrodinger, Auto Dock and GROMACS in the pre-formulation phase. This paper highlights how molecular docking is employed for the prediction of drug-polymer miscibility and encapsulation efficiency, while Molecular Dynamics (MD) are used to estimate critical formulation attributes like particle size (Radius of Gyration), shape and thermodynamic stability. Adopting these computer-based strategies not only saves formulation development time but also reduces the cost and animal usage, eventually creating a drastic shift in the field of drug discovery and formulation development.

Keywords: In Silico Design, Molecular Dynamics, Polymeric Nanoparticles, Targeted Drug Delivery, Colorectal Cancer

Study of Neuronal Spacing Across the Estrous cycle within the Anterior Hypothalamus of Female Wistar Rat, *Rattus norvegicus*

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Abstract
Rattus norvegicus commonly referred as the Norway rat, is a species native to Asia and also has worldwide distribution. *R. norvegicus* is distinguished by the presence of white fur and pink eyes (lack of pigment). Lack of melanin results in the form of genetic mutation, hence it is also known as Albino rat.The hypothalamus consists of regulatory circuits and integrates sensory inputs to influence physiological and behavioral functions. Anterior Hypothalamus (AH) situated in the rostral part of the diencephalon surrounding third ventricle is known to play significant role in reproductive physiology, thermoregulation, maternal care and sleep cycle. Neuronal plasticity in hypothalamus of rat is accompanied by seasonal variations. The previous studies have reported that hypothalamus shows high plasticity in terms of endocrinology and cognitive learning whereas the present study investigates the changes in neuronal spacing within the AH. In this study, brain of female *Rattus norvegicus* during the estrus and diestrus phase were perfused with 10% formalin solution of Cresyl-violet staining (basic dye) for the cytoarchitectonic study. It was observed that spaces between neurons i.e., neuronal spacing in anterior hypothalamus of female wistar rat (*R. norvegicus*), significantly accredited during estrus phase of rat. Neuronal variation is directly influenced by sex steroid such as Gonadotrophin releasing hormone (GnRH) hence any fluctuation in these hormone of anterior hypothalamus affect the neuronal parameters. The result obtained in the present study suggests better functioning and networking of this region concerned for high sexual receptivity and ovulation during estrus phase.

Keywords: Neurons, Plasticity, Anterior Hypothalamus, Cytoarchitectonic, Ovulation.

Systems-Level Evaluation of Gene Expression Dynamics and Key Transcription Factors in an Obesity-Induced PCOS Rat Model

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Abstract
Polycystic ovary syndrome (PCOS) is a multifactorial endocrine disorder often linked to obesity. This hormonal disorder also associated with different metabolic disorders and highlights the understanding of its molecular pathways is essential for developing an effective treatments approach. This work presents a systems-level evaluation of gene expression dynamics and key transcription factors which are involved in an obesity-induced PCOS rat model. Using high-throughput transcriptomic analysis in the study we identified significant alterations in the expression of the different genes associated with metabolic, endocrine, and reproductive pathways. A particular focus was placed on key transcription factors that regulate ovarian and adipose tissue functions, including those involved in steroidogenesis and inflammation. This study shows a distinct gene expression profile in the ovaries and adipose tissues of obese rats that mirrors key features of human PCOS, including disrupted folliculogenesis. These results provide insights into the molecular mechanisms which are able to connects obesity with PCOS pathogenesis and indicates the potential biomarkers and therapeutic targets for this complex condition. By integrating multi-omics data in prescribed therapeutic study we offer a comprehensive systems-level perspective of the obesity-induced PCOS phenotype, which will leadfor more targeted and personalized interventions in both clinical and preclinical settings.

Keywords: Polycystic ovary syndrome, obesity, gene expression, inflammation, biomarkers, reproductive pathways

Understanding the role of host-gut microbiome co-metabolism in aging: A metabolic phenotyping approach

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Abstract

Aging is characterised by gradual and progressive decline in cellular function and increased vulnerability to chronic diseases, accompanied by immunosenescence and inflammaging. Studies suggests that concurrently the gut microbiota undergoes functional and compositional shifts (gut microbial dysbiosis), influencing host physiology. Emerging evidence highlights that gut microbiota-host derived co-metabolites act as critical biochemical mediators, influencing host immunity and host mitochondrial health and thereby modulating the aging process. Gut microbial-host co-metabolites -such as tryptophan and other microbial metabolites- has acquired much attention in aging research as it serves as a critical substrate and the kynurenine, serotonin, and indole routes and modulate mitochondrial function, oxidative stress, and cellular senescence, yet the metabolic interactions between host and gut microbiota in aging remain unclear. Metabolic Phenotyping provides a powerful platform to study these alterations, however, due to wide physicochemical diversity within these pathways, a "one-size-fits-all" mass spectrometry approach remains challenging.

To address the analytical and knowledge gap, we developed a solid-phase extraction coupled with targeted LC-MS/MS method development based workflow which screens different ion-exchange extraction SPE i.e., weak (cation and anion exchanger) and moderate (cation and anion exchanger) combined with different chromatographies namely, reverse phase and HILIC with different pH conditions and obtain optimal conditions required to capture target analytes. Further, we validate this method and demonstrate its reproducibility and clinical utility by applying it to clinical human cohort samples among different age groups. Data analysis is undergoing using R studio (version 2026.01.0+392).

This validated workflow provides a reliable and high-throughput method for analysing diverse gut-microbial-host co-metabolites in complex biofluids. SPE helps to provides better matrix clean-up leading to specificity and accuracy for target analytes. This also enables the investigation of associations between gut microbial derived metabolites and age associated diseases and preliminary analysis of the human cohort successfully identified key shifts in gut-microbial-derived metabolites, highlighting the utility of this integrated analytical platform. This workflow demonstrates the synergistic strength of integrating complementary analytical tools, expanding the scope and depth of scientific investigation.

Keywords: Aging, Gut Microbiota, Solid-Phase Extraction, Mass Spectrometry, R.

Targeting ferroptosis as therapeutic intervention in Nephrolithiasis

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Abstract
Ferroptosis is a type of cell death that depends on iron, lipid peroxidation and weak antioxidant defences. The kidney is particularly at risk since it consumes a lot of oxygen and is exposed to circulating iron, which makes renal tubular cells vulnerable to oxidative stress. In nephrolithiasis, calcium oxalate (CaOx) crystals harm tubular cells and heighten oxidative stress, leading to ferroptosis. This occurs due to a drop in glutathione, lower activity of GPX4 and SLC7A11, and a buildup of iron and lipid peroxides. As a result, tubular cells lose their membrane integrity, send out inflammatory signals, and become sites for crystal attachment. Research shows that CaOx crystals cause typical ferroptosis changes like iron overload, lipid peroxidation, damage to mitochondria, and reduced antioxidant ability. Overall, ferroptosis plays a role in tubular injury, inflammation, and crystal retention, which helps in the formation and recurrence of kidney stones. Ferrostatin-1 and Liproxstatin-1 directly stop ferroptosis by scavenging lipid radicals and blocking iron-dependent lipid peroxidation in cell membranes. This action helps maintain the integrity of the membranes. Iron chelators like Deferoxamine, Deferiprone, and Deferasirox lower the labile iron pool. This reduction limits Fenton reactions and the generation of reactive oxygen species (ROS) that cause ferroptotic damage. N-acetylcysteine (NAC) restores intracellular glutathione by providing cysteine, which helps restore GPX4 activity and improve antioxidant defense. Vitamin E (α-tocopherol) serves as a lipid-soluble antioxidant that disrupts lipid peroxidation chain reactions in membranes. Ebselen mimics glutathione peroxidase activity and reduces lipid hydroperoxides, which supports GPX4 function. Sulforaphane activates the Nrf2 pathway, boosting the expression of antioxidant and iron-handling genes, including those that are important for glutathione synthesis. Resveratrol increases SIRT1 activity, leading to p53 deacetylation, higher SLC7A11 expression, and reduction of oxidative injury related to ferroptosis.

Keywords: Ferroptosis, Nephrolithiasis, Glutathione, Ferrostatin-1, Sulforaphane

T-Cell–Fibroblast crosstalk in Rheumatoid Arthritis Using Smart Biomaterials: A Targeted Strategy for Immune Reprogramming and Joint Regeneration

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Abstract
Rheumatoid arthritis (RA) is a chronic autoimmune disorder characterized by persistent synovial inflammation, progressive cartilage erosion, and irreversible joint damage. Pathogenic interactions between activated T lymphocytes and rheumatoid arthritis fibroblast-like synoviocytes (RA-FLS) play a central role in disease progression. Sustained immune stromal crosstalk drives excessive

production of pro-inflammatory cytokines, including tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and interleukin-17 (IL-17), leading to synovial hyperplasia, matrix degradation, and disruption of joint tissue homeostasis.Effective management of RA requires therapeutic strategies capable of reprogramming cytokine-driven cellular responses within the inflamed synovial microenvironment.Smart biomaterial platforms such as stimuli-responsive injectable hydrogels, polymeric nanoparticle-based carriers, and bioactive polymeric scaffolds enable localized and comprehensive controlled delivery of anti-rheumatoid arthritis drugs. These systems can be developed to respond to inflammatory that associated with elevated TNF-α, IL-6, and IL-17 levels, allowing adaptive regulation of drug release at disease-relevant sites. By controlling local drug exposure, smart biomaterials selectively modulate pathogenic T-cell signaling while suppressing the pro-inflammatory phenotype of RA-FLS.Recent advances demonstrate that biomaterial-based delivery approaches enhance local drug retention, reduce systemic exposure, and sustain immunomodulatory activity. However, the bioactive properties support cartilage protection and joint regeneration by establishing a reprogrammed microenvironment conducive to tissue repair. In conclusion, smart biomaterial-mediated reprogramming of T-cell–RA-FLS crosstalk represents a promising controlled drug delivery strategy for rheumatoid arthritis, integrating immune modulation with regenerative support.

Keywords: Rheumatoid arthritis, Fibroblast-like synoviocytes, Smart biomaterials, Immune reprogramming, Anti-rheumatoid arthritis drugs, Controlled drug delivery, Joint regeneration

Mechanisms of Cancer Metastasis

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Abstract
Introduction: Cancer metastasis is the primary cause of cancer-related mortality, accounting for more than 90% of cancer deaths worldwide. Metastasis is a multistep and highly complex biological process through which cancer cells disseminate from the primary tumor and colonize distant organs. Although the metastatic cascade shares common pathways across cancers, distinct tumor-specific molecular events also play a critical role in disease progression.
Objectives: This abstract aims to summarize the key molecular and cellular mechanisms involved in cancer metastasis and to highlight the major factors that contribute to tumor dissemination and secondary tumor formation.
Methodology: A systematic review of current literature was conducted focusing on molecular, genetic, and cellular mechanisms underlying cancer metastasis. Key processes analyzed include epigenetic regulation of tumor suppressor genes, the functional activity of tumor-associated

chemokine receptors, the role of circulating tumor cells, epithelial–mesenchymal transition (EMT), and resistance to anoikis.
Conclusion: Cancer metastasis is driven by a coordinated interaction of molecular and cellular mechanisms, with EMT and anoikis resistance playing central roles in metastatic progression. A comprehensive understanding of these pathways is essential for the development of effective diagnostic markers and targeted therapeutic strategies aimed at preventing and treating metastatic disease.

Keywords: Cancer metastasis, epithelial–mesenchymal transition, circulating tumor cells, chemokine receptors, tumor progression

Mechanistic Insights to the Role of Ferroptosis in Nephrolithiasis

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Abstract
Ferroptosis is one of the types of cell death caused by iron-dependent phospholipid peroxidation, which is controlled by a number of components such as redox homeostasis, iron metabolism, lipid metabolism, cellular metabolism, and mitochondrial function. Ferroptosis is a key factor in the development of diseases and damage to different tissues and organs. Recent studies indicates that in kidney stone formation, ferroptosis has a significant role. Through mechanisms such as oxidative stress, endoplasmic reticulum stress, and autophagy calcium oxalate, urate, phosphate, and selenium deficiency induces ferroptosis and promotes kidney stone formation. Through the activation of ferroptosis mediated by the p53/SLC7A11 pathway, ankyrin repeat domain 1 (ANKRD1) contributes to the growth and production of CaOx kidney stones. The GSH/GPX4 system acts against iron-dependent lipid peroxides and is a marker of ferroptosis. Loss of GPX4 expression or its inactivation leads to lipid hydroperoxides accumulation, interaction with excessive ferrous ions, and the generation of harmful lipid peroxides. Mechanisms such as the nuclear factor erythroid 2-related factor 2 (Nrf2), thioredoxin, p53, and nitrogen oxides (NOXs) are found to be involved in process of ferroptosis. In CaOx nephrolithiasis models, treatment with ferrostatin-1 (Fer-1) which is a ferroptosis inhibitor was partially found to reverse oxidative stress and lipid peroxidation. By modulating Acyl-CoA synthetase long-chain family member 4 (ACSL4) expression, yes-associated protein (YAP), a transcriptional co-activator in the hippo pathway, promotes ferroptosis. To suppress ferroptosis, YAP silencing works by downregulating ACSL4 expression, thereby mitigating calcium oxalate crystal-induced renal fibrosis. For preventing renal fibrosis in patients with kidney stones, targeting the YAP–ACSL4 axis and ferroptosis therefore hold promise as a potential therapeutic approach.

The molecular linkages between ferroptosis and the pathophysiology of nephrolithiasis have bee n demonstrated by growing experimental evidence, emphasizing the promising potential of ferroptosis-based therapeutic approaches in the treatment of kidney stones.

Keywords: Ferroptosis, Nephrolithiasis, Renal fibrosis, ferrostatin-1

Track III:
Drug Discovery and Biologicals

5HT7 receptor-targeted dual imaging carbon dots for glioblastoma imaging

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Abstract

The integration of SPECT and fluorescence imaging into a single probe offers a synergistic approach to cancer and tumour detection. In this study, we reported the synthesis and characterization of Tryptamine, diethylenetriaminepentaacetic acid, and ethylenediamine-based carbon dots for fluorescence and SPECT imaging. Carbon dots were synthesised from a pot pyrolysis method from tryptamine and ethylenediamine, where ethylenediamine acts as a carbonaceous source and tryptamine acts as a $5HT_7$ expressed tumour targeting functionalizing ligand. The resulting carbon dots exhibited a well-defined hydrodynamic size of 137.9 nm and a surface zeta potential of -22.5 mV, suggesting good colloidal stability. Optically, the carbon dots showed blue-green fluorescence under UV irradiation with distinct excitation-dependent emission behaviour. For nuclear imaging, the carbon dots were conjugated with 99m-technitium (^{99m}Tc) for highly sensitive gamma imaging. In vitro biocompatibility assessment via hemolysis and MTT assay confirms its biocompatibility. In the hemolysis assay, only 4% of cell rupture was observed even at 4h of incubation, and in the MTT assay, 18.3 % of cell death was observed with 100 µM concentration at 72 h of incubation. In vitro fluorescence imaging was also done with the U87 MG cell line to assess the cell uptake of the synthesized carbon dots. Further, dynamic and static Gamma imaging, along with biodistribution studies, confirm the uptake in the tumour. By successfully merging Gamma-FL imaging, this carbon dot-based imaging probe addresses the limitations of single-mode imaging and is useful for early-stage tumour imaging.

Keywords: Carbon dots, Multimodal imaging, Gamma imaging, Fluorescence imaging, Tumour imaging

A Dual-Platform Personalized mRNA and Oncolytic Viral Vaccine Approach in Cancer Immunotherapy

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Abstract
Many countries spend billions of dollars in search of an effective therapy against cancer in today's world. The most commonly seen forms of cancer are lung, breast, and colorectal cancer, many of which are being studied and researched in hopes of finding a cure. Meanwhile, a Russian research institute is presently working on designing a vaccine named "Enteromix," which is based on mRNA, which can treat the disease. Whereas the trial is currently in Phase I, the results suggest that the vaccine's dual component and approach are performing well. To overcome the challenges of tumor heterogeneity and the immunosuppressive nature, this dual-platform combines customized messenger RNA (mRNA) with engineered oncolytic enteroviruses. This dual-platform technique overcomes the challenges of tumor heterogeneity and the immunosuppressive microenvironment via the combination of customized messenger RNA (mRNA) with engineered oncolytic enteroviruses. The adaptive immune system is simultaneously focused toward new antigens that don't exist in healthy tissues through the inclusion of patient-specific mRNA, which originates from the specific mutational environment of the individual's tumor. Preliminary studies are done on the gastrointestinal and dermatological cancer in which biopsy used to take the tumor to exclude the mRNA strand of the cancer cells. The combined effect of the precision of mRNA-encoded CTL priming and viral-mediated "heating" of immunologically cool tumors signifies an effective barrier to immune invasion. This approach could decrease the probability of disease recurrence by promoting both acute tumor regression and long-term immune memory. Given the currently available evidence, this hybrid approach offers an exciting prospect for the next wave of cancer therapies, bridging the gap between personalized genomic medicine and broad-spectrum viral therapy

Keywords: mRNA, tumour, enteromix, immunotherapy

Revolutionizing Drug Delivery: Biodegradable Polymers Microneedles

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Abstract
The microneedles are tiny devices that are designed to pierce the outer layer of skin and deliver medicine directly into the skin. They are made from biodegradable polymer that dissolves and breaks down in the body. They are made of various materials like silicon, metals (stainless steel, nickel, and titanium), and polymers. Usually biodegradable polymers are preferred due to their biocompatibility and nontoxicity. They effectively increase the delivery of medicine, molecules like protein and extract biofluids for diagnostics. Thus increasing transdermal drug delivery up to 1000 times. They can be fabricated by using microelectronic industry tools like 3D printing,

photolithography, molding, or injection molding. They directly penetrate medicine through the skin without causing breaking, pain and discomfort. Microneedles are applicable for vaccine delivery (like Covid-19 vaccines and influenza vaccines delivered painlessly), insulin delivery, cancer immunotherapy, or targeted drug delivery. They can also be designed for controlled release and delivery of drugs based upon the polymer structure and composition. Microneedles are expected to have rapid growth due to their potential for self-administration and overcoming the need for trained medical professionals; microneedles can always be used for mass vaccination in the future.

Keywords: Microneedles, Transdermal drug delivery, Biodegradable polymers, 3D printing, Photolithography, Vaccine delivery, Insulin delivery, Cancer immunotherapy, Controlled drug release, Pain-free delivery, Self-administration, Microfabrication techniques

A Systems Pharmacology Framework to Elucidate the Therapeutic Potential of *Paederia foetida* Against Urolithiasis

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Abstract

Urolithiasis is a multifactorial renal disorder characterized by inflammation, oxidative stress, and metabolic imbalance, highlighting the need for multi-target therapeutic strategies. *Paederia foetida* Linn. (*P. foetida*), a member of the Rubiaceae family, is a climbing vine that can be found in temperate and tropical climates throughout Asia. This plant has long been highly valued for its medicinal properties by many cultures, including Ayurveda (Gandha Prasarini) and Traditional Chinese Medicine (TCM). The present study employed an integrated systems pharmacology and computational drug discovery framework to elucidate the anti-urolithiatic mechanisms of *Paederia foetida*. Phytochemical profiling identified 269 compounds. Network pharmacology analysis predicted key interactions with ABCB11, CYP2C19, FASN, G6PD, IL2, and PTGS2, indicating the involvement of inflammatory, lipid metabolic, and oxidative stress-related pathways. To provide disease-contextual support, transcriptomic profiling of Randall's plaque tissue (GSE73680) was performed to characterize urolithiasis-associated gene expression patterns. Although stringent differential expression filtering did not yield direct overlap with predicted targets, pathway-level enrichment revealed significant perturbations in inflammatory response, metabolic regulation, and redox homeostasis, supporting the systems-level relevance of the identified targets. Molecular docking demonstrated favourable binding affinities between the selected phytoconstituents and their respective protein targets, and these affinities were further validated by molecular dynamics simulations, which confirmed the structural stability of ligand-protein complexes under physiological conditions. In silico ADMET analysis indicated acceptable

pharmacokinetic properties and low predicted toxicity profiles for the prioritized compounds. Collectively, this integrative in-silico approach suggests that *Paederia foetida* exerts anti-urolithiatic effects through multi-target modulation of inflammation, oxidative stress, and metabolic pathways. The findings provide mechanistic insights and a rational basis for further experimental validation, supporting the potential of *Paederia foetida* as a promising source of lead compounds for urolithiasis management.

Keywords: Molecular docking, Network pharmacology, Urolithiasis, Transcriptomics, Molecular dynamics simulation.

Advances in Nanoparticle-Mediated CRISPR-Cas9 Strategies for Targeted Chronic Myeloid Leukaemia (CML) Therapy

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Abstract

Chronic Myeloid Leukaemia (CML) is a rare blood cancer disease. It affects about 1-2 people per 100,000 adults annually and accounting for 15% of newly diagnosed leukaemia cases. CML was the first cancer connected to a certain abnormality in a chromosome: the Philadelphia chromosome, which is formed by translocation between chromosomes 9 and 22. The result behind is it is the formation of the BCR-ABL fusion gene, which encodes a tyrosine kinase protein that drives uncontrolled white blood cell growth. Today's treatment relies on tyrosine kinase inhibitors (TKIs) such as imatinib, dasatinib, and many more, but TKIs present challenges in front of us, including long-term side effects, drug resistance, and limited bioavailability. Moreover, TKIs fail to eradicate leukemic stem cells, contributing to disease persistence and relapse.To overcome these issues, nanoparticles are being explored as one of the advanced new drug delivery systems. They allow targeted delivery of chemotherapeutics to malignant cells, minimize systemic toxicity, improve bioavailability, and help overcome drug resistance. CRISPR-Cas9 genome editing is a patient-friendly alternative. This technology is directed by the gRNA, which cuts defective DNA, corrects or disables the BCR-ABL gene. Integration of nanotechnology with CRISPR-Cas9 platforms, such as lipid-based nano-encapsulation, enhances safe delivery of CRISPR components into human cells. CML progresses through chronic, accelerated, and blast phases, highlighting the importance of early diagnosis and molecular monitoring using quantitative PCR for personalized treatment strategies. Preclinical studies in vivo mouse models showed that CRISPR-Cas9 successfully dismembered the BCR-ABL, which leads to better survival outcomes. Further research and clinical trials are going on to check the safety, efficacy, and long-term benefits of CRISPR-based therapies for CML.

Keywords: CRISPR-Cas9, BCR-ABL Fusion gene, Chronic myeloid leukaemia (CML), Nanoparticles, Systemic toxicity, Tyrosine kinase inhibitors (TKIs).

Advances in Targeting The Tumour Microenvironment And Immune Checkpoints In Triple-Negative Breast Cancer -Translational Therapeutic Strategies

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Abstract

Introduction Triple-negative breast cancer (TNBC) is an aggressive molecular subtype lacking oestrogen receptor, progesterone receptor, and HER2 expression, resulting in limited targeted therapies and significant unmet need. Advances in immunotherapy and tumour microenvironment (TME)-directed strategies have reshaped management. PD-1 and PD-L1 checkpoint blockade combined with chemotherapy improves outcomes in selected patients, while antibody–drug conjugates (ADCs) targeting TROP-2 demonstrate clinical benefit. However, response heterogeneity, adaptive immune resistance, and TME-driven immunosuppression limit durability. This study synthesizes recent translational advances targeting immune checkpoints and the TME to improve therapeutic precision and long-term outcomes in TNBC. *Methods* A narrative review of literature published between 2022 and 2025 was conducted using PubMed, Scopus, and Web of Science. Randomized trials, phase II/III studies, translational analyses, and mechanistic preclinical investigations were included. Key domains examined were checkpoint inhibitor efficacy and biomarker stratification, ADC activity and TME interactions, TME-reprogramming strategies including myeloid modulation and fibroblast targeting, and rational combination approaches addressing resistance. Regulatory updates and major oncology conference data were incorporated to enhance translational context. *Results* Phase III trials demonstrate that PD-1/PD-L1 blockade plus chemotherapy significantly improves progression-free and overall survival in PD-L1–selected TNBC cohorts. TROP-2–directed ADCs extend benefit to broader populations and show synergy with immunotherapy. Predictive biomarkers include PD-L1 combined positive score, tumour-infiltrating lymphocytes, immune gene signatures, and tumour mutational burden. Nonetheless, immunosuppressive myeloid niches, stromal barriers, and altered chemokine signalling reduce checkpoint efficacy. Preclinical models show that myeloid reprogramming, vascular normalization, and ADC-induced immunogenic cell death enhance antigen presentation and T-cell infiltration. *Conclusion* Biomarker-driven combination strategies targeting tumour-intrinsic pathways and TME-mediated immune suppression represent a promising translational framework in TNBC. Adaptive trials, multiplex biomarker validation, and optimized sequencing are critical to achieving durable benefit across heterogeneous TNBC populations.

Keywords: Triple-negative breast cancer; Tumour microenvironment; Immune checkpoint inhibitors; Antibody–drug conjugates; Translational oncology.

AI in the lifecycle of Pharmaceutical products

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Abstract
Involvement of AI in the development of a pharmaceutical product from the bench to the bedside can be imagined given that it can aid rational drug design ; assist in decision making; determine the right therapy for a patient, including personalized medicines; and manage the clinical data generated and use it for future drug development. E-VAI is an analytical and decision-making AI platform developed by Eularis, which uses ML algorithms along with an easy-to-use user interface to create analytical roadmaps based on competitors, key stakeholders, and currently held market share to predict key drivers in sales of pharmaceuticals, thus helping marketing executives to allocate resources for maximum market share gain, reversing poor sales and enabled them to anticipate where to make investments. AI faces some significant data challenges, such as the scale, growth, diversity, and uncertainty of the data. The data sets available for drug development in pharmaceutical companies can involve millions of compounds, and traditional ML tools might not be able to deal with these types of data. Quantitative structure-activity relationship (QSAR)-based computational model can quickly predict large numbers of compounds or simple physicochemical parameters, such as log P or log D. However, these models are some way from the predictions of complex biological properties, such as the efficacy and adverse effects of compounds. In addition, QSAR-based models also face problems such as small training sets, experimental data error in training sets, and lack of experimental validations. To overcome these challenges, recently developed AI approaches, such as DL and relevant modeling studies, can be implemented for safety and efficacy evaluations of drug molecules based on big data modeling and analysis. In 2012, Merck supported a QSAR ML challenge to observe the advantages of DL in the drug discovery process in the pharmaceutical industry. DL models showed significant predictivity compared with traditional ML approaches for 15 absorption, distribution, metabolism, excretion, and toxicity (ADMET) data sets of drug candidates.

Keywords: drug design, QSAR, AI, lifecycle

AI-DRIVEN SMART DRUG DELIVERY SYSTEMS IN ONCOLOGY

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Abstract

The emergence of Artificial Intelligence (AI) in pharmaceutical sciences has revolutionized drug delivery, particularly in oncology. Conventional approaches to cancer therapy, such as systemic chemotherapy, suffer from limitations including poor tumor specificity, off-target toxicity, low bioavailability, heterogeneous tumor microenvironments, and drug resistance. These challenges result in suboptimal therapeutic efficacy and severe side effects. AI, encompassing Machine Learning (ML) and Deep Learning (DL), addresses these by enabling predictive modeling, real-time adaptive release, and personalized dosing, ushering in "smart" systems that respond to stimuli (pH, temperature, enzymes) for precise, targeted delivery to tumor sites.

Aim & Objective: This work aims to explore recent advancements in AI-driven smart drug delivery systems for oncology, highlighting their role in enhancing targeted therapy precision, reducing toxicity, and improving patient outcomes through intelligent design and control.

Materials and Methods: A comprehensive literature search was conducted using Google Scholar, Scopus, and PubMed databases. Keywords included "AI", "machine learning", "deep learning", "smart drug delivery", "targeted delivery", and "oncology". Inclusion criteria focused on peer-reviewed articles, reviews, and studies from 2019–2025, emphasizing AI/ML applications in stimuli-responsive or targeted systems for anticancer delivery. Relevant data on methodologies, predictive models, and clinical/translational insights were extracted and synthesized narratively.

Results & Discussion: AI models (e.g., deep neural networks, generative algorithms), predict tumor delivery kinetics and design stimuli-responsive systems for controlled release in oncology. Applications include enhanced EPR effect exploitation, reduced off-target effects, and personalized nanomedicines for cancers like breast and prostate. Challenges such as data quality and model interpretability persist, but AI accelerates development, achieving higher tumor accumulation and efficacy in preclinical models compared to traditional methods. Integration with IoBNT and bio-cyber interfaces promises autonomous, adaptive delivery.

Conclusion: AI-driven smart drug delivery holds transformative potential for precision oncology, enabling safer and more effective targeted therapies.

Keywords: Artificial Intelligence, Deep Learning, Machine Learning, Drug Delivery, Cancer, Oncology

ALZHEIMER'S

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Abstract
Background: Alzheimer's disease is a progressive neurodegenerative disorder characterized by memory loss, cognitive impairment, and behavioral changes that interfere with daily activities. It is the most common cause of dementia among elderly individuals and represents a growing public health burden in India due to population aging. In 2024, the number of dementia patients in India was estimated to be around 8.8–9.0 million, which is projected to increase to approximately 9.3–9.5 million by 2025. Among these cases, nearly 6–6.6 million individuals are affected by Alzheimer's disease. The disorder is strongly associated with increasing age and is more prevalent among individuals aged 65–75 years, and nearly 30–40% of people above 85 years of age. Gender distribution indicates that females constitute about 60–65% of total Alzheimer's cases, whereas males account for approximately 35–40% of cases.
Methodology: This review paper is based on a systematic analysis of recently published national and international research articles on Alzheimer's disease. Relevant data were collected from epidemiological reports, clinical studies, and healthcare databases published between 2020 and 2025, including reports from national research organizations.
Result: The reviewed studies demonstrate that Alzheimer's disease prevalence in India increases with advancing age and shows a higher incidence among elderly females than males. The disease is primarily associated with amyloid-beta plaque accumulation and neurofibrillary tangles, resulting in neuronal degeneration and synaptic dysfunction.
Conclusion: Pharmacological therapies such as cholinesterase inhibitors and NMDA receptor antagonists have shown effectiveness in improving cognitive function and slowing disease progression. However, these treatments provide only symptomatic relief and do not offer a permanent cure. Early diagnosis, awareness, and timely therapeutic interventions are essential to reduce disease burden and improve the quality of life among affected individuals.

Keywords: Alzheimer's dementia; Cholinesterase receptor; NMDA receptor; Cognitive impairment; Age factor; Gender differences

Analytical Quality by Design (AQbD): A Practical and Science-Driven Approach to Robust Analytical Method Development

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Abstract

The aim of Analytical Quality by Design (AQbD) is to bring quality into the analytical method development process right from the start. AQbD emphasizes understanding the impact of different experimental variables on method development rather than performing test and error experiments. The first step in the procedure is to establish the Analytical Target Profile (ATP), which defines the expected results of the analytical method and the level of accuracy and precision required. Following that, potential risks are identified on the basis of the ATP to point out the variables that have a significant impact on the analysis result. Critical Method Attributes (CMAs) and Critical Method Parameters (CMPs) are identified through risk assessment methods. After that, the relationship between these parameters is understood in detail through the Design of Experiments (DoE) method. This helps to identify a Method Operable Design Region (MODR), where the method produces reliable and repeatable results. Operating within this defined region enables analysts to ensure method stability and minimize uncertainties through regular quality control testing. Another important aspect of AQbD is the management of longevity, where the method is regularly assessed and optimized if necessary. Since it has been taken into consideration, AQbD encourages a better understanding of analytical procedures and guarantees reliable performance throughout the entire lifetime of the product. By changing the emphasis from preventive troubleshooting to proactive planning, AQbD improves the reliability of analysis and helps to create safe and effective pharmaceuticals.

Besides enhancing robustness in methods, AQbD facilitates informed decision-making during method development by offering a scientifically sound explanation for the choice of conditions. The methodological approach is more transparent since all critical steps are justified by risk assessments documented in the literature and experimental data. Such an understanding is less prone to unexpected failures of the method during validation and use.

Keywords- Analytical Quality by Design (AQbD), Analytical Target Profile (ATP), Design of Experiments (DoE), Method Operable Design Region (MODR)

Artificial Intelligence as a Transformative Tool in One Health Strategies Against Antimicrobial Resistance

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Abstract:

Antimicrobial resistance (AMR) is a growing concern in global public health due to the inappropriate and excessive use of antimicrobials in human and veterinary medicine, agriculture, and environmental contamination. The efficacy of currently available antimicrobial agents is

threatened by the rapid development of multidrug-resistant microorganisms, which also affects general medical practices. The relevance of the One Health approach is highlighted by monitoring programs, including national monitoring programs, that highlight the linkages between humans, animals, and the environment in the development of antimicrobial resistance. The lack of coordination, implementation, and global surveillance, however, remains a challenge in the control of antimicrobial resistance, particularly in developing countries.
However, the pipeline for developing antibiotics remains insufficient, with very few new antibiotic approvals in recent years. According to the WHO report on antibacterial agents in clinical development, only 18 new antibiotics have been approved since 2014. Hence, new antibiotics are urgently required. The traditional method of drug discovery is costly and time-consuming; hence, there is a need for new and innovative methods. Artificial intelligence (AI) and machine learning (ML) are increasingly being utilized to accelerate antimicrobial drug discovery, enhance small molecules and antimicrobial peptides, predict resistance mechanisms, and enhance diagnostic performance. Moreover, new strategies such as phage therapy, vaccine development, microbiome-based therapy, and enhanced stewardship programs provide complementary tools to tackle resistance. To tackle AMR, there is a need for global collaboration that includes AI-driven innovation, enhanced surveillance infrastructure, regulatory reforms, antimicrobial stewardship, infection control, and public engagement. A multidisciplinary and One Health approach is essential to preserve antimicrobial efficacy and safeguard global health.

Keywords: Antimicrobial resistance; Artificial intelligence; One Health, Surveillance; Antibiotic stewardship; Drug discovery, Global health.

Artificial Intelligence–Driven Innovations in Veterinary Drug Development

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Abstract
Artificial Intelligence (AI) is reshaping the drug discovery and development in veterinary sciences by making the process faster, smarter, and more efficient. In particular, AI has the potential to play various important roles in the veterinary clinical practice, enhancing the way veterinary care is delivered to the animals, improving as well as enhancing the outcomes for animals and ultimately humans. Artificial intelligence is also vital in information technology modernization efforts, aimed at smooth-running data management and enhancing operational efficiency. This abstract highlight the efforts to integrate AI and Machine learning in safety surveillance, including signal detection and case processing. It emphasizes the importance of human-led governance, data quality, and model validation in ensuring the ethical deployment of AI technologies. The field of veterinary science has traditionally relied on empirical observations, clinical expertise, and diagnostic tests

to diagnose and treat animal diseases. While these methods have served the veterinarians well for many centuries, the rapid progression of AI over the years has opened new possibilities for enhancing veterinary care. AI detects fine anomalies in diagnostic images and genetic markers, enhancing early disease detection capacity. This early identification is vital in initiating timely interventions or treatments, potentially preventing the progression of diseases or enabling more effective management strategies with respect to the disease. AI-driven diagnostics identify health issues and contribute to personalized treatment recommendations. By considering individual variations in genetic makeup and response to therapies and drugs, these tools assist veterinarians in tailoring treatment plans that are more likely to yield positive outcomes but in cost of time. Using tools such as machine learning as well as deep learning, scientists can identify potential drug targets, can predict how molecules will behave, and screen thousands of compounds in a fraction of the usual time

Keywords: veterinary sciences, innovation , AI, faster , smarter

Azole-Pyrazole Hybrids and Nitroimidazole Prodrugs as Anti-TB Leads

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Abstract

Background Tuberculosis (TB) is a leading cause of death worldwide, and the challenge is compounded by the rise of multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains. *Objective* This study focuses on azole heterocyclic derivatives as anti-tubercular agents which are found to be effective against both latent and active TB. besides natural products could help therapeutics. *Methods* The study highlights bicyclic nitroimidazole azole derivatives, their modes of action through cytochrome P450 inhibition, impairment of lipid and mycolic acid biosynthesis, and F_{420}-dependent nitroreductase activation etc. Besides that, plant-based derivatives like curcumin, alkaloids, and terpenoids etc were also incorporated for understanding the mechanism towards antitubercular activity. The emphasis was on hypoxia models, resistance-linked targets, and comparative structure, activity trends that have been reported across preclinical studies. *Results* Azole heterocycles found to exhibit antimycobacterial properties not only under the presence of oxygen but also in hypoxic conditions. Nitroimidazole derivatives were also reported active against dormant bacteria. Development of the resistance phenomenon remains an issue whereas the natural products showed the features of immunomodulatory and hepatoprotective potential. *Conclusion* The study provided suitable evidence that azole heterocycles as scaffolds could be a base for new antitubercular drugs. Combining them with plant-based host-directed therapies could probably be an effective strategy for enhancing efficacy, reducing the toxicity, and found to be an effective against TB management and reducing the time span for the treatment duration. These combined approaches have the potential to increase

treatment adherence, resolve MDR/XDR persistence, and help in the development of shorter regimens.

Keywords: Tuberculosis, Azole derivatives, Nitroimidazoles, Pretomanid, Drug-resistant TB

Beta Blockers in the Management of Cardiovascular Disorder Modulators: A Review

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Abstract

Cardiovascular disorders (CVDs) remain one of the leading causes of morbidity and mortality worldwide, creating a continuous demand for effective and evidence-based therapeutic strategies. Among the various pharmacological interventions available, beta-adrenergic receptor blockers (beta-blockers) play a central role in the management of multiple cardiovascular conditions such as hypertension, ischemic heart disease, arrhythmias, and chronic heart failure. These drugs exert their pharmacological effects primarily by blocking β-adrenergic receptors, resulting in decreased heart rate, reduced myocardial contractility, and lowered cardiac output, which collectively reduce myocardial oxygen demand and improve cardiac performance.
Beta-blockers are broadly classified into non-selective agents, cardioselective β1-blockers, and third-generation beta-blockers with additional vasodilatory or antioxidant properties. Clinical studies have demonstrated that the appropriate use of beta-blockers significantly decreases mortality and rehospitalization rates in patients with heart failure and following myocardial infarction. Their effectiveness in controlling ventricular rate in arrhythmias and preventing recurrent anginal episodes further highlights their importance in long-term cardiovascular therapy. Despite their therapeutic advantages, careful dose titration and patient selection are essential to minimize adverse effects such as bradycardia, fatigue, bronchospasm, and metabolic disturbances. Recent advancements in pharmacogenomics and personalized medicine are improving the understanding of patient-specific responses to beta-blockers, thereby enhancing treatment outcomes. Furthermore, ongoing research focuses on the development of novel formulations and combination therapies aimed at maximizing therapeutic efficacy while maintaining safety. In conclusion, beta-blockers continue to represent a cornerstone in the pharmacological management of cardiovascular disorders due to their proven clinical benefits, safety profile, and versatility across diverse cardiac conditions.

Keywords: Beta-blockers, cardiovascular disorders, hypertension, heart failure, arrhythmia, pharmacotherapy.

Bioanalytical Method Development and Validation for Quantification of Caffeine & Misoprostol in Biological Matrix

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Abstract
Orthodontic tooth movement can be enhanced pharmacologically by agents involved in bone remodeling and inflammatory pathways. Caffeine and misoprostol are considered two compounds of interest in orthodontic research. Caffeine influences cellular signalling and bone turnover by modulating inflammatory mediators, while misoprostol, a prostaglandin E_1 analogue, enhances osteoclastic activity and bone resorption associated with tooth movement. In order to translate this pharmacological concept into a clinically relevant approach, a localized formulation has been developed in our laboratory to deliver these agents directly into the gingival tissues. Prior to *in vivo* evaluation, bioanalytical studies are necessary to quantify drug permeation and retention in gingival tissue. However, simultaneous quantification of these agents in the gingival tissue is challenging due to the complex biological matrix. To the best of our knowledge, no HPLC-UV method has been reported for the simultaneous estimation of caffeine and misoprostol in biological matrix. The present study aimed to develop and validate a simple, sensitive and selective HPLC-UV bioanalytical method for the simultaneous estimation of caffeine and misoprostol in gingival tissue using an internal standard. Chromatographic separation was achieved on a reversed-phase C_{18} column using a mobile phase consisting of ACN, orthophosphoric acid and water with UV detection. The sample preparation involved tissue homogenization followed by protein precipitation. The developed method was validated in accordance with USFDA bioanalytical guidelines. The method demonstrated good selectivity, linearity and acceptable sensitivity for both the analytes. Precision, accuracy, recovery, matrix effect, carry-over effect and stability met the recommended acceptance criteria across the studied concentration range. Thus, the developed bioanalytical method offers a reliable and cost-effective approach for the quantitative determination of caffeine and misoprostol in biological matrix.

Keywords: Orthodontic, Bioanalytical, USFDA, HPLC-UV

Mycosynthesis of Iron Nanoparticles for Suppression of pathogenic fungal proliferation

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Abstract:
The increasing prevalence of antifungal resistance and the environmental burden associated with chemical fungicides necessitate the development of sustainable antifungal alternatives. In this study, we report a green, fungus-mediated mycosynthesis of iron nanoparticles (Fe-NPs) using the cell-free culture filtrate of *Aspergillus flavus* and evaluate their antifungal efficacy against the pathogenic fungus *Aspergillus niger*. The fungal filtrate functioned as both a reducing and stabilizing agent under mild reaction conditions, yielding stable, predominantly spherical Fe-NPs. Nanoparticle formation and physicochemical properties were confirmed using UV–visible spectroscopy and dynamic light scattering, while zeta potential analysis indicated good colloidal stability and surface charge characteristics imparted by fungal biomolecules.
The antifungal potential of the biosynthesized Fe-NPs was assessed through in vitro assays including radial growth inhibition, minimum inhibitory concentration (MIC) determination, and spore-germination studies, which demonstrated a clear concentration-dependent suppression of *A. niger* growth and sporulation. Microscopic examination of treated mycelia revealed pronounced alterations in hyphal morphology, branching patterns, and spore structure, indicating nanoparticle-induced cellular stress. To further elucidate the mechanism of action, extracellular biochemical analyses were performed, including chitin content estimation and protease activity assays. Significant modulation of chitin levels and protease activity in treated cultures suggested disruption of fungal cell-wall architecture and associated metabolic processes.
The observed antifungal activity highlights a selective cross-species interaction between *A. flavus*-derived nanoparticles and *A. niger*, underscoring the role of biologically derived surface capping in mediating antifungal efficacy. Collectively, this work integrates green synthesis, nanoparticle characterization, antifungal bioassays, and fungal biochemical profiling to position biogenic iron nanoparticles as promising eco-friendly candidates for antifungal and agricultural pathogen control applications.

Keywords: Mycosynthesis, Iron Nanoparticles, Antifungal activity, Green Nanotechnology, Pathogen control

Biomimetic Nanocarriers for the Management of Colorectal Cancer

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Abstract
Background: Colorectal cancer (CRC) is one of the most prevalent and deadly malignancies worldwide, and its treatment is often limited by poor drug bioavailability, systemic toxicity, and

the emergence of drug resistance. Biomimetic nanocarriers, which utilize cell membrane-coated nanoparticles, have emerged as a promising strategy to overcome these limitations by mimicking biological systems and enhancing therapeutic precision.
Aim: This study aims to review the design, fabrication, and therapeutic applications of biomimetic nanocarriers for targeted colorectal cancer therapy and to highlight their advantages, challenges, and future prospects in clinical translation.
Methodology: A comprehensive literature review was conducted using databases such as PubMed, Scopus, Web of Science, and Google Scholar, covering studies published from 2012 to 2025. Relevant research articles, reviews, and experimental studies on biomimetic nanocarriers, membrane-coated nanoparticles, and targeted CRC therapy were analyzed and critically evaluated.
Results: Biomimetic nanocarriers fabricated using membranes derived from red blood cells, platelets, cancer cells, immune cells, and hybrid systems demonstrated enhanced biocompatibility, prolonged circulation time, immune evasion, and improved tumor targeting. These systems have shown significant potential in various therapeutic modalities, including chemotherapy, immunotherapy, gene therapy, photothermal therapy, enzyme-based therapy, and theranostic applications. Compared to conventional nanocarriers, biomimetic systems exhibited superior tumor penetration, sustained drug release, and reduced systemic toxicity. However, challenges such as scalability, membrane heterogeneity, stability, immunogenicity, and regulatory concerns remain major barriers to clinical translation.
Conclusion: Biomimetic nanocarriers represent a promising next-generation drug delivery platform for colorectal cancer therapy, offering enhanced targeting efficiency and therapeutic outcomes. Future research should focus on standardized manufacturing protocols, personalized nanomedicine approaches, and integration of advanced technologies to facilitate clinical translation and improve patient-specific cancer management.

Keywords: Biomimetic nanocarriers, colorectal cancer, targeted drug delivery, nanotechnology, immunotherapy

Bridging Regulatory Gaps For Vaccine Translation In Emerging Markets: Pathways To Harmonized Approvals

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Abstract
Vaccination remains one of the most effective public health interventions, yet the pathway from innovation to equitable deployment is uneven across emerging markets. While scientific advances such as mRNA and viral vector platforms have transformed vaccine development, regulatory

systems in many low- and middle-income countries remain fragmented, resource-constrained, and procedurally divergent. Global access analyses, including lessons from COVID-19 vaccine rollout, show that regulatory heterogeneity contributes significantly to delays in authorization and distribution.

Pandemic-era accelerated reviews demonstrated that regulatory agility is achievable without compromising scientific rigor. Mechanisms such as rolling submissions, structured scientific dialogue, and reliance on prior assessments substantially reduced review timelines. However, these approaches have not been uniformly institutionalized in emerging markets, where differences in Chemistry, Manufacturing and Controls (CMC) requirements, post-approval change management, and documentation standards often lead to duplicative evaluations and extended approval timelines.

Regulatory reliance and recognition mechanisms have emerged as practical strategies to address inefficiencies. International collaborative pathways and structured reliance pilots indicate that such frameworks can shorten timelines while preserving national sovereignty. Importantly, reliance is increasingly viewed not only as a procedural efficiency tool but also as a mechanism to advance vaccine equity and reduce access disparities.

Capacity limitations within National Regulatory Authorities remain a critical barrier to timely access. Strengthening regulatory science competencies, harmonizing technical standards, and advancing regional convergence efforts are essential for sustainable manufacturing and supply resilience.

This research comparatively evaluates regulatory pathways across selected ICH-aligned and emerging market authorities, focusing on CMC lifecycle management, clinical expectations for platform technologies, post-approval variations, and implementation of reliance models. A harmonization-oriented framework is proposed, integrating early scientific advice, standardized documentation, structured reliance agreements, risk-based oversight, real-world evidence, and coordinated pharmacovigilance. The study concludes that harmonization enhances efficiency, predictability, and equity, supporting faster vaccine translation while safeguarding quality, safety, and efficacy.

Keywords: Vaccine Regulation; Regulatory Harmonization; Emerging Markets; Regulatory Reliance; CMC Alignment; Post-Approval Change Management; Translational Development; WHO Collaborative Registration Procedure; Regulatory Science; Vaccine Equity; Platform Technologies; National Regulatory Authorities.

Caffeine as a Clinical Drug: Mechanism, Therapeutic Applications and Clinical Limitations

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Abstract
Caffeine (1,3,7-trimethylxanthine) is one of the most widely consumed central nervous system stimulants and easily crosses the blood–brain barrier. It has almost complete oral bioavailability and predictable pharmacokinetics, which makes its effects reliable and consistent. Although it is commonly consumed in beverages like coffee and tea, caffeine has important therapeutic applications beyond its role as a dietary stimulant. This review evaluates its mechanism of action, clinical uses, metabolic pathway, and limitations to better understand its potential as a clinical drug.
Caffeine primarily acts as a competitive antagonist at adenosine A1 and A2A receptors in the brain. By blocking these receptors, it prevents the inhibitory effects of adenosine, leading to increased neuronal activity and enhanced release of excitatory neurotransmitters such as dopamine and norepinephrine. As a result, alertness and cognitive performance are improved. Clinically, caffeine citrate is widely used in the treatment of apnea of prematurity, where it stimulates the respiratory center and reduces episodes of interrupted breathing in premature infants. It is also included in formulations for migraine and tension headaches, as it causes cerebral vasoconstriction and improves the effectiveness of analgesics. Recent studies also suggest possible neuroprotective effects, including protection of dopaminergic neurons and reduction in amyloid-beta accumulation, indicating potential benefits in neurodegenerative conditions.
Caffeine is metabolized in the liver by Cytochrome P450 1A2 through N-demethylation to form paraxanthine, an active metabolite that contributes to its prolonged pharmacological action. However, its clinical use is limited by dose-dependent adverse effects, development of tolerance with long-term use, possible drug interactions mediated by CYP1A2, and genetic variations that affect individual metabolism.

Keywords - Caffeine, Adenosine receptor antagonism, Apnea of prematurity, Neuroprotection, CYP1A2 metabolism, Pharmacokinetics

Car-t Cell–derived Extracellular Vesicles for Targeted Rna Drug Delivery In Lymphoma - Preclinical Advances And Translational Roadmap

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Abstract
Introduction Chimeric antigen receptor T (CAR-T) cell therapy achieves high remission rates in relapsed or refractory B-cell lymphomas but is constrained by manufacturing complexity, limited

tumour penetration, and severe immune toxicities. CAR-T cell–derived extracellular vesicles (CAR-EVs) preserve antigen specificity while offering a cell-free platform with reduced inflammatory risk. This work synthesizes recent preclinical evidence on CAR-EV biology and evaluates their potential as vehicles for targeted RNA delivery to lymphoma cells, defining translational opportunities and development bottlenecks. *Methods* Experimental data were integrated from in vitro cytotoxicity assays, murine lymphoma xenografts, and GMP-scale EV isolation studies to evaluate (1) biodistribution and tumour targeting, (2) delivery of siRNA and mRNA cargos, (3) antigen-dependent cytotoxicity, and (4) safety metrics including cytokine induction and off-target effects. Engineering strategies such as surface CAR display, RNA loading approaches, and synthetic EV analogues were compared for delivery efficiency and translational feasibility. *Results* Preclinical evidence indicates that CAR-EVs expressing surface CAR molecules preferentially bind antigen-positive lymphoma cells, enabling RNA-mediated gene knockdown or pro-apoptotic signalling. CAR-EV administration reduced tumour burden in xenografts and restored sensitivity to adjunct therapies while producing lower systemic cytokine responses than parental CAR-T infusions. Synthetic EVs and optimized loading methods improved RNA stability and tumour uptake in vivo. Key translational challenges include scalable GMP manufacturing, targeting heterogeneity, pharmacokinetics, immune clearance, and biosafety validation. *Conclusion* CAR-T cell–derived EVs represent a promising drug delivery platform for targeted RNA therapeutics in lymphoma, combining antigen specificity with improved safety. Clinical translation requires standardized GMP production, validated RNA loading, pharmacokinetic modelling, and staged first-in-human trials to enable safer off-the-shelf immunotherapeutic strategies.

Keywords: CAR-T cell–derived extracellular vesicles, Targeted RNA drug delivery, B-cell lymphoma, immunotherapy, Cell-free nanotherapeutics.

Chronotherapeutic Drug Delivery System: Bridging Circadian Biology and Pharmaceutical Technology

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Abstract
The transition from the historical reliance on homeostatic stability to a dynamic chronobiological paradigm represents a seminal shift in the trajectory of precision medicine. While traditional pharmacotherapy has long prioritized zero-order kinetics to maintain steady-state plasma concentrations, the emergence of chronobiology reveals that human physiology is inherently

oscillatory, governed by a hierarchical network of circadian oscillators. This review provides a comprehensive synthesis of Chronotherapeutic Drug Delivery Systems (ChDDS), which are engineered to synchronize pharmacological intervention with the body's endogenous rhythms, thereby maximizing therapeutic efficacy while ameliorating dose-dependent toxicities. At the molecular level, the study elucidates the intricate transcriptional-translational feedback loops—driven by core clock genes such as CLOCK, BMAL1, PER, and CRY—that orchestrate rhythmic variations in drug metabolism, transporter activity, and receptor sensitivity. These biological rhythms underpin the phenomenon of chronopathology, where disease states such as cardiovascular crises, nocturnal asthma, and rheumatoid arthritis exhibit predictable temporal surges in symptom severity. Technologically, the review evaluates the evolution of ChDDS from conventional time-controlled barriers to sophisticated, stimuli-responsive platforms. Innovations in materials science, including pH-responsive polymers, enzyme-triggered matrices, and externally regulated systems like magnetic and light-responsive nanocarriers, offer unprecedented control over drug release profiles. Furthermore, the integration of 3D-printing, microchip-based implants, and AI-driven "chrono-phenotyping" allows for the customization of dosage forms to an individual's specific chronotype. Despite prevailing regulatory hurdles regarding bioequivalence and inter-patient physiological variability, the convergence of digital health and nanopharmaceutics positions chronotherapeutics at the vanguard of next-generation healthcare. By transcending the limitations of the "one-size-fits-all" model, ChDDS offer a robust framework for achieving a truly personalized, biology-centric therapeutic approach in the 21st century.

Keywords: Chronotherapeutic Drug Delivery Systems, Chronopharmacology, Circadian Rhythm, CLOCK-BMAL1, Pulsatile Release, Chronopathology, Precision Medicine, Nanopharmaceutics, Chrono-phenotyping, 3D-Printed Pharmacotherapy.

Competitive Intelligence in Biosimilars: Cross-Market Regulatory and Pricing Analysis

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Abstract
The global market for biosimilars marks a significant transition in regulatory science and pharmaceutical economics. This paper presents comprehensive market intelligence across three major jurisdictional ecosystems United States, United Kingdom, and India examining regulatory pathways, competitive dynamics, and pricing mechanisms that shape biosimilar market evolution. The worldwide biosimilars market is expected to grow from its 2025 valuation of USD 40.36 billion to USD 191.29 billion by 2035 (CAGR: 16.84%), according to our estimate. The FDA's centralized interchangeability framework contrasts with the EMA's member-state discretion, and India's new DCGI norms generate different competitive conditions. These significant regulatory

differences continue despite efforts to harmonize. In developed countries, biosimilar market entry is associated with 10–13% originator price decreases per competitor; nevertheless, later-entrant firms' profitability is constrained by pricing convergence. India is positioned as a crucial node in global biosimilar supply chains due to its rise as a hub for biosimilar manufacturing, cost-competitive advantage, and changing regulatory frameworks. This paper provides strategic intelligence for biopharmaceutical manufacturers, healthcare payers, and regulatory agencies navigating complex market dynamics and developing evidence-based biosimilar commercialization strategies. An integrated global market intelligence framework—combining market sizing, competitor mapping, and product benchmarking—provides a structured approach to understanding and forecasting biosimilar competition. As biologic patent expirations continue, such frameworks will become increasingly essential for manufacturers, investors, and policymakers navigating complex pharmaceutical ecosystems. The analysis integrates three dimensions: market sizing and opportunity realization, competitor landscape dynamics, and product-level benchmarking.

Keywords: Biosimilar Market Intelligence, Regulatory Strategy, Comparative Pricing Analysis, Global Market Dynamics, Manufacturing Economics.

Cyclisation of Favipiravir with $PhPCl_2$ and its Chalcogenides

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Abstract

Favipiravir is a well-established broad-spectrum antiviral agent widely used for the treatment of RNA virus infections due to its ability to inhibit viral RNA-dependent RNA polymerase. Despite its proven therapeutic potential, certain limitations such as moderate bioavailability, dose-related side effects, and the need for improved pharmacokinetic performance encourage structural modification to enhance its overall efficacy. Chemical derivatization of favipiravir provides an effective strategy to optimize its biological activity and physicochemical properties.

In the present study, favipiravir was subjected to cyclisation using phenylphosphonic dichloride ($PhPCl_2$), leading to the formation of a novel phosphorus-containing heterocyclic intermediate. The incorporation of a phosphorus moiety is particularly significant, as organophosphorus heterocycles are known to exhibit enhanced biological activity, improved lipophilicity, and better membrane permeability. Following cyclisation, the resulting phosphorylated compound was further reacted with different chalcogen sources to synthesize a new series of derivatives containing oxygen, sulfur, and selenium atoms. The introduction of chalcogen elements is expected to modulate electronic distribution, redox behavior, and molecular stability, thereby potentially improving antiviral and pharmacological properties.

The synthesized compounds were thoroughly characterized using spectroscopic techniques, with particular emphasis on ^{31}P NMR spectroscopy. ^{31}P NMR serves as a powerful analytical tool for confirming the formation of P=O, P=S, and P=Se functionalities and for assessing the electronic environment around the phosphorus center. The observed chemical shifts and coupling patterns provided clear evidence of successful cyclisation and chalcogen incorporation.
Overall, this structural modification strategy opens new avenues for the development of improved favipiravir-based antiviral agents with enhanced therapeutic potential.

Keyword: Favipiravir derivatives; Organophosphorus heterocycles; Antiviral drug design; Chalcogen incorporation; ^{31}P NMR spectroscopy; Pharmacokinetic optimization

Design and Optimization of a Nanoformulation Using QbD Approach for Enhanced Antifungal Treatment of Seborrheic Dermatitis

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Abstract
Seborrheic dermatitis is a chronic inflammatory dermatological disorder affecting the scalp, face, and upper chest, characterized by erythema, pruritus, and scaling, and is strongly associated with *Malassezia* species. Current management primarily relies on topical antifungals and corticosteroids. Although corticosteroids effectively suppress inflammation, their prolonged use may result in adverse effects such as skin atrophy, while systemic antifungals including itraconazole and fluconazole are associated with potential systemic complications. Conventional topical formulations further exhibit limitations such as poor skin penetration, irritation, delayed onset of action, variable dosing, and the requirement for frequent application.
To address these challenges, cubosomal formulations of ciclopirox olamine were developed to enhance topical delivery and therapeutic efficacy. Preformulation studies were performed to assess drug–excipient compatibility. Formulation development involved selection of a suitable preparation technique followed by optimization of lipid and surfactant concentrations, stirring time, and stirring speed. A central composite design comprising 13 experimental runs was employed to achieve systematic optimization.
The optimized cubosomes exhibited particle sizes ranging from 46.58 ± 16.64 nm to 78.15 ± 62.29 nm, with a polydispersity index of 0.189–0.315 and a zeta potential of −26.38 mV, indicating good stability. Drug entrapment efficiency ranged from 92.13 ± 0.03% to 97.34 ± 0.04%. In vitro drug release reached 97.70 ± 0.79% over 24 h compared with 78.13 ± 1.20% for the marketed formulation. The optimized cubosomal gel demonstrated enhanced permeation, superior antifungal activity, and minimal inflammatory response. These findings suggest that the developed

cubosomal system represents a promising, safe, and effective therapeutic approach for the management of seborrheic dermatitis.

Keywords: Seborrheic dermatitis; Cubosomal drug delivery; Ciclopirox olamine; Topical antifungal therapy; Skin permeation enhancement; Controlled release

Resolving The Therapeutic Dilemma: Acute And Sub-acute Toxicity Assessment Of Euphorbia Lactea Extract Using Oecd Guidelines

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ABSTRACT
The genus Euphorbia presents a significant therapeutic dilemma. While E. Lactea is traditionally valued for its anti-inflammatory and antimicrobial properties, literature confirms that related species (e.g., E. Tirucalli and E. Hirta) have demonstrated clear dose-dependent toxicity. Specific findings include significant hepatic enzyme elevation and renal tubular damage at high doses, raising major safety concerns regarding the genus as a whole. Existing acute toxicity studies on E. Lactea are grossly insufficient, reporting non-lethality but critically lacking detailed histopathological confirmation and comprehensive serum biochemical profiling. Furthermore, sub-acute (28-day repeated-dose) safety data is entirely absent. Therefore, a standardized assessment is an absolute necessity. The objective of this research is to logically and comprehensively close this critical safety gap. Our study will determine the LD50 and establish the No-Observed-Adverse-Effect Level (NOAEL) for the E. Lactea extract in Wistar rats. The methodology will strictly adhere to international standards: the acute study will follow OECD Guideline 423, and the 28-day sub-acute study will follow OECD Guideline 407. Evaluation will encompass the systematic analysis of hematology, serum biochemistry (including LFTs, RFTs, and Lipid Profile), and microscopic Histopathology of all major organs (liver, kidney, heart, spleen). This research will provide the essential preclinical safety data required by regulatory bodies, demonstrating the necessity of this study for guiding the responsible advancement of E. Lactea phytomedicines.

Keywords: Euphorbia lactea, Therapeutic Dilemma, Sub-Acute Toxicity, NOAEL, OECD 407, Histopathology.

Design, *In-Silico* Studies and Microwave Assisted Synthesis of Pyrazole Derivatives as Anti-inflammatory Agents

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Abstract
A novel series of pyrazole derivatives (3a–3g) was synthesized efficiently via the Vilsmeier–Haack reaction under microwave-assisted conditions, offering a rapid, high-yielding, and environmentally favorable synthetic approach. The microwave methodology significantly reduced reaction time while improving overall efficiency compared to conventional heating techniques. All synthesized compounds were structurally characterized using appropriate spectroscopic and analytical methods to confirm their chemical structures and purity.
The newly synthesized derivatives were evaluated for their anti-inflammatory potential through a combination of computational and experimental approaches. Molecular docking studies were performed against selected inflammatory targets to investigate ligand–receptor interactions and predict their biological activity. The docking analysis revealed that compounds 3a, 3c, and 3e exhibited superior binding affinities and stable interactions within the active site of the target proteins, suggesting strong inhibitory potential against key mediators of inflammation. Detailed interaction profiling indicated favorable hydrogen bonding, hydrophobic interactions, and optimal orientation within the binding pocket, which may contribute to their enhanced activity.
To validate the in-silico findings, in-vivo anti-inflammatory activity was assessed using the rat paw edema model. The experimental results demonstrated that compounds 3a, 3c, and 3e significantly reduced edema formation compared to the control group, showing a clear correlation with the docking predictions. The consistency between computational and biological data highlights the reliability of the integrated approach used in this study.
The combined in-silico and in-vivo investigations suggest that these pyrazole derivatives, particularly compounds 3a, 3c, and 3e, possess promising anti-inflammatory activity and may serve as potential lead candidates for the development of novel therapeutic agents targeting inflammatory disorders.
Keywords: anti-inflammatory, *in-silico*, *in-vivo,* molecular docking, pyrazole.

Design, Optimization, and Therapeutic Potential of Mucoadhesive Nasal Patch-Based Drug Delivery Systems.

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Abstract
Mucoadhesive nasal patches are a promising non-invasive platform that improves local as well as systemic therapeutic outcomes. The nasal route has several advantages in that it provides rapid drug absorption, bypasses first pass hepatic metabolism and provides a direct avenue to the

systemic circulation and central nervous system via the nasal and trigeminal routes. Conventional nasal sprays and drops, however, have limitations such as short residence time, mucociliary clearance and the varying bioavailability. Mucoadhesive patches eliminate all these challenges due to their good adhesion property to the nasal mucosa which
increases the residence time and improves absorption. Designing of mucoadhesive patches involves the selection of polymers that are strongly mucoadhesive, biocompatible and mechanically robust. Common polymers are chitosan, Carbopol, hydroxy propylene methyl cellulose, sodium alginate which form hydrogen bonds and electrostatic interactions with mucosa of the nose. Optimization of therapy Patch thickness, drug loading, swelling behaviour, mucoadhesive strength, and controlled release kinetics are optimization goals that will lead to the best performance in therapy while also ensuring the best comfort and safety for the patient. Therapeutically, the mucoadhesive patches have shown great promise when it comes to delivering peptides, proteins, vaccines, hormones, and drugs to treat neurological disorders. Because they increase bioavailability and have a sustained release, they are especially suitable for chronic conditions in which dosing frequency is high. These systems also bring with them improved compliance in the patient and greater reduction of systemic side effects compared with invasive routes. Overall, mucoadhesive nasal patterns are a diverse novel technique with important clinical possibilities. Ongoing research, in formulation design, optimization methods, and in vivo evaluation, is necessary to transmute this technology for effective and commercially viable therapies.

Keywords: Mucoadhesive nasal patches, Nasal drug delivery, Mucoadhesive polymers, Enhanced bioavailability

Development of a Microemulsion-Based Topical Gel Containing Eberconazole and Mometasone Furoate for Cutaneous Fungal Infections.

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Abstract:
Cutaneous fungal infections are highly prevalent dermatological conditions often accompanied by inflammation, itching, and erythema, which adversely affect patient quality of life. Combination topical therapy comprising an antifungal agent and a corticosteroid is commonly employed to achieve rapid symptomatic relief alongside effective antifungal action. However, conventional topical formulations may exhibit limitations such as inadequate drug penetration, non-uniform drug distribution, and reduced therapeutic efficacy. The present study was undertaken to develop and evaluate a microemulsion-based topical gel containing eberconazole nitrate and mometasone furoate for the management of cutaneous fungal infections.

Microemulsions were formulated using appropriate oils, surfactants, and co-surfactants, and optimized through pseudoternary phase diagram studies based on clarity, stability, and droplet size. The optimized microemulsion was incorporated into a suitable gel base to obtain a patient-compliant topical formulation. The prepared microemulsion-based gel was evaluated for physicochemical parameters such as pH, viscosity, spreadability, drug content uniformity, and in-vitro drug release characteristics. Ex-vivo skin permeation and skin retention studies were carried out using excised animal skin to assess topical delivery performance. Stability studies were conducted under accelerated conditions to evaluate formulation stability.
The developed microemulsion-based topical gel exhibited acceptable physicochemical properties, uniform drug distribution, and controlled drug release. Ex-vivo studies demonstrated improved skin permeation and enhanced retention of eberconazole nitrate and mometasone furoate compared to conventional topical formulations. Stability studies indicated that the formulation remained stable throughout the study period.
The findings suggest that a microemulsion-based topical gel may serve as an effective and promising delivery system for eberconazole nitrate and mometasone furoate, potentially enhancing therapeutic efficacy and patient compliance in the treatment of cutaneous fungal infections.

Keywords:
Microemulsion-based gel; Eberconazole nitrate; Mometasone furoate; Topical drug delivery; Cutaneous fungal infections.

Development and evaluation of curcumin and oxaliplatin loaded nanoconstructs for colon targeting

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Abstract
Oxaliplatin (OHP) resistance is a major hurdle in the chemotherapeutic treatment of colorectal cancer (CRC). The concomitant administration of OHP and curcumin act synergistically in OHP resistant cell lines, leading to the reversion of their resistant phenotype. The present study was aimed to formulate Eudragit S-100 (ES-100) coated alginate beads bearing drugs loaded targeted liposomes for simultaneous delivery of OHP and curcumin (CUR) to exert a synergistic therapeutic effect on OHP resistant HT 29 cell line. The liposomes were fabricated by the film dispersion method and optimized using Box-Behnken design (BBD. Hyaluronic acid (HA) was conjugated on the liposomal surface using carbodiimide chemistry to target CD44 receptors overexpressed on the CRC cells. The conjugated liposomes (i.e. OC-L-HA) depicted uniform vesicular size (132.4 ± 21 3.4 nm) and low polydispersity index (0.165 ± 0.070) and high entrapment of OHP and CUR. HA coupled drugs bearing liposomes (OC-L-HA) are exhibiting higher cellular uptake than

unconjugated liposomes (UC-L), as evidenced by confocal laser microscopy. OC-L-HA were entrapped in the alginate beads and characterized for various *in vitro* parameters such as bead size, in vitro drug release, and % swelling. MTT assay demonstrated that OC-L-HA exhibited 2.76 and 2.58-fold higher cytotoxicity than targeted CUR liposomes and targeted OHP liposomes, respectively. The colon targeting ability of these liposomes entrapped Eudragit S 100 coated beads on oral administration were assessed by X-ray radiography. *The in vivo* X-ray images affirmed a good targeting ability of the targeted beads to the colon. The outcomes of the studies revealed that these surface-modified liposomes entrapped in Eudragit S-100 coated beads could be an effective strategy for the treatment of CRC.

Keywords: oxaliplatin, alginate beads, colon cancer, Eudragit S 100, curcumin

Development and Validation of Tandem UV-Spectrophotometric Methods for Simultaneous Estimation of Dapagliflozin and Vildagliptin in Pharmaceutical Dosage Forms

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Abstract

Dapagliflozin and Vildagliptin are used for the type-2 diabetes mellitus. Dapagliflozin acts on sodium-glucose cotransporter-2(SGLT-2) inhibitor, whereas vildagliptin act on dipeptidyl peptidase-4(DPP-4) inhibitor. The study proposes and validates two simple, rapid and specific tandem UV-spectroscopic method for simultaneous estimation of dapagliflozin and vildagliptin in dosage forms. The method was developed by using absorption correction technique. Dapagliflozin shows absorbance at 223nm, whereas Vildagliptin exhibit minimal absorbance at same wavelength. The spectral behaviour of dapagliflozin at 223nm, by using absorption correction technique vildagliptin was quantified and allowing accurate estimation without spectral interference. The proposed method exhibits good linearity over the concentration range of dapagliflozin and for vildagliptin, with correlation coefficient respectively. Method was validated in accordance with ICH $Q_2(R_1)$ guidelines and demonstrated satisfactory accuracy, precision, reproducibility and robustness, as evidence by %RSD value and mean recovery range. The sensitivity of the method was confirmed by the determination of limit of detection and quantification which are found for dapagliflozin and for vildagliptin respectively. This works reports the first tandem UV-spectroscopic method for simultaneous estimation of dapagliflozin and vildagliptin in combined dosage forms, providing an efficient solution to spectral overlap without separation, derivatives process or advanced chemometric treatment. This method adheres the principles of green chemistry by reducing the solvent usage, analysis time. In industrial and laboratories this method is alternative to chromatographic techniques. The analytical procedure is

simple, rapid and environmental, highly suitable for quality control and regulatory analysis in pharmaceutical dosage forms.

Keywords: Vildagliptin, Dapagliflozin, UV-spectroscopic, Method validation

Development of Azithromycin-Based Albumin Nanoparticles in Fast-Dissolving Oral Films for Enhanced Therapy of Streptococcal Throat Infection

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ABSTRACT

Streptococcal pharyngitis, commonly known as strep throat, is a bacterial infection caused by Group A *Streptococcus*. Azithromycin (AZI) is commonly prescribed as a second-line therapy for its management, particularly in patients who are allergic to penicillin. The present study aimed to develop azithromycin-loaded albumin nanoparticles incorporated into oral fast-dissolving films (OFDFs) to enhance local drug delivery at the site of infection. This approach was intended to minimize the required dose and reduce dosing frequency by improving drug retention and therapeutic action in the throat region. Albumin nanoparticles were prepared using the desolvation technique, while the solvent casting method was employed to formulate the fast-dissolving oral films. A three-factor, three-level Central Composite Design (CCD) was applied using Design-Expert software to evaluate the effect of critical material attributes on key quality characteristics of the nanoparticles. The optimized formulation demonstrated a particle size of 250.6 ± 19.6 nm, a zeta potential of –0.656 mV, and an entrapment efficiency of 98.67% ± 0.002, indicating efficient drug encapsulation and stable nanoparticle formation. In vitro drug release studies of the optimized nanoparticles revealed an initial burst release of 18.11% ± 0.0024 within the first two hours, followed by a sustained release pattern, achieving approximately 96% ± 0.15 drug release over 36 hours. When incorporated into oral fast-dissolving films, the formulation exhibited rapid drug release, with 95% ± 0.659 of azithromycin released within one hour. The antibacterial activity of the developed formulation was evaluated against *Streptococcus aureus*, showing a significant zone of inhibition of 38 mm ± 0.152 compared to a marketed oral tablet. Overall, the results suggest that azithromycin-loaded albumin nanoparticle-based fast-dissolving films represent a promising and effective therapeutic strategy for the treatment of strep throat. Further preclinical investigations are recommended to support its potential clinical translation.

Development of Mucoadhesive Buccal Patch Containing Meloxicam–β-Cyclodextrin Complex for Tooth Pain: Formulation, Characterization, and Ex Vivo Assessment

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Abstract

Meloxicam (MLX), a selective cyclooxygenase-2 (COX-2) inhibitor, exhibits potent anti-inflammatory, analgesic, and antipyretic effects. The buccal delivery system, a promising approach for localized management of tooth pain, delivers drugs to a specific area and minimizes adverse effects. MLX, a poorly water-soluble NSAID, was complexed with β-cyclodextrin (1:1) to enhance its solubility. This study aimed to develop and optimize a mucoadhesive buccal patch containing an MLX–β–cyclodextrin inclusion complex for localized tooth pain management. Buccal patches (1×1 cm^2) were prepared using the solvent casting method with HPMC K4M (X_1) and HPMC K100M (X_2) and PVP K30 (X_3) as film-forming polymers, PEG 400 as a plasticizer, and a backing layer made up of ethyl cellulose. A Box–Behnken design was employed to optimize the formulation variables and their concentrations, targeting dependent variables for ideal thickness (Y_1), mucoadhesive strength (Y_2), and folding endurance (Y_3). Each patch was designed to deliver 0.5 mg of MLX locally. The optimized patch exhibited a thickness of 0.46 ± 0.040 mm, surface pH of 6.5–7.0, folding endurance over 200, tensile strength (0.358 ± 0.040 N/mm^2), and mucoadhesive strength (0.075 ± 0.01 N/cm^2). It showed over 80% *in vitro* drug release, exhibiting sustained kinetics characterized by a Higuchi model, with >70% *ex-vivo* drug permeation within 12 hours, and uniform drug content (98.25 ± 0.23%). The optimized formulation displayed pH within the physiological range, good flexibility, uniformity, and sustained drug release for up to 12 hours, indicating suitability for buccal application. The optimized formulation provides a promising, patient-friendly approach for localized pain relief, minimizing systemic side effects.

Keywords: Meloxicam; β–Cyclodextrin; Box-Behnken design; Mucoadhesion, Tensile strength; Tooth pain

Drug Utilization Pattern of Antiglaucoma Medications in a Tertiary Care Hospital: Implications for Rational Pharmacotherapy

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Abstract

Background Glaucoma is a major cause of irreversible blindness and requires long-term pharmacotherapy to control intraocular pressure and prevent disease progression. Real-world

evaluation of antiglaucoma drug utilization is essential to assess rational prescribing, tolerability, adherence, and cost implications in routine clinical practice. *Objectives* To evaluate utilization patterns and prescribing trends of antiglaucoma drugs in a tertiary care ophthalmology outpatient department and to assess rational pharmacotherapy with respect to drug class, monotherapy versus combination therapy, generic versus branded prescribing, patient-reported adherence, adverse drug reactions, and cost. *Methods* A hospital-based observational cross-sectional study was conducted over one year after Institutional Ethics Committee approval. Consecutive glaucoma patients receiving antiglaucoma therapy were enrolled after informed consent. Data were collected using a structured proforma capturing demographics, clinical details, type of glaucoma, prescribed medications (class, dose, frequency, route, and therapy type), generic or branded status, cost, adherence, and adverse drug reactions. Descriptive statistics were applied. *Results* Among 120 patients, prostaglandin analogues were most frequently prescribed, followed by beta-blockers and carbonic anhydrase inhibitors. Monotherapy was used in a substantial proportion, while combination therapy was prescribed for inadequate intraocular pressure control. Generic prescribing was observed in a notable proportion. Common adverse effects included ocular irritation, redness, and dryness. Non-adherence was reported by some patients, mainly due to cost burden and dosing complexity. *Conclusion* The study demonstrates real-world utilization of antiglaucoma medications and emphasizes rational drug selection, cost-effective prescribing, and adherence-enhancing strategies to optimize long-term outcomes in glaucoma care.

Keywords: Glaucoma; Drug Utilization Study; Antiglaucoma Drugs; Prescribing Pattern; Rational Pharmacotherapy.

Dual Drug Targeting in Human Diseases: A Promising Strategy to Enhance Treatment Outcomes

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Abstract
Dual drug targeting has emerged as an innovative therapeutic strategy to address the limitations of conventional single-target drug therapy. Many human diseases, including cancer, infectious diseases, neurological disorders, and metabolic conditions, are complex and involve multiple signaling pathways and molecular targets. Single-target therapies often show limited efficacy due to pathway redundancy, compensatory mechanisms, and the development of drug resistance. Dual drug targeting overcomes these challenges by simultaneously modulating two distinct biological targets using either a single dual-acting molecule or a rational combination of drugs. This approach enhances therapeutic efficacy through synergistic or additive effects, improves disease control, and reduces the likelihood of resistance development. Additionally, dual targeting can allow dose

reduction of individual agents, thereby minimizing adverse effects and improving patient compliance. Recent advances in molecular biology, systems pharmacology, and computational drug design have significantly contributed to the identification and development of effective dual-target strategies. Several dual-target drugs and combination therapies have already shown promising results in preclinical and clinical studies. Despite its advantages, dual drug targeting presents challenges such as increased risk of drug– drug interactions, complex pharmacokinetic profiles, and regulatory hurdles. Nevertheless, ongoing research continues to optimize safety and efficacy. Overall, dual drug target in represents a promising and evolving strategy in modern therapeutics, offering improved treatment outcomes and opening new avenues for the management of complex human diseases. dual drug targeting stands as a promising and evolving therapeutic paradigm with significant potential to improve treatment outcomes and expand clinical options for managing complex and resistant diseases.

Keywords: Dual drug targeting; Combination therapy; Drug resistance; Multifunctional drugs; Human diseases; Therapeutic strategy; drug– drug interactions; clinical studies.

Early Diagnostic Markers for Cancer

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Abstract
Cancer is one of the most identified reasons for mortality across the world despite chances for therapeutics are immensely beneficial through identification of a disease during its initial phases. The current molecular and clinical diagnostic developments have proved the criticality of the early diagnostic markers which could surge the chances of survival and symptom amelioration. DNA and RNA methylations, and other epigenetic biomarkers notably assist in the progression and onset of tumors by sabotaging the usual gene regulatory pathways, and cellular functional mechanisms, without altering the genetic code. Epigenetic disturbances and abnormalities in methylation of promoter regions are now considered hallmark of carcinogenic transformation.
Protein-based tumor markers and imaging technologies, other than epigenetic changes, can also be instrumental in identifying cancer in the early stages. Protein-based tumor markers and imaging technologies can also be helpful in identifying cancer at a very early stage apart from the epigenetic changes, and biomarkers of Afamin in ovarian cancer, α-methylacyl-CoA racemase (AMACR) in prostate cancer, and CA 15-3, erbB-2 and, E-cadherin in breast cancers affirm this growing significance of targeted and personalized diagnostic strategies.
Research in lung cancer further provides for antibodies-based innovations approach of sputum analysis, and screening methods based on epithelial cells, aiming at detecting cells morphological changes that can co-occur with a pre-cancerous condition in a patient. Other approaches range

circulatory proteome evaluation and positron emission tomography as an image-backed, non-invasive interventions attempt with the purpose of bettering diagnostic accuracy.
In general, the triad of epigenetic analysis, tumor markers, and modern imaging systems offers a multidisciplinary avenue for earlier detection of cancer for enhanced treatment efficacy, also requiring cost-effective and accessible screening tools that are minimally invasive and less stressful to the patient.

Engineered Erythrocytes and Artificial Oxygen Carriers - Translational Strategies for Emergency Care

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Abstract
Acute haemorrhagic shock and tissue hypoxia are major determinants of morbidity and mortality in trauma, mass-casualty incidents, battlefield injuries, and disaster medicine. Conventional allogeneic blood transfusion is limited by donor dependency, immune haematological compatibility, pathogen transmission risk, and stringent cold-chain logistics. Advances in cellular bioengineering, nanotechnology, and biomimetic material science have catalysed the development of engineered erythrocytes and artificial oxygen carriers (AOCs) designed to replicate red blood cell (RBC) oxygen transport and microcirculatory function.
This study evaluates the translational potential of engineered erythrocyte-based systems and artificial oxygen carriers as temporary oxygen therapeutics for emergency and resource-constrained clinical settings. A systematic narrative analysis of peer-reviewed literature (2022–2025) was performed using PubMed, Scopus, and Web of Science. Studies on haemoglobin-based oxygen carriers (HBOCs), haemoglobin vesicles (HbVs), polymer-encapsulated haemoglobin nanoparticles, perfluorocarbon emulsions, and genetically engineered erythrocyte mimetics were assessed for oxygen-binding kinetics (P50 modulation), nitric oxide scavenging, oxidative stress profiles, rheological behaviour, circulation half-life, and preclinical efficacy in haemorrhagic shock models. Contemporary AOCs demonstrate optimized oxygen affinity, reduced vasoconstrictive toxicity, enhanced endothelial compatibility, and prolonged intravascular persistence. Engineered erythrocytes exhibit controlled oxygen release, improved microvascular perfusion, immunological neutrality, and ambient-temperature storage stability. Preclinical trauma and ischemia-reperfusion models report significant improvements in systemic oxygen delivery, lactate clearance, and short-term survival outcomes. Engineered erythrocytes and artificial oxygen carriers represent a paradigm shift in transfusion-independent resuscitation strategies. With further refinement in biocompatibility, regulatory validation, and clinical translation, these oxygen therapeutics hold substantial promise for emergency medicine, military healthcare, and disaster response.

Keywords: Engineered erythrocytes; Haemoglobin-based oxygen carriers; Artificial blood substitutes; Haemorrhagic shock; Translational emergency medicine.

Enhancing the Oral Bioavailability of Curcumin through Glycerol Monostearate-Based Solid Lipid Nanoparticles: A Systematic Review

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Abstract

Curcumin has been endowed with numerous medicinal properties, such as anti-inflammatory, antioxidant, and anticancer properties. However, its oral administration has poor bioavailability due to poor solubility, high metabolism, and low absorption through the gastrointestinal tract. Therefore, Solid Lipid Nanoparticles (SLNs) have been proposed as a promising lipid nanocarrier system to solve these problems by adding solubilization and guarding curcumin from degradation in the gastrointestinal tract. This systematic review critically evaluates in vivo and clinical data on oral formulations of curcumin grounded on glycerol monostearate (GMS)-containing Solid Lipid Nanoparticles (SLNs) regarding pharmacokinetics, bioavailability, and efficacy compared to conventional curcumin formulations. A structured search of the major databases was conducted to find studies using glycerol monostearate (GMS) or nanostructured lipid carriers for orally co-administered curcumin, reporting pharmacokinetic parameters and/or efficacy in a suitable disease model. In some cases, SLN-revised curcumin was absorbed 9–70 times better than regular curcumin. Such pharmacokinetic advantages were translated into enhanced biological activities, such as potent anti-inflammatory and anticancer activity, disease control in asthma and cancer models, and advanced stability toward gastrointestinal conditions. However, the evidence for glycerol monostearate (GMS)-based systems is, at present, mostly preclinical and limited human evidence. Current evidence supports the rational and promising use of glycerol monostearate (GMS)-based Solid Lipid Nanoparticles (SLNs) to improve oral bioavailability and pharmacological profiles of curcumin. Still, well-formalized pharmacokinetic expression, toxicological, and clinical studies are needed to demonstrate such a pledge.These findings highlight the growing interest in lipid-based nanocarrier systems as a strategic approach to overcome bioavailability challenges associated with phytoconstituents like curcumin.

Keywords: Curcumin, Solid Lipid Nanoparticles (SLNs), Glycerol Monostearate, Oral Bioavailability, Lymphatic Transport.

Exploring The Synergistic Anti-Breast Cancer Potential Of Marine-Derived Bioactive Compounds

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Abstract

Breast cancers continue to be among the most common tumors and are regarded as a major therapeutic challenge due to medication resistance and route flexibility. It has recently been determined that the sea is a highly abundant source of new bioactive substances with potential anticancer effects. In addition to the individual usage of these substances, there has been a growing interest in the potential synergistic effects of sea-derived combinations, including medication combos and combinations with other sea chemicals. The most recent data on the use of combinational techniques based on marine resources in the treatment of breast cancer, with an emphasis on in vitro studies and their molecular mechanisms, has been included in this review/experimental summary.

Numerous marine species, such as sponges, mollusks, sea cucumbers, and brown algae, produce peptides, alkaloids, macrolides, and sulfated polysaccharides that are extremely cytotoxic to brea st cancer cells, particularly the MCF-7 and MDA-MB-231 lines, according to local literature.

More significantly, these substances have been shown to enhance the effects of conventional che motherapeutic medications like as paclitaxel and doxorubicin, resulting in decreased ICβ₀ values. According to the mechanismistic approach, marine-derived combinations affect a number of cell survival pathways, including the induction of mitochondrial-mediated apoptosis, the activation of caspase cascades, the disruption of cell cycle progression, the down-regulation of EGFR/PI3K/Akt signaling, increased production of reactive oxygen species, and the suppression of metastatic markers. Given that redundancy is a major factor in cancer cells' resistance to medication, these polypharmacological compounds may be very helpful in treating breast cancer. Additionally, a number of studies have shown that marine chemicals can lessen breast cancer cells' resistance by reducing the production of anti-apoptotic and drug efflux proteins.

Bioanalytical investigations provide light on the crucial role that HPLC profiling, purity assessment, and quantitative analysis play in standardizing marine extracts as well as the connection between chemical patterns and biological activity. Though this strategy is yet largely unexplored, the status of the literature as of right now shows the potential of marine combinations for the treatment of breast cancer. Combination analyses, pathway clarification, standardization, and validation using in-vivo models should be the main topics of future research.

Keywords: Breast cancer; Marine bioactives; Synergy; In vitro; HPLC

FDA approved drug for Prostate Cancer and BPH (Benign Prostatic Hyperplasia)

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Abstract
Prostate cancer and benign prostatic hyperplasia (BPH) are common prostate disorders that predominantly affect elderly men and represent a major clinical and public health concern worldwide. The United States Food and Drug Administration (FDA) has approved several pharmacological agents for the effective management of both conditions, with therapies tailored according to disease stage and symptom severity. In prostate cancer, FDA-approved drugs mainly target androgen signaling pathways, as the disease is largely androgen dependent. These include gonadotropin-releasing hormone (GnRH) agonists and antagonists such as leuprolide and degarelix, androgen receptor inhibitors like enzalutamide and apalutamide, and androgen biosynthesis inhibitors such as abiraterone acetate. In advanced and metastatic prostate cancer, chemotherapeutic agents (docetaxel, cabazitaxel), radiopharmaceuticals (radium-223), and newer targeted or immunotherapeutic drugs have significantly improved survival and disease control. Benign prostatic hyperplasia is a non-malignant enlargement of the prostate gland characterized by lower urinary tract symptoms, including urinary hesitancy, nocturia, and decreased urinary flow. FDA-approved drugs for BPH focus on symptomatic relief and reduction of prostate size. Alpha-1 adrenergic blockers such as tamsulosin, alfuzosin, doxazosin, and terazosin relax prostatic smooth muscle to improve urine flow, while 5-alpha reductase inhibitors such as finasteride and dutasteride reduce dihydrotestosterone levels, leading to prostate shrinkage. Phosphodiesterase-5 inhibitors like tadalafil and combination therapies further enhance treatment outcomes. In conclusion, FDA-approved drugs play a vital role in the effective management of prostate cancer and BPH by improving symptoms, slowing disease progression, and enhancing patient quality of life.

Keywords: Prostate cancer, Benign prostatic hyperplasia, FDA-approved drugs, Androgen deprivation therapy, Alpha-blockers, 5-alpha reductase inhibitors**.**

From Natural Pigments to Precision Medicine: Integrating Phytochemistry, Drug Conjugation and In-Silico Design for Next-Generation Therapeutics

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Abstract

Natural pigments, especially plant polyphenols, have been the subject of continuous research because of their extensive biological functions and the fact that they are generally innocuous to humans. But actually getting these compounds into clinical applications still remains a roadblock especially when it comes to translating in-vitro success into real patients. Their inherently poor hydrophilicity, oral absorptivity, rapid metabolism, and lack of selectivity for molecular targets lead to their failure as precision medicine candidates. These problems can only be solved by marrying the age-old wisdom of phytochemicals with state-of-the-art pharmaceutics.

Phytochemical-inspired drug conjugation and prodrug strategies are efficient ways to unlock the latent potential in natural pigments. Through chemical conjugation, ADME properties of bioactives can be improved; drug delivery can be accurately targeted and the dosage-related side effects minimized. Design of prodrugs also make it possible to temporarily mask the negative drug characteristics so that the modified drug can be better absorbed, be more stable and achieve controlled drug release at the targeted site. Both strategies together set the stage for the development of natural bioactive compounds into viable, clinically useful drug candidates.

Concurrently, computer-aided design and in-silico modeling not only helped but revolutionized the rational design of natural product-based drugs. Techniques such as molecular docking, binding affinity prediction, and pharmacokinetic modeling provide the best clues from the molecular interaction, structural function, and early safety perspectives respectively. When computational tools are used in combination with phytochemical studies, experimental rejects are reduced and decisions regarding drug development stages can be taken more confidently.

Although, translation and regulatory aspects can be considered gatekeepers to the clinical usage of polyphenol-based therapeutics. Issues such as standardization, reproducibility, large scale synthesis (scalability), and regulatory compliance must be taken into account if the laboratory results are to be replicated in the clinic.

In brief, integrating phytochemistry, drug conjugation strategies, and in-silico design provides a very innovative, multidisciplinary approach for the advancement of natural pigments in the field of precision medicine. The application of such methods demonstrates that investigations of natural compounds can be allied with pharmaceutical science to yield safer, impactful, and innovative therapeutic modalities.

Keywords - Natural Polyphenols, Drug Conjugation Strategies, Prodrug Design, In-Silico Drug Development.

In silico Drug Development of 4 Aminoquinoline derivatives for antimicrobial resistance

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Abstract
Antimicrobial resistance (AMR) has appeared as one of the most demanding global health crises of the present era. AMR occurs when different microorganisms, such as bacteria, parasites, fungi and viruses undergo transformation leading to resistance against antimicrobial drugs which are frequently used for the treatment of infections. Quinoline derivatives have been reported to exhibit significant antibacterial activity. These compounds interact with key bacterial enzymes including tyrosyl-tRNA synthetase and DNA gyrase. These enzymes are essential for protein synthesis and DNA replication. By targeting these crucial pathways, quinoline derivatives show potential for development of novel antibiotics. The rational design of quinoline derivatives against drug resistant bacterial pathogens has been supported by Advanced computational strategies such as molecular docking, structure–activity relationship (SAR) analysis, ADMET profiling, molecular dynamics simulations, and virtual screening. The 4-aminoquinoline pharmacophore is important for antibacterial drug discovery due to the miscellaneous biological applications of its derivatives. The molecular hybridization approach has been applied to the 4-aminoquinoline scaffold to enhance antibacterial activity. This strategy involves conjugation with complementary moieties such as piperazine, triazine, sulphonamide, isatin, cinnamic acid and thiosemicarbazide. Hybribization of these pharmacophores leads to improved antibacterial potency. In this context, an *in silico* methodologies play an important role in the discovery and development of 4-aminoquinoline-based antimicrobial agents by computational screening with experimental validation. These approaches significantly increase antimicrobial drug discovery by minimizing development time, lowering costs, and reducing reliance on extensive laboratory experimentation.

Keywords: ADMET profiling, Docking, Drug resistant, Quinoline, SAR, Molecular hybridization.

In Silico Potential of Antiepileptic Drugs: Molecular Docking Insights Against IL-6

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Abstract
Background: Epilepsy is a chronic neurological disorder that affects millions of people worldwide and is characterised by recurrent seizures and associated with neuroinflammation. Recent findings indicate that inflammatory cytokines such as interleukin-6 (IL-6) play a pivotal role in epileptogenesis and seizure propagation, thereby representing a novel therapeutic target.
Objective: The study aimed to evaluate the binding affinities of six commonly prescribed AEDs against the key inflammatory targets (IL-6) using molecular docking.
Methods: Molecular docking was performed using Schrödinger Suite 2021-2 for six antiepileptic drugs (Valproic acid, carbamazepine, phenytoin, levetiracetam, lamotrigine, and topiramate). Ibuprofen is chosen as a standard anti-inflammatory drug. The three-dimensional crystal structure of IL-6 protein was retrieved from the Protein Data Bank (PDB). Protein structures were prepared using the Protein Preparation Wizard before docking.
Results: The molecular docking experiments showed variability in the binding affinities of the AEDs tested to IL-6. The binding affinity of Lamotrigine was the highest compared to Carbamazepine and Phenytoin (-4.909 kcal/mol and -4.017 kcal/mol, respectively). Interestingly, Lamotrigine, Carbamazepine and Phenytoin were shown to have a higher binding affinity than Ibuprofen (-3.867 kcal/mol), which is the reference anti-inflammatory drug.
Conclusion: This in silico experiment shows that some AEDs, especially Lamotrigine, Carbamazepine, and Phenytoin, have substantial anti-inflammatory properties, especially by binding to IL-6, and their pharmacological action is not limited to traditional sodium channel inhibition and GABAergic activity. Further in vitro, in vivo, and molecular dynamics analyses are justified that would confirm these computational results and enable the rational design of the next generation antiepileptic drugs that have dual immunomodulatory properties, especially in patients with refractory epilepsy.

Keywords: Antiepileptic drugs, Molecular docking, IL-6, Neuroinflammation, In silico, Neuroprotection, Anti-inflammatory.

Innovative Frontiers in Neurodegeneration: A Comprehensive Review of Developmental Research

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Abstract
Neurodegenerative diseases represent a complex group of disorders characterized by the progressive deterioration and eventual death of neurons within the human nervous system. Prevalent conditions such as Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis (ALS) serve as primary examples of these debilitating

pathologies. These diseases severely impact a patient's cognitive and motor functions, leading to memory loss and the erosion of daily independence, which significantly reduces the overall quality of life. At present, the majority of available pharmacological interventions are limited to symptom management and lack the capacity to fully halt or reverse the underlying nerve damage. Consequently, contemporary developmental research has shifted its focus toward the biological restoration of the nervous system.

The field of neurodegeneration explores the mechanisms of repairing or replacing damaged nerve cells. Scientists are currently investigating the therapeutic potential of neurotrophic factors, such as nerve growth factor (NGF) and brain-derived neurotrophic factor (BDNF), which are essential for protecting existing neurons and encouraging new growth. Furthermore, breakthroughs in stem cell therapy suggest that these cells can be guided to develop into functional neurons to replace lost tissue. Gene therapies also represent a significant avenue for correcting genetic abnormalities or increasing the synthesis of neuroprotective proteins.

In addition to cellular replacement, new medicinal strategies aim to reduce neuroinflammation, oxidative stress, and the toxic buildup of proteins, all of which are primary drivers of neural decay. However, a major hurdle in clinical application is the effective delivery of these drugs to the brain. To address this, researchers are engineering advanced delivery systems capable of crossing the blood–brain barrier. In conclusion, these diverse research efforts offer a transformative outlook for the future development of effective treatments for neurodegenerative diseases.

Keywords: Neurodegenerative diseases, Neurodegeneration, Neurotrophic factors, BDNF, Stem cell therapy, Gene therapy, Blood-brain barrier, Neuroinflammation.

In-Silico And Admet Study Of Multiple Phytoconstituents From Plants For Potential Therapeutic Activity Against Varicose Veins

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Abstract

Varicose veins is a chronic venous disorder characterised by venous dilation, valve incompetence, and impaired blood flow, often leading to pain and inflammation. The present study aimed to evaluate major phytoconstituents present in plants through in silico analysis and also predict their pharmacokinetic properties, toxicity profiles, and potential therapeutic relevance in varicose vein management. A total of multiple bioactive compounds, including flavonoids (naringenin, apigenin, luteolin), phenolic acids (quinic acid, chlorogenic acid), and related plant metabolites, were screened for ADMET parameters using computational prediction tools. The results revealed that

most compounds exhibited favourable drug-likeness, with molecular weights below 500 g/mol, acceptable Log P values, and compliance with Lipinski's Rule of Five. Toxicity profiling indicated low mutagenic, cardiotoxic, hepatotoxic, and skin-irritant potentials. In our study, two bioactive compounds such as Myricetin and Quercetin demonstrated optimal pharmacokinetic profiles with high intestinal absorption and low predicted systemic toxicity. Other phytoconstituents used in our *in-silico* evaluation study showed poor binding profile with toxicity. Further, *in-silico* analysis of selected phytoconstituents was investigated with NF-κB-Inducing Kinase receptor [PDB ID - 4G3D] using pyrx docking software. In our study, we found selected phytoconstituents possess promising *In-silico* characteristics suitable for further *in vitro* and *in vivo* evaluation. Overall, this in silico screening provides a rational basis for identifying safe and effective plant-derived molecules with therapeutic potential in the prevention and management of varicose veins.

Keywords: Phytoconstituents , Varicose Veins, *In Silico* Analysis, ADMET Prediction, Drug-Likeness

In-Silico **Screening and Pharmacokinetic Profiling of Bioisosterically designed molecules as Potential Tyrosine Phosphatase Inhibitors for Next-Generation Psoriasis Therapeutics**

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Abstract
The discovery of novel therapeutic targets and rational small-molecule design are pivotal for advancing next-generation psoriasis therapeutics. Psoriasis, a chronic inflammatory disorder driven by dysregulated immune responses (Th17/IL-23 axis, innate cell activation), remains underserved by oral options despite effective biologics and TYK2 inhibitors. Protein tyrosine phosphatases (PTPs), such as CD45 (PTPRC), regulate immune signalling and are implicated in psoriasis pathogenesis through T-cell activation, leukocyte trafficking, and inflammatory amplification in psoriatic lesions and peripheral blood cells.
This study employed integrated computational approaches to design and screen bioisosterically modified molecules as potential PTP inhibitors. Starting from known scaffolds, bio-isosteric replacements (e.g., enhanced non-acidic mimics for better permeability) were applied to improve drug-likeness. In-silico screening via molecular docking, interaction fingerprint analysis, per-residue energy decomposition, and pharmacophore modelling identified lead candidates with favourable binding affinities and selective interactions at the target site.
Pharmacokinetic profiling (using tools like SwissADME) assessed ADME properties, confirming compliance with Lipinski rules, high gastrointestinal absorption, low toxicity flags, and optimized solubility/log P—positioning these as promising candidates.
These findings integrate chemistry (bio-isosteric design and virtual screening), bioscience (PTP modulation in immune/inflammatory pathways underlying psoriasis), and early regulatory

considerations (small-molecule advantages: cost-effectiveness, accessibility, reduced immunogenicity vs. biologics, potential for streamlined CDSCO/FDA pathways). The workflow provides actionable insights for developing selective PTP inhibitors targeting novel inflammatory pathways.
Future validation includes synthesis, in vitro PTP assays, selectivity profiling, and preclinical models (e.g., IMQ-induced psoriasis). This multidisciplinary strategy accelerates translational development of next-gen therapeutics for psoriasis.

Keywords: Psoriasis Therapeutics, Tyrosine Phosphatase Inhibitors, Bio-isosteric Design, *In Silico* Screening, Pharmacokinetic Profiling, CD45 (PTPRC), Computational Drug Discovery, Inflammatory Pathways

Integrated QSAR, DFT, and Molecular Docking Analysis of Coumarins and Quinones as Redox-Active Agents Targeting Multidrug-Resistant Staphylococcus aureus

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Abstract
The escalating threat of multidrug-resistant *Staphylococcus aureus* (MDR-SA), particularly methicillin-resistant strains (MRSA), demands innovative therapeutic strategies beyond conventional antibiotics. This study uses a combination of experimental, computational, and theoretical methods to examine the redox-active phytoconstituents plumbagin (quinone) and umbelliferone (coumarin) as powerful antibacterial agents against MDR-SA. Both substances showed strong antibacterial action, however plumbagin was more effective against resistant microorganisms (MIC 2–12 µg/mL) than umbelliferone (MIC 128–256 µg/mL). Plumbagin's quick bactericidal efficacy (≥3 $\log_{10}$ CFU/mL reduction in 8 hours) was verified by time-kill kinetics, and checkerboard experiments showed additive effects with oxacillin and high synergistic interactions with ciprofloxacin (FICI 0.31) and vancomycin (FICI 0.38). The redox-mediated mechanism was evidenced by ROS generation, disruption of NADH/NAD^+ balance, oxidative damage to proteins, lipids, and DNA, and subsequent membrane integrity loss. Even in highly resistant strains, molecular docking studies showed that the compounds formed stable binding to key target pockets, forming hydrophobic interactions and hydrogen bonds (e.g., Ser403, Glu143, Asp87), indicating that resistance is primarily caused by enzymatic or efflux mechanisms rather than target mutation. Density functional theory (DFT) calculations (HOMO-LUMO energies, dipole moments, logP, TPSA) and quantitative structure-activity relationship (QSAR) modeling demonstrated a strong correlation between predicted and experimental pMIC values. Plumbagin had the highest predicted potency and the lowest energy gap (ΔE = 2.07 eV). These results offer a route for additional optimization and clinical translation in the age of antimicrobial resistance,

positioning plumbagin and umbelliferone as prospective redox-disrupting leads or antibiotic adjuvants for fighting MDR-SA infections.

Keywords: Molecular Docking, Multidrug-resistant Staphylococcus aureus, Plumbagin, Redox-active compounds, Umbelliferone

Integrating AI-Driven Molecular Design with Regulatory-by-Design Frameworks to Accelerate Translational Drug Development

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Abstract
Artificial intelligence has emerged as a transformative tool in modern drug discovery, particularly in accelerating molecular design, virtual screening, target identification, and optimization of lead compounds. AI-driven models can analyze vast chemical libraries, predict molecular interactions, and estimate pharmacokinetic and toxicity profiles in significantly shorter timeframes compared to traditional experimental approaches. These capabilities have improved efficiency during early-stage research. However, despite these technological advances, a substantial number of AI-generated drug candidates continue to fail during translational progression from laboratory research to clinical development. One of the primary reasons for this high attrition rate is the limited integration of regulatory considerations during the early phases of computational drug design. In many current workflows, regulatory assessment is performed after candidate selection, often revealing issues related to safety margins, toxicological risks, or insufficient compliance with international guidelines. This sequential approach contributes to delays, increased costs, and late-stage failures. The present study proposes a regulatory-by-design AI framework in which essential regulatory expectations—such as toxicity thresholds, pharmacokinetic parameters, quality requirements, and harmonized international standards—are incorporated directly into AI-driven molecular modeling and screening processes. By embedding regulatory intelligence within machine learning systems, candidate molecules can be evaluated not only for biological activity but also for their likelihood of regulatory acceptability. This integrated approach combines computational chemistry, bioscience datasets, and regulatory science principles to create a more structured and anticipatory development pathway. Machine learning algorithms trained on curated chemical, clinical, and regulatory data can assist in identifying compliance-related risks early in development, thereby improving prioritization of viable drug candidates. Adopting a Regulatory-by-Design strategy has the potential to reduce late-stage attrition, optimize resource allocation, and shorten overall development timelines. More importantly, it encourages a shift from a reactive regulatory model to a proactive and integrated framework that aligns technological innovation with

real-world pharmaceutical and public health requirements. Such alignment may significantly enhance the translational success of next-generation therapeutics.

Keywords: Artificial Intelligence in Drug Discovery, Regulatory-by-Design Framework, Machine Learning in Molecular Modeling, Translational Drug Development, Regulatory Intelligence Integration.

Integrating In-Silico Drug Design with Pharmacokinetics and Toxicity Predictions: Toward Faster and Safer Drug Development

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Abstract

Background: Traditional drug discovery is usually limited by factors such as the high cost, long timelines, and high attrition rates, which are mainly caused by pharmacokinetic inefficiencies and unexpected toxicities. A computer-aided or in-silico drug design is a revolutionary way to go beyond these boundary walls by combining molecular modeling, virtual screening, and predictive algorithms to speed up the process of finding effective and safe drug candidates.

Aim: This review is committed to probing how in-silico drug design methods are combined with pharmacokinetic (ADMET) and toxicity prediction tools to result in drug development that is rapid, safe, and of low cost.

Materials and Methods: A systematic review of the literature through databases like PubMed, Scopus, and ScienceDirect was performed. Articles from 2003 to 2025 related to structure-based and ligand-based drug design, molecular docking, QSAR modeling, molecular dynamics, pharmacophore mapping, and AI/ML-aided ADMET prediction were surveyed. Focus was given on recent developments in combining computational drug design with PK/toxicity modeling and how these have contributed to enhancing predictability accuracy and translation success.

Results: The review established that early-stage decision-making is greatly inspired by the combination of computational drug design with ADMET and toxicity prediction to eliminate unsafe or unproductive molecules prior to expensive laboratory experiments. In combination with AI-driven pharmacokinetic modeling, both structure-based and ligand-based methods showed better hit-to-lead optimization, and fewer late-stage attritions. Moreover, the recent technologies, including deep learning, generative models, and multi-omics integration, have demonstrated the great potential to generate compounds with optimized efficacy, bioavailability, and safety profiles at the same time.

Conclusion: The combination of in-silico design with pharmacokinetic and toxicity predictions is the paradigm shift to rational and data-driven drug discovery. This method allows identifying drug-like compounds in the shortest possible time, reducing preclinical failure rates, and facilitating

safer and more efficient development of therapeutics. More progress in artificial intelligence, cloud computing, and explainable modelling should occur to further simplify the end-to-end virtual pipelines and reduce the distance between computational predictions and clinical outcomes.

Keywords: In-silico drug design; pharmacokinetics; ADMET; toxicity prediction; molecular docking; QSAR; artificial intelligence; machine learning; virtual screening

Latest Developments on Simultaneous Estimation of Fluoroquinolones by UV Spectroscopy

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Abstract
A class of manufactured broad-spectrum antibiotics known as fluoroquinolones has found extensive application in medicine for humans as well as animals. They work well against a variety of germs and are especially useful in treating a range of infectious disorders. Ciprofloxacin, lomefloxacin, and enrofloxacin, Delafloxacin, Pradofloxacin, Prulifloxacin are some of the most often used fluoroquinolones that have shown notable therapeutic benefits. Bacterial DNA gyrase and topoisomerase IV are essential enzymes for DNA replication and transcription, and these antibiotics work by blocking them, which eventually kills the bacteria. Methods to estimate Fluoroquinolones are UV + Chemometric Methods in which each fluoroquinolone absorbs UV light, but their spectra overlap. Instead of measuring at a single wavelength, absorbance across a whole spectral range is recorded and mathematically separated using multivariate calibration models. Derivative UV Spectrometry here Instead of normal absorbance, the derivative of the spectrum is used. At some wavelengths, one drug shows zero response while the other shows measurable signal—allowing selective measurement. Absorbance Ratio (Q – Absorption) that uses ratio of absorbances at two wavelengths to calculate concentrations of each component in a mixture and can be extended to fluoroquinolone pairs when absorption peaks are reasonably distinct. From the methods discussed above Chemometric UV is considered the best because Fluoroquinolones have highly overlapping UV spectra, which limits simple wavelength-based methods. Chemometric approaches solve this problem by mathematically separating contributions from each drug. Derivative UV Spectrometry is considered Second best because of its strength such as improves resolution between overlapping peaks, Simple instrumentation, Good for binary or ternary mixtures, Cost-effective for routine labs. Best used in QC labs.

Keywords: Chemometrics, Fluoroquinolones, UV Spectromtetry

Leveraging in-silico studies to complement the performance evaluation of haemostatic agents

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Abstract

The race of achieving rapid and stable haemostasis is at full pace to prevent deaths due to blood loss in traumatic wound management. However, evaluation of haemostatic agents, often involves empirical screening and animal testing leading to decrease in translatability.

This study demonstrates *in-silico* approaches, data mining and structural analysis of transcriptomic data relevant to haemostasis and wound healing to identify differentially expressed genes associated with coagulation, platelet activation, and tissue adhesion. GEO (Gene Expression Omnibus) was used to select relevant transcriptomic dataset and further processed with ($|\log2FC| \geq 1$; adjusted $p < 0.05$) for potential DEGs. The Gene Ontology, Functional enrichment and PPI network analyses using STRING databases of DEGs were employed to select key molecular targets. Gene hits were found in platelet activation and fibrin assembly pathways. Further PubChem and STITCH database were used to determine chemical structures of compounds selected via physicochemical studies of the biomaterial to be used as ligand. Based on the targets and ligands, molecular docking was performed to evaluate binding affinity and stability between target proteins and bioactive compounds derived from the selected haemostatic biomaterial, which is to be followed by molecular dynamics simulation.

This integrative *in-silico* workflow reduced potential experimental targets by approximately 60–70%, with target pairs (such as, VWF, ITGB3, and FGA), thereby refining experimental focus. Subsequent *in-vitro* evaluation, including blood clotting index and hemocompatibility assays, was carried out to validate computational predictions.

In conclusion, this study highlights the value of *in-silico* analysis integration in experimentation reducing trial-and-error screening and narrowing experimental variables leading to enhanced efficiency, interpretability, and ethical compliance

Marine Animals as a Source of Novel Therapeutic Agents in Drug Discovery

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Abstract

The ocean's remarkable biodiversity has unlocked a treasure chest of potential new medicines. Marine animals such as sponges, cone snails, tunicates, molluscs, and crustaceans flourish in extreme environments and produce unique bioactive compounds with potent pharmacological properties. These natural molecules have sparked considerable interest in modern drug discovery research.

Over several years, numerous marine-derived compounds have successfully made it from lab to clinic. For example, cytarabine and vidarabine, originally found in marine sponges, are established cancer and antiviral treatments. Ziconotide, a peptide from the cone snail Conus magus, is an FDA-approved medication for managing severe chronic pain, offering a valuable non-opioid option. Another notable example is trabectedin, it is derived from the tunicate Ecteinascidia turbinata, used to treat soft tissue sarcoma and ovarian cancer. Research continues to uncover the vast potential of marine animals as sources of diverse compounds with novel mechanisms, boasting anticancer, antimicrobial, anti-inflammatory, and neuroactive effects. Though extracting and making these drugs is though due to challenges like sustainable harvesting and large-scale production but advances in synthetic and semi-synthetic approaches have made development of marine-derived drugs more feasible.

In conclusion, the inhabitants of our oceans, ranging from marine animals to microscopic organisms ,play an integral role in expanding the drug discovery pipeline. These organisms represent more than just a biological resource; they are a unique library of chemical diversity that offers exciting opportunities for developing next-generation therapeutics. By exploring these marine environments, we are finding new ways to treat complex diseases that have long challenged traditional medicine. This potential highlights why preserving marine biodiversity is so critical. Protecting our oceans isn't just about conservation; it is a strategic necessity for the future of healthcare.

Keywords : Marine animals; Drug discovery; Marine natural products; Bioactive compounds; Anticancer agents; Antiviral; Marine pharmacology

Mechanistic Insights into Penicillin-Binding Proteins Through Ensemble Docking and Inclined Molecular Dynamics Simulations

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Abstract
Staphylococcus aureus remains a major human pathogen, responsible for a spectrum of infections ranging from superficial skin lesions to life-threatening systemic diseases. The rise of methicillin-resistant S. aureus (MRSA) continues to pose a serious clinical challenge, driven largely by the evolution of antibiotic resistance mechanisms. The present study employed an integrated virtual screening workflow combining molecular docking, pharmacophore modeling, and molecular dynamics simulations to identify novel small molecules targeting crucial residues of penicillin-binding proteins (PBPs) involved in bacterial cell wall biosynthesis. Both ligand-based and structure-based pharmacophore models were generated to identify common chemical features essential for PBP inhibition. Structure-guided docking against key PBP isoforms was performed to prioritize molecules with optimal binding affinity. A series of multisubstituted triazine derivatives, representing a novel scaffold distinct from existing β-lactam antibiotics, was designed and subjected to structure-based pharmacophore mapping to examine their interactions within PBP active sites. Virtual screening coupled with ADMET filtering was employed to refine the hit list based on drug-likeness criteria. The most promising candidates were then evaluated through 200-ps molecular dynamics simulations to understand their binding stability and to gain deeper insights for future structural optimization. Among the designed molecules, compound 2 demonstrated the most favorable selectivity profile and strong, stable interactions with key catalytic residues of PBP 2a, 3 and 4. These results suggest that compound is a promising lead compound that may be advanced for further experimental validation as an inhibitor of PBPs involved in bacterial peptidoglycan biosynthesis.

Keywords: Antimicrobial Resistance; Methicillin; Molecular Docking; Penicillin-binding proteins; Triazine; Simulations

Microbiome Immune Axis Dysregulation in Ankylosing Spondylitis - Emerging Biomarkers and Next Generation Therapeutic Strategies

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Abstract
Introduction: Ankylosing spondylitis (AS), the prototypical form of axial spondyloarthritis, is a chronic immune-mediated inflammatory disorder characterized by enthesitis, progressive spinal ankylosis, and systemic inflammation. Although strong genetic associations such as HLA-B27 are well established, increasing evidence implicates gut microbiome dysbiosis as a key environmental driver of aberrant mucosal immunity and systemic immune activation. Alterations in bacterial, viral, and metabolomic profiles suggest that the microbiome–immune axis contributes significantly to disease heterogeneity, inflammatory burden, and therapeutic response. The aim of

this review is to evaluate emerging microbiome-derived biomarkers and translational therapeutic strategies targeting microbiome–immune interactions in ankylosing spondylitis.
Methods: A structured synthesis of recent original research (2022–2025) was conducted using PubMed and Scopus, focusing on human cohort microbiome studies, virome analyses, microbiome–metabolome integration, HLA-B27–associated microbial signatures, and translational interventions including biologics, microbiota modulation, and next-generation precision therapies.
Results: Recent studies consistently demonstrate gut microbial dysbiosis in AS, with disease activity and HLA-B27 status correlating with distinct taxonomic shifts, impaired microbial diversity, and enrichment of pro-inflammatory microbial pathways. Metagenomic investigations reveal not only bacterial alterations but also virome perturbations, highlighting phage-mediated immune modulation as an emerging component of pathogenesis. Integrated metabolomic analyses identify microbial metabolites influencing Th17/IL-17 immune polarization, epithelial barrier integrity, and systemic cytokine activation. Biomarkers such as fecal calprotectin, microbial-derived metabolic signatures, and dysbiosis indices show promise for stratifying disease severity and predicting treatment response. Translational evidence suggests that targeted biologics (TNF and IL-17 inhibitors) partially normalize microbial composition, while future strategies including defined microbial consortia, postbiotics, and precision microbiome therapeutics may complement immunomodulatory therapy.
*Conclusion:*Microbiome–immune axis dysregulation represents a critical mechanistic and translational frontier in ankylosing spondylitis. Emerging microbiome-based biomarkers and microbiota-targeted therapeutic innovations offer substantial potential for precision medicine approaches aimed at improving diagnosis, risk stratification, and next-generation treatment paradigms.

Keywords: Ankylosing spondylitis; Gut microbiome dysbiosis; HLA-B27; Microbiome biomarkers; Precision therapeutics.

Modified Polysaccharides as Excipients for the Treatment of Intestinal Inflammation

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Abstract
Effective management of intestinal inflammation requires site-specific drug delivery systems capable of maximizing local therapeutic action while minimizing systemic side effects. Targeted therapy demands excipients which are capable of responding to the altered colonic microenvironment characterized by enzymatic activity, disrupted mucus barrier and pH variability.

Natural polysaccharides are widely explored as pharmaceutical excipients due to their biocompatibility, biodegradability, low toxicity and susceptibility to enzymatic degradation by colonic microflora. However, native polysaccharides often exhibit limitations such as premature swelling, rapid dissolution in the upper gastrointestinal tract, poor mechanical strength and limited control over drug release, which restrict their effectiveness in targeted intestinal therapy. Chemical modification offers a rational and versatile approach to tailor the physicochemical and functional properties of polysaccharides for colon-specific drug delivery. Esterification and acetylation increase hydrophobicity, thereby reducing premature solubility in gastric conditions and improving stability in the upper gastrointestinal environment. Etherification and carboxymethylation introduce ionizable functional groups that enhance pH responsiveness and controlled swelling, facilitating preferential drug release in the inflamed colonic region. Crosslinking modifies the polymer network density, regulating drug diffusion and improving resistance to early degradation. Graft copolymerization incorporates synthetic segments to enhance mechanical strength, muco-adhesion and stimulus-responsive behaviour. Additionally, sulfation alters surface charge characteristics, potentially improving interaction with inflamed mucosal tissues and enhancing localized retention. By strategically correlating chemical modification techniques with specific property alterations, polysaccharides can be transformed into smart excipients capable of responding to the pathological microenvironment of intestinal inflammation. Therefore, chemically modified polysaccharides represent a rational and promising platform for achieving targeted, controlled and inflammation-responsive drug delivery in intestinal inflammatory disorders.

Keywords: Polysaccharides; Chemical Modification; Colon-Targeted Drug Delivery; Intestinal Inflammation; Controlled Drug Release

Molecular Roles and Therapeutic Implications of Histone Deacetylases in Human Diseases

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Abstract
Histone deacetylases (HDACs) are a central gene family that controls epigenetic functions by regulating chromatin structure and transcriptional dynamics. Addition of acetyl groups to the histone tails and other protein chains attached to chromatin is carried out through the enzymatic elimination of acetyl groups on lysine residues, and this process leads to restoration of positive charges, which consequently leads to chromatin condensation and transcriptional repression.
This enzyme activity supports numerous cellular functions, including proliferation, metabolism, circadian regulation, immune, and adaptive responses to stress. Eighteen HDAC isoforms are grouped into four groups of humans, based on structural homology and cofactor requirements.

HDACs of class I, including HDAC1, HDAC2, HDAC3, and HDAC8, are found in the majority of nuclei and immobilize corepressor complexes. The alteration of HDAC activity in an aberrant manner has been related to diverse disease conditions.
Oncology Hyperactive HDACs contribute to the silencing of tumor suppressor genes, inhibition of cellular differentiation, enhancement of oncogenic signal transduction, and immune evasion. Pharmacological HDAC inhibitors, such as vorinostat, romidepsin, and belinostat can induce apoptosis, reinstate deviant gene expression patterns, and enhance antitumor immunity.
Neurodegenerative disorders also contribute to the disruptions in HDAC that result in the ectopic loss of neuro-projection and encourage the formation of collaborating with neuro-vapors that lead to protein aggregation and neuroinflammation.
Class III sirtuins have unique functions; SIRT1 is often involved in causing neuroprotection, with SIRT2 disrupting neurotoxicity under certain circumstances. In immune and inflammatory pathways, HDACs coordinate cytokine synthesis, immune regulator differentiation, and transcriptional signaling, due to diseases caused by NF -KB and STAT3; hence, leading to chronic inflammation and immune dysregulation.
Cardioprotective genes repressed by HDAC have been reported for cardiac hypertrophy, fibrosis, and maladaptive stress responses. Despite the therapeutic potential of the broad-spectrum HDAC inhibitors, they are non-specific and provoke adverse effects, which underscores the need to find isoform-specific and tissue-specific therapies.
The continued studies of biology of HDAC are needed to develop accuracy, gene-based therapeutic solutions in oncology, neurodegeneration, immunology, infectious, and cardiovascular diseases.

Keywords: Histone deacetylases (HDACs), Epigenetic regulation, Chromatin remodeling, Transcriptional repression, Oncogenesis, Neurodegenerative diseases, Sirtuins , Isoform-selective therapeutics

Nano-crystal Drug Delivery System: Scale up Challenges and Industrial Translation

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Abstract:
Nano-crystal drug delivery systems (NCDDS) have emerged as a promising strategy to overcome the bioavailability challenges of poorly soluble drugs, offering enhanced dissolution rates, improved therapeutic efficacy, and reduced dose-related toxicities. This review critically examines the multifaceted scale-up challenges inherent in transitioning NCDDS from laboratory-scale formulation to industrial production, focusing on the critical parameters impacting reproducibility, stability, and cost-effectiveness. Key hurdles include maintaining particle size distribution and

homogeneity during large-batch processing, ensuring polymorphic stability throughout manufacturing and storage, and addressing the complexities of sterile filtration and lyophilization for parenteral applications. Furthermore, the selection and concentration of polymeric or surfactant stabilizers must be precisely optimized to prevent Ostwald ripening and uncontrolled crystal growth under high-shear industrial conditions.
The selection of appropriate milling technologies, such as media milling and high-pressure homogenization, is crucial, necessitating a thorough understanding of process parameters, equipment design, and material attributes. Furthermore, the industrial translation of NCDDS requires robust analytical methods for real-time process monitoring and quality control, alongside comprehensive regulatory strategies for product approval. Successful translation also hinges on mitigating energy-intensive processes that may trigger chemical degradation or unintended phase transitions in sensitive active pharmaceutical ingredient**s.** This abstract highlights the need for integrated quality-by-design (QbD) approaches, emphasizing continuous manufacturing principles and advanced process analytical technology (PAT) tools to mitigate risks and streamline the scale-up pathway. Overcoming these challenges is paramount for realizing the full therapeutic potential of nano-crystal formulations and ensuring their successful commercialization, ultimately broadening treatment options for patients.

Keywords: Nanocrystal Drug Delivery Systems (NCDDS); Industrial Scale-up; Bioavailability; Quality by Design (QbD); Media Milling; High-Pressure Homogenization; Polymorphic Stability; Process Analytical Technology (PAT).

Nanoparticle Systems for Controlled Drug Delivery and Treatment of Autoimmune Disorders

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Abstract

Autoimmune diseases arise from an inappropriate immune response against self-tissues, Leading to persistent inflammation and gradual organ damage. Current treatment approaches primarily depend on systemic immunosuppressive drugs, which often lack tissue specificity and may cause adverse effects with prolonged use. To address these limitations, nanoparticle mediated drug delivery systems have gained increasing attention as an alternative therapeutic strategy in autoimmune disorders. This review explores the role of nanoparticle-based platforms in improving drug delivery for conditions such as rheumatoid arthritis, systematic lupus erythematosus, multiple sclerosis and inflammatory bowel disease. Various Nanocarriers, including liposomes, polymeric nanoparticles, lipid nanoparticles and metallic nanoparticles are examined with respect to their formation characteristics, drug encapsulation efficiency and ability to selectively interact with immune cells and inflamed tissues. Emphasis is made in delivery systems that increase localized

drug accumulation, regulate antigen presentation and encourage immune tolerance rather than widespread immunosuppression. Findings from preclinical investigations indicate much higher therapeutic efficacy, longer drug action and lesser systematic toxicity when compared to standard dosage forms. Early clinical trials further reveal that these systems are mostly well tolerated and hold translation promise. However, issues related to immunogenic responses, manufacturing expansions, regulatory review and variability in disease pathology remain notable problems. Overall, nanoparticle mediated drug delivery represents a growing and better approach for autoimmune disease therapy, warranting more studies to assist effective clinical translation.

Keywords: Nanoparticles, Immunology, Inflammation, Nanotechnology, Targeted, Nanomedicine, Immunomodulation.

Navigating Regulatory Innovations for Oncology-Based In Vitro Diagnostics: Harnessing Emerging Technologies

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Abstract

Oncology-based *in-vitro* diagnostics (IVDs) play a crucial role in precision cancer care by enabling early detection, monitoring, and personalized treatment strategies. As demand for advanced cancer diagnostics increases, the regulatory landscape is quickly evolving to address the unique challenges posed by breakthrough technologies. This review examines current regulatory innovations shaping the global approval and oversight of oncology IVDs, with a focus on emerging technologies such as artificial intelligence, nanotechnology, and genomics. Regulatory authorities worldwide are adopting risk-based strategies, adaptive assessment pathways, and harmonization initiatives to facilitate the development and market entry of high-impact IVDs. The integration of artificial intelligence into diagnostic algorithms, nanomaterials for greater sensitivity, and genomics for targeted analysis is transforming traditional validation and compliance processes. Key considerations now include real-world evidence, data privacy and security, analytical performance assessment, and robust clinical validation frameworks. Through case studies and comparative analysis of major regulatory frameworks, this review highlights opportunities as well as challenges in achieving regulatory efficiency while ensuring patient safety and test reliability. Collaboration among stakeholders, manufacturers, regulators, clinicians, and researchers is essential to translate technological breakthroughs into practical cancer diagnostic solutions. Ultimately, understanding and utilizing regulatory innovations are vital for the timely adoption of new oncology IVDs, leading to better patient outcomes and a new era in cancer diagnostics. This review aims to promote informed discussions on advancing regulatory science alongside technological progress to support future-ready oncology diagnostics for supporting new research

and to ensure that patient's gets access to effective personalized treatment. Harmonization of the regulatory framework, assessment standards, and PMS is essential.

Keywords: *In-Vitro* Diagnostics (IVDs), Cancer Diagnostics, Regulatory Framework, Risk-based Approval, Global Harmonization, Oncology Diagnostics, Precision Medicine, Emerging technologies

New series of Pyrrole and Imidazole derivatives as Antioxidant Agents: *IN-SILICO*, ADMET Studies, Synthetic Insights and In-Vitro Safety

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Abstract:
Drug discovery progress is maintained by the limited research on its pharmacological potential and mechanism of action. In order to determine their potential for antioxidant applications, this study focuses on incorporating *In-Silico* techniques, such as molecular docking and ADMET prediction. A new series of thirty five hybrids (2a-2y) and (4a-4j) had the greatest potential to function as inhibitors of the target protein (human glutathione peroxidase 7 PDB ID - 2P31) based on a comparison of the ADMET attributes and molecular docking scores. The compounds 2i, 2p, 2r, 2t, 2u, 4a, 4c, 4f, 4h, 4j showed highest binding scores as compared with reference drug (Ascorbic acid). The physicochemical characteristics of the selected molecules were first assessed using "Lipinski's rule of five" criteria. A new series of selected molecules were synthesized from condensation method and proven by FTIR, 1H NMR, Mass spectral analysis. Under synthetic approach, novel pyrrole and imidazole derivatives were produced, ensuring a yield of around 59% to 83%, minimal hazardous emissions. Additionally, the antioxidant activity was assessed using the DPPH assay, which measures radical scavenging activity. Subsequent analysis of the compound's antioxidant protection capacity in vitro cellular-based models identified compounds 2r, 2t, 4a and 2c as the most optimistic and safe profile.

Keywords – Pyrrole and Imidazole derivatives, Synthesis, Spectral analysis, Antioxidant activity, In-vitro activity, Molecular docking, ADME prediction

Next-generation Treatment Approaches For Non-alcoholic Fatty Liver Disease (Nafld) - Metabolic, Anti-inflammatory, And Microbiome-driven Innovations

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Abstract

Introduction: Non-alcoholic fatty liver disease (NAFLD) represents the most prevalent chronic liver disorder worldwide and is strongly associated with obesity, insulin resistance, type 2 diabetes mellitus, and cardiometabolic syndrome. Progression from simple steatosis to non-alcoholic steatohepatitis (NASH), fibrosis, cirrhosis, and hepatocellular carcinoma is driven by complex interactions involving lipid dysregulation, oxidative stress, immune activation, and gut–liver axis dysfunction. Despite its growing burden, NAFLD remains a major therapeutic challenge due to disease heterogeneity, limited approved pharmacotherapies, and the multifactorial nature of its pathogenesis. The aim of this review is to evaluate next-generation therapeutic innovations targeting metabolic, inflammatory, and microbiome-mediated mechanisms in NAFLD.

Methods: A structured synthesis of recent translational and clinical research (2022–2025) was performed using PubMed, Scopus, and Web of Science databases. Emphasis was placed on emerging drug classes, immune-metabolic modulators, microbiome-based interventions, and precision therapeutic strategies under advanced clinical evaluation.

Results: Next-generation metabolic therapies, including GLP-1 receptor agonists, dual incretin co-agonists, and thyroid hormone receptor-β agonists, demonstrate significant improvements in hepatic steatosis, weight reduction, and insulin sensitivity. Anti-inflammatory and anti-fibrotic strategies targeting FXR signalling, CCR2/CCR5 pathways, and hepatic stellate cell activation show promise in slowing fibrosis progression. Additionally, microbiome-driven innovations such as prebiotics, postbiotics, engineered probiotics, and faecal microbiota–derived therapeutics are emerging as modulators of endotoxemia, bile acid metabolism, and systemic inflammation through the gut–liver axis. Combination regimens integrating metabolic correction with immunomodulation and microbiota restoration are increasingly viewed as essential for effective long-term disease control.

Conclusion: NAFLD therapeutics are rapidly evolving toward precision-based, multi-target strategies that address metabolic dysfunction, chronic inflammation, and microbiome dysbiosis. Continued clinical validation, biomarker-guided stratification, and integrative translational approaches will be critical for advancing next-generation treatments and reducing NAFLD-related global morbidity.

Keywords: Non-alcoholic fatty liver disease; NASH; GLP-1 agonists; Gut–liver axis; Precision therapeutics.

Novel Drug Delivery Systems: Bridging the Gap Between Conventional Therapy and Precision Medicine

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Abstract
Novel Drug Delivery Systems (NDDS) are an innovative discovery in the pharmaceutical field, which overcome the drawbacks of conventional drug delivery systems such as oral and parenteral routes, which may have low bioavailability, non-specific distribution, fluctuating plasma concentrations, and toxicity. NDDS are designed to improve the efficacy and compliance of drug therapy by providing greater precision in spatial, temporal, and dosage control. NDDS include a few technologies such as liposomes, nanoparticles, microspheres, and hydrogels, which improve the protection, solubility, and controlled release of drugs. Most NDDS have targeted delivery systems, which use ligands or antibodies to bind to disease-specific markers. This reduces the damage to normal tissues and is very effective in cancer therapy, as it prevents systemic toxicity by specifically targeting cancer cells. Precision medicine focuses on personalized treatment that considers genetic, environmental, and lifestyle variables. Nanocarriers and smart delivery systems are essential in precision medicine because they enable personalized dosing and targeted drug delivery according to molecular profiles. These systems can respond to physiological stimuli, thus enhancing the efficacy of treatments by matching them with individual disease characteristics. Novel Drug Delivery Systems (NDDS) play a crucial role in bridging conventional treatment and precision medicine through enhanced targeting, control, and customization of drugs. The successful translation of NDDS requires continued research and development across various disciplines. NDDS are poised to play a pivotal role in shaping the future of therapeutics as the healthcare industry moves towards personalized medicine.

Keywords: Nanoparticles, bioavailability, Conventional drug delivery system, Precision Medicine.

OTC drugs and their adverse effects on prolonged use

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Abstract
Over-the-counter medications commonly known as OTC drugs are very widely used for self-medication . These drugs deal with the very common ailments such as pain,cold, digestive issues

and allergies. The popular notion associated with these drugs is that they are absolutely safe and effective even without the supervision from a health care professional. This has led to high consumption rate with Analgesics (49.1%) tops the list. This short term relief could be Hazardous in case of prolonged usage, diagnosis errors, excessive dosing and drug interaction.
This review highlights the potential threats of OTC consumption in various categories. The NSAIDs are associated with GIT irritation, renal failure, cardiovascular disease. e.g- ibuprofen. Acetaminophen (PCM) overuse has been associated with acute liver failure. Sedative histamines e.g- (diphenylhydramine) should be taken with caution as it posses anticholinergic toxicity, cognitive impairment especially in elderly. Additional concerns include codeine-based combinations fostering opioid dependence and proton pump inhibitors linked to bone fractures. In conclusion the OTCs can do more bad then good when associated risks are underestimated and vigilance of health care professional is neglected. Promoting health literacy is very critical for self-medication practices worldwide.

Keywords: OTC, ibuprofen, NSAIDs, codeine, anticholinergic toxicity , diphenylhydramine

Pathophysiological Mechanism of Atherosclerosis: Endothelial Injury to Plaque Rupture

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Abstract
Atherosclerosis is a chronic, progressive inflammatory disease of medium and large-sized arteries and represents the principal underlying cause of cardiovascular disorders such as myocardial infarction and stroke. The pathogenesis of atherosclerosis begins with endothelial dysfunction triggered by risk factors including hyperlipidaemia, hypertension, diabetes mellitus, smoking, and oxidative stress. Endothelial injury leads to increased vascular permeability, enhanced expression of adhesion molecules (VCAM-1, ICAM-1), and recruitment of circulating monocytes into the intima. These monocytes differentiate into macrophages, internalize oxidized low-density lipoprotein (oxLDL), and transform into lipid-laden foam cells, forming the earliest visible lesion known as the fatty streak.
Progression of the lesion involves smooth muscle cell (SMC) migration and proliferation from the media into the intima, along with extracellular matrix deposition, resulting in fibrous cap formation over a lipid-rich necrotic core. Chronic inflammation, mediated by cytokines and matrix metalloproteinases (MMPs), gradually weakens the fibrous cap. Vulnerable plaques are characterized by a thin fibrous cap, large necrotic core, and increased inflammatory cell infiltration.
Plaque rupture occurs when mechanical stress exceeds cap stability, exposing thrombogenic material such as collagen and tissue factor to circulating blood. This triggers platelet aggregation

and thrombus formation, potentially leading to acute coronary syndromes or ischemic stroke. Understanding the sequential pathophysiological mechanisms from endothelial injury to plaque rupture provides critical insight into preventive and therapeutic strategies targeting lipid metabolism, inflammation, and endothelial function.
Early detection and intervention at molecular and cellular levels remain central to reducing the global burden of atherosclerotic cardiovascular disease.

Keywords: Atherosclerosis, Endothelial dysfunction, Foam cells, Inflammation, Plaque rupture, Thrombosis

Pediatric and geriatric topical formulations

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Abstract
Pediatric and geriatric populations require special consideration in the design and development of topical drug formulations due to age-related physiological differences in skin structure and function. The skin of pediatric patients, particularly neonates and infants, is immature, characterized by an underdeveloped stratum corneum and a higher surface area-to-body weight ratio, which can lead to increased percutaneous absorption and a greater risk of systemic toxicity. Conversely, geriatric skin undergoes progressive changes such as thinning of the epidermis, reduced lipid content, decreased hydration, impaired barrier function, and delayed wound healing, all of which influence drug permeation and therapeutic response. Recent advances in pediatric and geriatric topical formulation development emphasize safety, efficacy, and patient acceptability. Formulation strategies focus on the selection of non-irritating excipients, avoidance of harsh preservatives and penetration enhancers, and optimization of drug concentration to minimize adverse effects. Age-appropriate dosage forms, including creams, gels, ointments, foams, and emulsions, are increasingly designed to improve ease of application and adherence to therapy. Novel delivery systems such as lipid-based carriers, hydrogels, and controlled-release topical formulations have demonstrated potential in enhancing local drug action while reducing systemic exposure. Regulatory guidelines and risk-based assessment approaches play a critical role in ensuring the safety and quality of topical products intended for pediatric and geriatric use. This conference topic aims to highlight current challenges, formulation considerations, evaluation strategies, and emerging technologies in the development of topical drug delivery systems tailored for pediatric and geriatric patients, underscoring the importance of age-specific and patient-centered therapeutic solutions.

Photobiomodulation in Fibroblast-Driven Wound Healing

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Abstract

Photo biomodulation (PBM) is a non-invasive therapeutic modality that utilizes non-ionizing light in the visible to near-infrared spectrum to stimulate biological processes involved in tissue repair and regeneration. Derived from heliotherapy and low-level light therapy, PBM acts through the activation of intracellular molecular pathways that modulate cellular metabolism, redox balance, and signaling cascades. Among target cells, fibroblasts play a central role in orchestrating wound healing by regulating proliferation, migration, extracellular matrix deposition, and tissue remodeling. The absorption of light energy by living cell depends on the presence of biomolecules that can be excited by light quanta. The essential prerequisite for any photobiological effect is the excitation of these molecules, which can be specialized or unspecialized, by electromagnetic radiation, which leads to a subsequent energy conversion. Wound healing is a complex biological process that involves coordinated interactions among cellular, molecular and systemic factors.

This work provides a comprehensive overview of the molecular mechanisms underlying PBM, with particular emphasis on fibroblast biology and its implications for regenerative medicine. Advances in omics technologies—including transcriptomics, proteomics, and metabolomics—have revealed complex signaling networks underlying PBM responses, providing a system-level understanding of its biological effects. In parallel, artificial intelligence (AI) and computational modeling emerge as powerful tools to analyze high-dimensional datasets, parameters, and support protocol optimization. By integrating molecular biology with data-driven approaches, PBM is increasingly positioned as a precision-guided regenerative strategy with significant translational potential. Further interdisciplinary research and robust clinical studies are required to standardize treatment parameters and strengthen its evidence-based application in clinical practice.

Keywords: Photo-biomodulation, Wound, Fibroblast, Healing, Proliferation etc.

Phytochemicals as Potential Therapeutic Agents for Anxiety Management: An In-Silico Network Pharmacology and Molecular Docking Approach

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Abstract
Anxiety disorders represent a significant global health burden, affecting over 300 million people worldwide and imposing socio-economic costs. Current pharmacotherapies, primarily benzodiazepines and selective serotonin reuptake inhibitors (SSRIs), are limited by side effects and dependency risks. Multi-target phytochemicals in Indian medicinal plants have potential opportunities in the anxiolytic field, but few studies have been systematically and computationally verified. This study engages network pharmacology and molecular docking to evaluate the top 10 phytochemicals of *Withania somnifera* (withanolides)- withaferin A, withanolide A, withanol, withanolide D, withanoside IV, 27-hydroxy withanone, withanolide B, 17-hydroxy withaferin A, withasomniferol A, and anaferin- as new therapeutic agents to manage anxiety disorders (Docking analysis in process). Preliminary network pharmacology on Swiss Target Prediction and Cytoscape has determined possible intersections with the major anxiolytic targets such as the GABAA receptor, 5-HT1A, and dopamine pathways. The multi-target networks of withanolides pointed to the polypharmacological role of withanolides in the regulation of GABAergic and serotonergic signaling pathways. Continued molecular docking applications using AutoDock Vina with respect to targeting of pertinent PDB structures (4COF-GABAA, 6VRH-5HT1A) seek to measure binding affinities and interaction profiles in comparison to conventional anxiolytics such as diazepam. Swiss ADME analysis is also being performed in order to determine drug-likeness (Lipinski compliance), BBB penetration and low risks (AMES negativity) safety profiles of these candidates. These findings underscore withanolides potential as safer, multi-target anxiolytics, bridging traditional Ayurvedic use with modern pharmacology. Future in-vivo validation and clinical translation could revolutionize anxiety treatment paradigms.

Keywords: Phytochemicals, anxiety disorders, network pharmacology, molecular docking, GABA receptors, Indian medicinal plants, *Withania somnifera* .

Plant Extracts and Herbal Products: Challenges in Acute and Sub-Acute Oral Toxicity Assessment under OECD Guidelines

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Abstract
Botanical extracts and herbal medicines are commonly used for therapeutic, preventive and nutraceutical purposes around the globe due to their assumed safety profile. Assessing their safety is challenging due to the complex phytochemical nature of herbal products and difficulty of standardisation. Acute and sub-acute oral toxicity studies following Organisation for Economic Co-operation and Development (OECD) Test Guideline 423 (Acute Oral Toxic Class Method) and

Test Guideline 407 (28-day Repeated Dose Oral Toxicity) are considered the gold standard for hazard characterisation and risk assessment of chemicals. When standardized toxicity testing methods—originally developed and validated for single, well-characterized synthetic compounds—are directly applied to complex botanical products, they frequently fail to capture the full spectrum of phytochemical interactions, batch-to-batch variability, and metabolite diversity inherent to plant-based preparations The challenges of batch variability, lack of standardisation, unidentified active or toxic ingredients, as well as synergistic and antagonistic effects between ingredients make selecting appropriate doses difficult and may impact reproducibility and interpretation of results. Ingredients that may be contaminated with heavy metals, pesticides or adulterants can also influence toxicity findings. Acute toxicity studies may fail to identify chronic or cumulative toxicity while sub-acute toxicity studies may demonstrate organ toxicities without being able to identify the causative ingredient. This article will review some of the challenges faced when using OECD toxicity studies with herbal products and offer some solutions on how to overcome these challenges to achieve a safer product that can be utilised in an evidence-based manner.

Keywords: Herbal products, Oral toxicity, OECD guidelines, Standardization challenges, Batch variability.

PLGA (Poly Lactic Co-Glycolic Acid) Microparticles in Anti-Diabetic Formulation: Future trend in Controlled Release Oral Solid Drug Delivery System.

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Asbtract
Use of microparticles such as (PLGA) Poly lactic co-glycolic acid incorporated with solid dosage form of Metformin HCL. The research will include review of solid dosage form containing microparticles such as PLGA which is biodegradable polymer will demonstrate superior biocompatibility & fewer side effects in diabetic patient. Use of PLGA microparticle solid dosage form such as Metformin HCL improve patient adherence due to reduced dosing frequency and better tolerability. The research will include both convergence and divergence in formulation outcomes thereby guide evidence based optimization of microparticles based controlled release systems for anti-diabetic study. The research will help for emerging trends in the application of microparticles such as PLGA ((Poly Lactic Co-Glycolic Acid) for controlled release oral solid drug delivery in antidiabetic formulation.

Keywords: Microparticles, PLGA, Controlled Release formulation, Anti-diabetic, Metformin HCL.

Postbiotics: The Future Beyond Probiotics

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Abstract:
The dawn of postbiotics is measured as one of the major breakthroughs in the therapeutics of the human microbiome. It reflects the transition from conventional, live-cell-based probiotics to bioactive, well-defined compounds extracted from inactivated cells or their metabolic fractions. Contrasting their conventional, live-cell-based counterparts, postbiotics evade the risks connected with the viability, translocation, and stability issues. Thereby it can provide better safety, longer shelf life, and reproducibility. These compounds represent a wide variety of bioactive compounds, including short-chain fatty acids, bacteriocins, peptidoglycans, lipoteichoic acids, exopolysaccharides, etc. The mechanisms of action of postbiotics are pleiotropic, including the modulation of the innate and adaptive immune response, strengthening the epithelial barrier integrity through the regulation of tight junction proteins, reduction of inflammatory cascades through the modulation of the NF-κB and MAP kinase pathways, etc. The preclinical and early clinical trials undertaken on postbiotics indicate their potential to treat various diseases, including gastrointestinal inflammatory diseases, metabolic syndrome, dermatological diseases such as atopic dermatitis, etc., along with their potential to be used as adjunct therapy in cancer. In spite of these promising results, the translation of postbiotics into clinical practice is hindered by certain issues, including the exact definition of the active compounds, the identification of the best biomarkers, the standardization of the dose, etc. So, to ensure reproducibility, safety, and clinical efficacy, it is important to implement a multidisciplinary approach, including involvements from advanced analytical chemistry, systems biology, and regulatory science. With further scientific validation, postbiotics hold significant potential to be developed into evidence-based, next-generation precision therapeutics.

Keywords: Postbiotics, Microbiome-Derived Therapeutics, Immunomodulation, Gut Barrier Integrity, Translational Medicine, Microbial Metabolites, Regulatory Science, Precision Therapeutics

Recent advancement in radio protective drugs: current scenario and the way ahead

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Abstract

Ionizing radiation is widely used in cancer treatment, diagnostic imaging, nuclear industries, occupational workplaces, and space missions. Despite its broad clinical and industrial applications, exposure to ionizing radiation can cause significant damage to normal tissues, resulting in both acute and long-term health complications such as tissue fibrosis, organ dysfunction, and increased cancer risk. Radioprotective drugs play a crucial role in minimizing radiation-induced damage, thereby improving patient safety, treatment tolerance, and overall therapeutic outcomes.

At present, clinically approved radioprotective agents such as amifostine and potassium iodide are used to protect normal tissues during radiation exposure. However, their widespread use is limited due to adverse side effects, narrow therapeutic windows, and insufficient tissue selectivity. These limitations have driven continuous research toward the development of safer, more effective, and targeted radioprotective drugs.

Radioprotective agents are extensively applied in cancer radiotherapy to shield radiosensitive normal tissues, including salivary glands, gastrointestinal tract, and bone marrow, without compromising tumor control. In addition, they play an essential role during radiation emergencies and nuclear accidents by preventing organ-specific damage, particularly thyroid injury caused by radioactive iodine exposure. Occupational and diagnostic radiation settings also benefit from radioprotective strategies aimed at reducing cumulative radiation exposure among healthcare professionals and industrial workers.

Recent Advances in Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

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Abstract

Non-steroidal anti-inflammatory drugs (NSAIDs) are among the most widely prescribed and over-the-counter medications used globally for the management of pain, inflammation, and fever. They play a crucial role in the treatment of acute and chronic inflammatory conditions such as arthritis, musculoskeletal disorders, postoperative pain, and dysmenorrhea. The primary mechanism of action of NSAIDs involves inhibition of cyclooxygenase (COX) enzymes, which are responsible for the conversion of arachidonic acid into prostaglandins. These prostaglandins are key mediators of inflammation, pain, and fever. Conventional NSAIDs inhibit both COX-1 and COX-2 isoenzymes. While inhibition of COX-2 produces the desired anti-inflammatory, analgesic, and antipyretic effects, suppression of COX-1 is associated with adverse effects such as gastric irritation, ulceration, gastrointestinal bleeding, renal impairment, and altered platelet function, which restrict their long-term clinical use. Recent advances in NSAID research have focused on

enhancing therapeutic efficacy while minimizing toxicity and improving overall patient safety. The development of selective COX-2 inhibitors marked a significant milestone by offering effective anti-inflammatory action with reduced gastrointestinal side effects. Furthermore, newer NSAID molecules and prodrug approaches have been introduced to improve bioavailability, prolong duration of action, and minimize direct contact with the gastric mucosa. Advances in pharmaceutical technology have also led to the development of novel drug delivery systems such as sustained-release and controlled-release formulations, transdermal patches, topical gels, nanoparticle-based carriers, and targeted delivery systems, which enhance therapeutic outcomes and improve patient compliance. In addition, emerging research on dual-acting NSAIDs, including nitric oxide-releasing and hydrogen sulfide-releasing derivatives, has demonstrated promising potential in providing improved gastrointestinal and cardiovascular safety. Overall, recent developments in NSAID research reflect a paradigm shift toward safer, more effective, and patient-centric anti-inflammatory therapies with enhanced clinical benefits.

Keywords: NSAIDs, COX inhibitors, Anti-inflammatory drugs, Drug delivery systems.

Regulatory Landscape of Drug-Eluting Stents in Modern Cardiovascular Therapy

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Abstract
Stents are small mesh tubes typically used to hold open passages in the body, like narrowed or blocked blood vessels. While it is a widely used procedure, it comes with its own complications. Many patients experience restenosis i.e., re-narrowing of the blood vessels. Coronary drug-eluting stents (DES) are an advancement in technology that has changed the standard of patient care undergoing percutaneous intervention for coronary artery disease. DES can be classified according to the scaffold, drug-delivery mechanism (polymer) and the therapeutic agent. Due to its high risk and complexity, DES are considered as high-risk medical devices across various global regulatory authorities. But regulatory classification differs across authorities. In the United States, according to the USFDA, coronary drug-eluting stents are regulated as high-risk (Class III) and require stringent premarket approval with extensive clinical evidence. In the European framework, DES are treated as combination products, and both device and medicinal aspects were considered in the evaluations. In India, CDSCO classifies coronary DES as high-risk (Class D) medical devices under the Drugs & Cosmetics Act and requires regulatory oversight for manufacturing and import. Despite their clinical success, there are various regulatory challenges. Key challenges being (1) inconsistent classification rules and lack of harmonization; (2) variability in clinical evidence requirements; (3) differences in post-approval monitoring mechanisms. These regulatory gaps complicate global product development and delay patient access to improved stent technologies.

Harmonization of classification rules, clearer guidance on preclinical/clinical evidence for combination products, and strengthened, consistent post-market surveillance across jurisdictions would streamline translational development while maintaining patient safety.

Keywords: Drug-eluting stents; combination medical devices; regulatory frameworks; US FDA; CDSCO; translational development

Repurposing of drug molecules to improve angiogenesis in volumetric muscle loss repair

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Abstract

Background: Volumetric muscle loss (VML) is the irreversible loss of skeletal muscle tissue, generally 20% or more, caused by high-energy trauma, which causes damage to myofibres and blood capillaries, triggering the activation of the response pathway. The donor tissue and scaffolds used for implantation are devoid of vessels and growth factors, leading to ischemia and necrosis. This creates an ideal environment for microbial growth, which can lead to sepsis or gangrene and necessitate amputation of the tissue.

Aim: This study aims to repurpose a drug molecule to induce angiogenesis and accelerate VML repair.

Methodology: *In-silico* analysis was performed to identify a drug candidate that induces the angiogenic pathway. To this end, we retrieved studies from the GEO database and identified responsive genes and pathways involved in angiogenesis induction. The list of drugs targeting the hub gene in angiogenesis pathways was retrieved from DGIdb (dgidb.org), and protein structure modelling was performed using SWISS-MODEL, AlphaFold, I-TASSER, and PyRosetta due to the unavailability of a PDB structure for HDAC5. Subsequently, we have performed molecular docking and MD simulations for 100 ns using PyRx v0.8 and GROMACS, respectively, to analyse the binding and stability of the protein-ligand complex. A tube formation assay was performed to evaluate the drug's angiogenic potential.

Results: The five datasets, viz. GSE48022, GSE183359, GSE267328, GSE140714, and GSE45176 were downloaded from the GEO database, normalised and converted to $\log_2$ values. A total of six common genes, including VEGFA, HDAC5, FOXC2, EFNB2, ITGA5, and GREM1, were identified as playing an essential role in angiogenesis. Pathway analysis revealed that HDAC5 could be the hub gene whose inhibition may induce angiogenesis. A list of HDAC5-targeting drugs was compiled, and, based on their indications, valproic acid was selected for further studies. A

binding simulation was performed to assess the interaction between valproic acid and HDAC5. The binding energy of the complex was -4.3 kcal/mol, confirming the successful docking. The complex remained stable throughout the MD simulation, with no fluctuations. The tube formation assay confirmed valproic acid's potential as an angiogenic inducer.
Conclusion: These results provide a foundation for the use of Valproic Acid to inhibit HDAC5, potentially promoting the angiogenesis necessary for functional muscle regeneration in VML.

Revolutionizing Precision Medicine: Therapeutic Applications of CRISPR-Based Gene Editing

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Abstract
Introduction: Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)-based gene editing has revolutionized therapeutic biotechnology by enabling precise and programmable modifications of genomic sequences. In contrast to traditional gene therapy, CRISPR systems like CRISPR-Cas9 allow for the targeted correction, disruption, or insertion of genes associated with both inherited and acquired disorders. Recent advancements have broadened their applications across oncology, hematological diseases, and rare genetic disorders.
Objective: This study aims to investigate the therapeutic potential, delivery strategies, and translational challenges of CRISPR-based gene editing systems in clinical applications.
Method: A comprehensive review and analytical evaluation of recent preclinical and clinical studies were conducted, focusing on CRISPR-Cas9, base editing, and prime editing platforms. The review emphasized various delivery mechanisms, including viral vectors (such as AAV and lentivirus) and non-viral systems like lipid nanoparticles. Safety parameters—including off-target effects, immunogenicity, and editing efficiency—were critically assessed.
Results: CRISPR-based therapeutics displayed high gene-editing precision in ex vivo applications, particularly in modifying hematopoietic stem cells for conditions such as β-thalassemia and sickle cell disease. In vivo delivery strategies have shown promising outcomes for liver-targeted gene editing utilizing lipid nanoparticle systems. However, challenges such as unintended off-target mutations, immune responses, and scalability continue to present significant barriers to widespread clinical translation.
Conclusion: CRISPR-based gene editing therapeutics represent a transformative advancement in precision medicine. While considerable progress has been achieved in enhancing accuracy and delivery efficiency, further optimization of safety and regulatory frameworks is essential for the successful integration of these technologies into mainstream clinical practice.

Keywords: CRISPR-Cas9, Gene Editing, Therapeutic Biotechnology, Precision Medicine, Base Editing, Lipid Nanoparticles

RNA-Based Therapeutics: Overcoming Translational Barriers Through Advanced Delivery Platforms

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Abstract

A revolutionary class of next-generation medications, RNA-based therapies have the capacity to highly selectively alter gene expression. Therapies based on messenger RNA, small interfering RNA, antisense oligonucleotides, and microRNA have shown great promise in treating a variety of illnesses, such as cancer, infectious diseases, and neurological diseases. The successful conversion of RNA-based therapies into clinically approved pharmaceuticals is still limited, despite promising preclinical and early clinical results. This is mainly because of issues with stability, targeted delivery, and manufacturing scalability. The inherent volatility of RNA molecules, their vulnerability to enzymatic breakdown, low cellular absorption, and off-target effects are significant obstacles to therapeutic success. Pharmaceutical technological advancements have produced novel delivery systems, such as ligand-targeted delivery systems, polymeric carriers, and lipid nanoparticles, which improve biodistribution, increase RNA stability, and allow tissue-specific targeting. To maximise pharmacokinetics, reduce immunogenicity, and guarantee therapeutic efficacy, these administration methods are essential. Reproducibility, quality assurance, and long-term safety assessment are among the manufacturing and regulatory obstacles that the translational development of RNA therapies must overcome. To speed up clinical translation, scalable manufacturing techniques, strong regulatory frameworks, and quality-by-design principles must be integrated. The potential to overcome these obstacles through concerted advancements in medication design, delivery technology, and regulatory science is demonstrated by the recent regulatory approvals of RNA-based pharmaceuticals. In addition to highlighting new delivery systems that are facilitating the clinical success of RNA-based therapies, this abstract addresses important translational issues related to these treatments. It is anticipated that regulatory alignment and ongoing pharmaceutical technology improvement will propel the next stage of RNA-based therapies toward broad clinical use.

Keywords: Targeted delivery systems, Lipid nanoparticles, Gene expression modulation, Translational challenges, Regulatory and manufacturing scalability

Role of Biosciences in Drug Discovery and Development of Safer Medicines

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Abstract
Understanding biological processes in the human body is crucial to modern pharmaceutical research. The biosciences are an important part of pharmacy. It plays a major role in the discovery of new medicines. We can understand disease initiation and progression, and the action of different drugs through study of biochemistry, molecular biology and pharmacology. This fundamental knowledge helps identify possible drug targets and design medicines that are safer and more effective for the patient.In ancient times, a lot of drugs were found due to guess work. Some drugs caused severe adverse effects due to lack of full knowledge concerning their precise mechanism of action.Drug discovery is, becoming more systematic & knowledge based with advancement of biosciences. Scientific research into diseases at the cell and molecular level will help select better drug candidates and reduce unwanted effects.Biosciences have aided the outcome of biological medicines like vaccines, monoclonal antibodies and recombinant proteins. People are using these biological drugs for curing cancer, other infectious diseases and chronic disorders. Better therapeutic effects are generally linked to their activities on specific targets.Biosciences also play a role in translational research, where lab results are put to actual patient treatment. Newly-formed medications get assurance of their safety and utility in clinical practice. Biosciences form the backbone of modern drug discovery and are crucial for the development of safer medicines and improved health care.Understanding the mechanisms underlying disease and how the body reacts to various therapeutic agents are essential for the creation of novel treatments. In this regard, biosciences offer a scientific foundation for enhancing patient safety and treatment quality. It is anticipated that ongoing bioscience research will improve medication safety and therapeutic efficacy in upcoming medical procedures.

Keywords: Biosciences, Drug Discovery, Drug Targets, Biological Medicines, Vaccines, Monoclonal Antibodies, Recombinant Proteins, Translational Research, Pharmaceutical Research, Safer Medicines

Role of Biotechnology in Modern Drug Discovery

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Abstract
Modern drug discovery has evolved significantly over the past few decades, with biotechnology emerging as one of its most powerful driving forces. Unlike traditional drug discovery approaches that largely relied on trial-and-error methods, biotechnology introduces a precise, science-based framework that utilizes living systems, cells, and biological molecules. Advances in molecular biology, genetics, and bioinformatics have enabled scientists to understand diseases at the cellular and genetic levels, paving the way for the development of targeted and highly effective therapies. Genomics and proteomics play a central role in biotechnology-driven drug discovery. Cells contain numerous compartments that store genetic and protein-based information, many of which serve as potential drug targets. By identifying genes and proteins associated with specific diseases, researchers can design drugs that interact selectively with these targets. This targeted approach enhances therapeutic efficacy while reducing unwanted side effects. Genetic engineering has further revolutionized this field by enabling the large-scale production of complex therapeutic proteins such as insulin, growth hormones, and monoclonal antibodies. These biopharmaceuticals have shown remarkable success in treating cancer, autoimmune disorders, and inherited enzyme deficiencies. Biotechnology also streamlines the drug discovery pipeline through techniques such as high-throughput screening, cell-based assays, and computational modeling. These methods allow rapid evaluation of thousands of drug candidates, saving both time and resources. In addition, biotechnology supports the advancement of personalized medicine, where treatments are tailored according to an individual's genetic profile, resulting in improved patient outcomes and safety. Furthermore, biotechnology has expanded therapeutic possibilities through the development of vaccines, gene therapies, and controlled drug delivery systems, offering solutions for diseases that were once considered untreatable. Despite challenges related to cost, regulation, and ethical concerns, biotechnology continues to reshape modern drug discovery. Overall, it has transformed healthcare by enabling more efficient, targeted, and patient-centric therapeutic strategies, ultimately contributing to improved global health outcomes.

Keywords: Biotechnology, Drug Discovery, Genomics, Proteomics, Recombinant DNA Technology, Personalized Medicine

Role of Computer-Aided Drug Design (CADD) in Modern Drug Discovery

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Abstract
The traditional process of drug discovery is a long, tedious, and costly one, with a high failure rate during clinical trials. Computer-Aided Drug Design (CADD) has emerged as a strong and innovative approach to overcome the challenges affecting the field of Drug Discovery by

incorporating computer techniques with Drug Research. CADD is a collection of computational techniques used to identify, optimize, and predict new prospective drug candidates at a molecular level. CADD methods are broadly classified into two types, which are structure-based drug design (SBDD) and ligand-based drug design (LBDD). Nowadays, with the help of structure-based methods like docking, molecular dynamics, or virtual screening, scientists are able to understand the interaction of a drug molecule with its biological targets, thus enhancing binding affinity as well as specificity. In ligand-based approaches, techniques like quantitative structure-activity relationships or pharmacophore modeling are used to predict biological activities based on known active chemicals. The use of CADD can significantly reduce the number of compounds that need to go into actual experimental screens. It is also important in lead optimization, toxicology, and pharmacokinetics. It increases the success rate of drug candidates entering into clinical trials. With further advancements in artificial intelligence, machine learning, or high-performance computing. CADD connects theoretical research with experimental validation, speeding up the creation of safe, effective, and targeted therapeutic agents.

Keywords: Computer-Aided Drug Design (CADD), Drug Discovery, Molecular Docking, Virtual Screening, QSAR, Pharmacoinformatics

ROS-Responsive Biomaterials Targeting Oxidative Stress in Chronic Diabetic Wounds

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Abstract

The chronic diabetic wounds are characterized by persistent oxidative stress fuelled by endogenous antioxidant defence which is compromised by hyperglycaemia-induced metabolic dysfunction. Excess reactive oxygen species (ROS) disrupt wound repair by prolonging inflammation, suppressing angiogenesis, and impairing fibroblast-mediated extracellular matrix remodelling. The existing wound dressings, as well as antioxidant-impregnated biomaterials are the passive systems or a constant release of drugs, leading to poor synchronization between therapeutic delivery and the dynamically fluctuating redox microenvironment of diabetic wounds. This therapeutic mismatch remains a significant limitation in existing wound care strategies. ROS-responsive biomaterials offer a targeted solution by selectively sensing elevated ROS levels and triggering stimulus-coupled, on-demand release of therapeutic agents. These responsive systems utilize redox-sensitive polymers/ ROS-cleavable linkers which is remain inactive under physiological conditions but activate beyond pathological ROS thresholds, enabling localized delivery of antioxidants, anti-inflammatory agents, and pro-angiogenic factors. This pathology-matched activation represents a key advancement over conventional biomaterials by aligning therapeutic action with disease severity and wound status. Recent reports have shown that ROS-

responsive platforms are useful towards restoring redox homeostasis, macrophage polarisation to a pro-healing phenotype, neovascularisation and organised collagen deposition, which result in wound healing in diabetic models. Nevertheless, translational challenges persist, including spatial heterogeneity of ROS across wound stages, risks of excessive ROS scavenging, and material stability under chronic oxidative exposure. The key reason is to change the current state of diabetic wound therapy that is passive intervention into self-regulated and microenvironment-driven therapy through oxidative stress as a major pathological driver.

Keywords: Reactive oxygen species; ROS-responsive biomaterials; Chronic diabetic wounds;

Selective Synthesis and Characterisation of Two Isomeric Oxazines

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Abstract:
The cyclisation of 2-(2-hydroxyphenyl)-2,3-dihydro-1H-quinazolin-4-one (1) with formaldehyde represents an efficient synthetic strategy for constructing structurally complex oxazine–quinazoline fused heterocycles. The reaction proceeds through a condensation mechanism in which formaldehyde acts as a methylene bridge, facilitating intramolecular nucleophilic attack between the phenolic hydroxyl group and the adjacent nitrogen center. This transformation results in ring closure and the formation of a new oxazine moiety fused to the quinazolinone core.
Interestingly, the nature of the solvent played a decisive role in directing the cyclisation pathway. When the reaction was carried out in toluene, the product obtained was 12,12a-dihydro-5-oxa-6a,12-diaza-benzo[a]anthracen-7-one (2). In contrast, performing the same reaction in tetrahydrofuran led to the formation of an isomeric compound, 10b,11-dihydro-6-oxa-4b,11-diaza-chrysen-12-one (3). This solvent-dependent regioselectivity highlights the influence of reaction medium polarity and stabilization of intermediates on product distribution.
Both synthesized compounds possess fused polycyclic frameworks incorporating nitrogen and oxygen heteroatoms, which are structural motifs commonly associated with significant biological activity. After isolation and purification, the structures of the newly formed heterocycles were thoroughly characterized. Elemental analysis confirmed their empirical compositions, while GC–MS provided molecular ion peaks consistent with the proposed molecular weights. Detailed structural elucidation was accomplished using ^{1}H and ^{13}C NMR spectroscopy, where characteristic chemical shifts and coupling patterns supported the formation of the oxazine ring and the fused aromatic system.
Overall, this methodology offers a straightforward route to novel oxazine–quinazoline derivatives with potential pharmacological relevance.

Serotonin-targeted nucleolipid nano-assembly as a potential drug delivery agent for the management of neurological disorders along with validation with gamma imaging

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Abstract:

Targeted drug delivery and molecular imaging of the brain remain challenging due to the blood-brain barrier (BBB). BBB poses a major hindrance as only 2.5% of drugs are able to cross it, and receptors are expressed at low levels. In this study, a novel nucleolipid-based self-assembled liposomal system was developed for potential CNS drug delivery applications, and validated for uptake by ^{99m}Tc-gamma imaging. Methoxyphenylpiperazine (MPP), an antagonist of the serotonin subclass 1A receptor, was conjugated with adenosine-derived nucleolipid using an amide linkage. The conjugated nucleolipid was synthesized via a multi-step synthesis and characterized using NMR and HRMS. Nanoassemblies were then made using the thin-film hydration method and characterized for physicochemical parameters. The nanoassemblies were radiolabeled with ^{99m}Tc (radiolabeling efficiency: 90 ± 4.5%) using stannous tartrate, with Tc speculated to interact with the purine moieties of adenosine. Biocompatibility studies demonstrated low hemolysis (2.3 ± 0.5% after 4 hours) and negligible cytotoxicity on HEK cell lines. Binding affinity studies using the Bradford assay revealed a binding constant of 0.00927 μM, indicating high receptor affinity. Drug loading efficiency and release kinetics of therapeutic agents, including doxorubicin and temozolomide, were also assessed, demonstrating favourable encapsulation efficiency (78 ± 3.3% and 82 ± 2.3%, respectively) and controlled release profiles. Additionally, biodistribution studies and ^{99m}Tc-Gamma imaging were conducted to assess the ability of the ability to cross the blood-brain barrier (BBB). The results confirmed efficient BBB penetration, with a strong correlation between imaging data and biodistribution profiles. In conclusion, the nanoassemblies exhibited promising dual functionality for SPECT imaging and brain drug delivery, offering a potential solution for managing neurological disorders.

Keywords: Drug Delivery, Blood Brain Barrier, Serotonin receptor, Nucleolipid, Liposomes, self-assembly

Smart Hydrogel Microbeads in Drug Delivery: Design Parameters, Material Properties and Therapeutic Applications Across Diseases

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Abstract:
Smart hydrogel microbeads have emerged as highly promising platforms in novel drug delivery due to its ability to combine the desirable properties of hydrogels with its structural advantages of microparticulate systems. These microbeads are three-dimensional, cross-linked polymeric networks capable of entrapping broader range of therapeutic agents, including small molecules, proteins, peptides and nucleic acid that provides protection from premature degradation. A prominent feature of smart hydrogel microbeads is their stimuli-responsive behaviour, enabling a controlled and site-specific drug release in response to physiological triggers such as pH variations, enzymatic activity, ionic strength, glucose concentration and redox conditions followed with external stimuli like temperature, light, ultrasound or magnetic fields. The effectiveness of these systems is largely influenced by critical design parameters including polymer selection (natural, synthetic or hybrid), cross-linking density, porosity, swelling capacity, particle size distribution, surface functionalization and drug-loading techniques. Such factors govern essential material properties like biodegradability, mechanical stability, muco-adhesion, diffusion kinetics and biocompatibility, ultimately determining therapeutic performance. Smart hydrogel microbeads have demonstrated broad applicability across diverse disease conditions. In cancer therapy, they facilitate localized and stimuli-triggered delivery of chemotherapeutics, reducing systemic toxicity while enhancing antitumor efficacy. In diabetes management, glucose-responsive microbeads offer potential for self-regulated insulin release. Additionally, pH-sensitive microbeads have been widely explored for oral drug delivery in gastrointestinal disorders, while injectable microbead systems are gaining attention in regenerative medicine for sustained growth factor delivery and tissue repair. Despite significant progress, challenges such as scalable manufacturing, long-term safety, reproducibility and regulatory translation remain key barriers to clinical application. Overall, smart hydrogel microbeads represent a versatile and innovative drug delivery approach with strong potential to support next-generation precision medicine by enabling responsive, targeted and patient-friendly therapeutic interventions.

Keywords: Microbeads; Stimuli-responsive; Mucoadhesive; Magnetic-responsive; Dual-responsive hydrogels

Shells Formation in Soft Gelatin Capsules: Design and characterization Review

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Abstract- Soft Gels Capsules (SGCs)are commonly used in pharmaceutical dosages forms of industries because these gels can be easily consumed, are highly versatile, and most importantly are capable of absorption of the poorly soluble drugs which eventually helps in improvement of the drug solubility in our body. The quality and performance of the capsules are largely dependent on the properties of the gelatin shells, which is again a evolving system. The factors that affect the capsules stability and functionality are the storage environment, manufacturing condition and the capsule interactions.

This review tells us about the detailed information of the designing of the soft gels, knowing the formulation that influences their mechanical and thermal behaviour. Gelatin sources and their extraction method, additives, molecular weight distribution, plasticizers are examined, the following factors plays a vital role in shell strength determination, elasticity and dissolution characteristics. It also acknowledges us about the storage and manufacturing, brittleness and fill shell incompatibilities which compromises the quality over time of the product.

For better understanding of the changes the thermal and mechanical characterization techniques are highlighted as the essential part of the gels. These methods like tesile testing, dynamic mechanical analysis, scanning calorimetry and many more analysis allows the detection of the stability-related changes that are not often visible in the routine inspection.

Overall, this review article emphasizes that the understanding of the gelatin shell behaviour from the formulation development through the entire shelf of the product is important. Using and applying the analytical methodologies at the time of drug designing and quality control can significantly improve the performances of the soft gels capsules.

Keywords: Soft gel capsules, Shell Formation, Fill-shell Interaction, Capsule Stability, Pharmaceutical dosage forms, Shelf-life evaluation.

Synergistic Phytochemical Interventions in Respiratory Viral Disorders: Emerging Evidence and Therapeutic Potential

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Abstract

Respiratory viral disorders, including influenza, respiratory syncytial virus (RSV), rhinovirus, and coronaviruses, continue to pose a serious threat to global public health due to their rapid transmission, high mutation rates, and limited availability of fully effective antiviral treatments. These infections significantly affect vulnerable populations such as children, elderly individuals, and immunocompromised patients. In recent years, there has been growing interest in phytochemicals derived from medicinal plants as alternative and complementary therapeutic agents due to their safety, availability, and wide range of biological activities. Among these approaches, synergistic phytochemical interventions have emerged as a promising strategy to enhance antiviral effectiveness.

Synergistic phytochemicals refer to combinations of plant-derived bioactive compounds that work together to produce enhanced therapeutic effects compared to individual compounds alone. These include flavonoids, alkaloids, terpenoids, and polyphenols, which exhibit antiviral activity by targeting multiple stages of the viral life cycle, such as viral entry, replication, and protein synthesis. Additionally, these compounds help strengthen the host immune response and reduce inflammation and oxidative stress associated with viral infections. Recent in vitro, in vivo, and in silico studies have demonstrated that phytochemical combinations can improve antiviral efficacy, enhance bioavailability, and reduce the likelihood of viral resistance.

The multi-targeted action and lower toxicity of phytochemical combinations make them attractive candidates for the management of respiratory viral disorders. These natural compounds offer a promising complementary approach alongside conventional antiviral therapies. However, further clinical studies and mechanistic investigations are necessary to validate their therapeutic potential and ensure their safe and effective application. Overall, synergistic phytochemical interventions represent a valuable and innovative approach for combating respiratory viral infections.

Keywords*:* Synergistic phytochemicals; Respiratory viral infections; Herbal antiviral agents; Phytotherapy; Medicinal plants

Targeted Drug Delivery in Breast Cancer Therapy: A Review of Solid Lipid Nanoparticles for Precise Chemotherapy

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Abstract

Background Breast cancer remains the most prevalent type of cancer among Indian women, with an estimated 1,92,020 new cases and 98,337 deaths in 2022, according to WHO estimates, and a 5-year survival rate of ~66.4% reflecting late diagnosis and limited access to advanced therapies.

Conventional chemotherapy is constrained by poor aqueous solubility of cytotoxic drugs, rapid plasma clearance, off-target toxicity, and multidrug resistance (MDR). Solid lipid nanoparticles (SLNs), formulated from physiologically compatible solid lipids and surfactants, have emerged as robust nanocarriers that improve pharmacokinetics, enable enhanced permeability and retention (EPR)-mediated tumor accumulation, and facilitate controlled intracellular drug release. Their solid lipid core minimizes leakage and provides greater stability than liposomal or polymeric systems. Methods A systematic review of peer-reviewed literature from 2022–2025 was conducted using PubMed, Scopus, and Web of Science with terms including "solid lipid nanoparticles," "breast cancer," "targeted delivery," and "nanomedicine." Emphasis was placed on formulation strategies, advanced preparation techniques (high-pressure and microfluidics homogenization), physicochemical characterization (particle size, polydispersity, zeta potential), targeted functionalization, and preclinical therapeutic efficacy. Results Recent SLN systems (<200 nm) significantly enhance drug solubility, systemic half-life, and tumor deposition while reducing cardiotoxicity of anthracyclines. Surface functionalization with folate, transferrin, antibodies, and PEG has enabled receptor-mediated uptake in overexpressed breast cancer targets (e.g., HER2 and folate receptors), thereby increasing cellular internalization and cytotoxic efficacy. Co-delivery SLNs combining paclitaxel and kaempferol demonstrated ~5-fold greater cytotoxicity relative to free combinations, underscoring synergistic efficacy. Surface engineering with folate, transferrin, and PEG has facilitated receptor-mediated uptake and enhanced intracellular drug accumulation. Microfluidics-assisted production improved batch uniformity and translational scalability. Conclusion SLNs represent a technically versatile and clinically promising platform for breast cancer chemotherapy, offering improved bioavailability, tumor selectivity, and reduced systemic toxicity. Continued progress in ligand engineering and scalable manufacturing is expected to accelerate clinical translation.

Keywords: solid lipid nanoparticles; breast cancer; targeted delivery; nanomedicine; controlled release.

Targeting Dormant Cancer Stem Cells Through Glycosaminoglycan (GAG) Mimetics: A Novel Approach to Preventing Relapse in Solid Tumours

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Abstract
Cancer relapse is considered a major problem where after chemotherapy, a patient can develop cancer again years later. This is believed to happen due to hibernating cancer cells, just like bears hibernating for survival in unfavourable conditions. Scientists have now understood why this happens—a small portion of cells within tumours, called stem cells, have a unique ability to enter

a stage of hibernation. This is why chemotherapy destroys dividing cells while dormant cells stay untouched. And when conditions are right, they wake up and regenerate the whole tumour.
In a recent study in January 2026, researchers at VCU Massey Comprehensive Cancer Centre addressed this challenge directly. They developed a synthetic molecule called G2.2 that belongs to a class of compounds known as glycosaminoglycan (GAG) mimetics. These are sugar molecules that coat human cells and regulate their behaviour. They seek out hibernating stem cells and bind to receptors on their surface, triggering destruction. In preclinical studies, this technique achieved nearly complete destruction of dormant cancer stem cells in different types of cancers such as colorectal, lung, pancreatic and renal cancers. Despite this discovery, GAG mimetics have historically been difficult to produce at scale because of their complex sugar structure, which is why they remain unexplored as therapeutic agents.
Weeks after the VCU announcement, Iowa State University received funding for research on bottromycin, a complex antibiotic that remained synthetically unavailable for decades. Using solid-phase peptide synthesis (SPPS), this automated technology has revolutionised peptide drugs like semaglutide for diabetes. In the same way, this technique can be applied to GAG mimetics, solving the scalability problem for their development.
A February 2026 review in Annals of Oncology highlighted the industrial push towards "untouchable targets"—transcription factors and survival pathways that have resisted conventional small molecule approaches. These are common in cancer stem cells, making GAG mimetics a uniquely promising strategy.
In conclusion, the discovery of G2.2, the use of techniques such as SPPS for its development, and the need to target these untouchable targets together push forward the development of GAG mimetics as scalable therapeutics for preventing cancer relapse across multiple solid tumours, combining these strategies with existing chemotherapies.

Keywords: Cancer stem cells, tumour relapse, GAG mimetics, drug discovery, G2.2, dormancy

Targeting NF-κB–Mediated Neuroinflammation in Alzheimer's Disease: An *In Silico* Assessment of Potential Inhibitors

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Abstract
Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by amyloid-β deposition, tau pathology, and chronic neuroinflammation. Among the inflammatory regulators, the nuclear factor-kappa B (NF-κB) signaling pathway plays a central role in mediating microglial activation and pro-inflammatory cytokine production. IκB kinase β (IKKβ) is a critical upstream kinase responsible for phosphorylation and degradation of IκB, leading to NF-κB activation.

Therefore, inhibition of IKKβ represents a promising therapeutic strategy to attenuate neuroinflammation in AD. In the present study, a panel of reported anti-inflammatory compounds was computationally evaluated for their inhibitory potential against key proteins involved in the NF-κB signaling pathway using molecular docking approaches. The three-dimensional structures of target proteins were retrieved from the Protein Data Bank, and ligand structures were optimized prior to docking. Binding affinity, interaction profiles, and hydrogen bonding patterns were analysed to assess stability and specificity of ligand–protein complexes. Selected compounds demonstrating favourable docking scores were further evaluated for drug-likeness and ADMET properties to assess their pharmacokinetic feasibility. Among the screened compounds, few compounds demonstrated strong binding affinity with stable hydrogen bond interactions within the catalytic domain. Drug-likeness and ADMET profiling suggested acceptable pharmacokinetic characteristics for three compounds, supporting their potential as lead candidates. These findings suggest that these three compounds may act as natural IKKβ inhibitors capable of modulating NF-κB-mediated neuroinflammation in Alzheimer's disease. The study integrates chemical, bioscientific, and computational strategies to support the development of safer, plant-derived next-generation therapeutics for neurodegenerative disorders.

Keywords: Alzheimer's disease**,** IKKβ inhibition**,** NF-κB signaling pathway**,** Molecular docking

Targeting the Renin–Angiotensin–Aldosterone System: Molecular and Translational Advances in the Management of Hypertension

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Abstract

Hypertension remains one of the most prevalent non-communicable diseases globally and is a major risk factor for cardiovascular, cerebrovascular, and renal complications. Despite the availability of multiple antihypertensive agents, suboptimal blood pressure control persists, highlighting the need for improved therapeutic strategies grounded in molecular and translational research. The renin–angiotensin–aldosterone system (RAAS) plays a central role in the regulation of vascular tone, fluid balance, and systemic blood pressure, and its chronic overactivation is a key contributor to the pathophysiology of essential hypertension.

This study explores recent molecular and translational advances in targeting the RAAS pathway for effective hypertension management. At the molecular level, RAAS activation promotes vasoconstriction, sodium and water retention, endothelial dysfunction, oxidative stress, and inflammatory signaling, all of which contribute to sustained elevation of blood pressure and vascular remodeling. Pharmacological interventions such as angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, direct renin inhibitors, and aldosterone antagonists act

by selectively interrupting different stages of the RAAS cascade, thereby restoring hemodynamic balance and reducing cardiovascular risk.
Translational developments have further enhanced the clinical utility of RAAS-targeted therapies through fixed-dose combinations, long-acting formulations, personalized treatment approaches, and integration with digital blood pressure monitoring technologies. These innovations bridge fundamental bioscience with clinical application, improving patient adherence, therapeutic precision, and long-term outcomes. By integrating chemical, bioscience, and translational perspectives, this work highlights RAAS modulation as a cornerstone of next-generation antihypertensive therapeutics and underscores its continued relevance in addressing the global burden of hypertension. Targeting the renin–angiotensin–aldosterone system remains a cornerstone in hypertension management. Continued molecular insights and translational advancements have strengthened the therapeutic effectiveness of RAAS modulation. Integrating pharmacological innovation with personalized and technology-assisted approaches offers promising potential for improved blood pressure control and long-term cardiovascular risk reduction.

Keywords: Hypertension, renin–angiotensin–aldosterone system, RAAS inhibitors, translational therapeutics, molecular pharmacology, cardiovascular bioscience.

The Evolution of Monoclonal Antibodies: Enhancing Specificity and Reducing Toxicity

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Abstract:
There has been a dramatic shift in how medications are used to treat diseases. In the past, medicines worked by affecting the entire body; however, today's medications (for example, monoclonal antibodies) target only specific areas of the body. When monoclonal antibodies were first developed, they were made using mice. Because we have developed more sophisticated techniques to manufacture monoclonal antibodies that resemble the antibodies produced in humans, monoclonal antibodies currently possess a significantly more effective and prolonged therapeutic effect when used as treatments. When developing monoclonal antibodies, the objective is to generate the maximum specificity. In essence, we can think of monoclonal antibodies as locking a key into a lock because they are designed to only attach to the target cells, thereby leaving healthy cells unaffected. By developing medicines that are highly specific to only the target cells, many of the negative side effects associated with other types of medicines can be avoided. We continue to make significant improvements to the efficacy of monoclonal antibodies. In addition to changing the method by which monoclonal antibodies are developed, we can now "manipulate" monoclonal antibodies to perform tasks (e.g., killing unwanted cells), which increases the overall effectiveness of these medicines and, thus, improves the health of individuals who take them. We are committed

to developing even more innovative monoclonal antibodies that will include incorporating toxins into the monoclonal antibody so the bad cell will die; however, the healthy cells will remain unaffected. In short, the development of monoclonal antibody technology offers healthier target selectivity, dropped systemic toxicity, and increased clinical efficacy, marking a substantial breakthrough in precision therapeutics.

Keywords: Monoclonal antibodies (mAbs), Humanized Antibodies, Immunotherapy, Hybridoma Technology, Cancer therapy

The Phosphorus Paradigm: Leveraging Biogenic Synthesis for Advanced Anti-Fungal Frameworks

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Abstract:
Green nano-biotechnology furnishes sustainable framework for evolving bio-functional nanomaterials with refined biological interface. The present report on biogenic synthesis of phosphorus nano particles (p-NPs) using *Aspergillus flavus* as a biological minimising and solidifying agents, ensured by a holistic analysis of their anti-fungal and biochemical effect on *Aspergillus niger.*
The synthesise nano particles were characterised by UV- Visible spectroscopy, while Dynamic light scattering (DLS) was kept deducing hydrodynamic size and size distribution. Zeta potential review was performed to assess colloidal stability and surface charges of the particles. The outcome confirms the victorious formation of stable, Nano scale, phosphorus particles with uniform distribution.
The anti-fungal capability of the biologically synthesised P-NPs was analysed through Minimum Inhibitory Concentration (MIC) assays against *Aspergillus niger.* Cytological assessment under light microscope revealed concentration depend on ways in spore morphology, hyphae integrity, branching patterns, and structural deformation, showing Nanoparticle- induced cellular stress.
To advanced research on the mechanism of action, extracellular, biochemical analyses were conducted, embracing chitin estimation, and protease activity assays. Considerable modulation in chitin content snd protease levels suggested disruption of fungal cell wall architecture, and metabolic pathways. Comparative study underscores the cross-species nano- interaction amid *A. flavus* derived Nano particles and *A. niger,* showing selective biological influence.
This rooted a novel rendering framework, association green synthesis, nano-characterisation, and fungal, biochemical profiling, positioning biogenic, phosphorus, nanoparticles as promising prospects for forthcoming anti-fungal and pharmaceutical applications. The insights confirm a

foundation for the coherent design of sustainable nano-enabled anti-fungal therapeutics with promising scalability and clinical relevance.

Keywords: Biogenic synthesis, Phosphorus nanoparticles, *Aspergillus flavus*, *Aspergillus niger,* UV-Vis spectroscopy, DLS, Zeta potential, MIC, Nano-fungal interaction.

The Quest for the Ideal Vitreous Substitute: Recent Advancements

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Abstract:
The vitreous humor is a highly specialized viscoelastic gel that plays a critical role in maintaining ocular homeostasis. Beyond providing structural support to the retina, it preserves intraocular pressure and ensures a clear optical pathway for vision. In conditions such as retinal detachment and diabetic retinopathy, vitrectomy becomes necessary, creating the need for artificial vitreous substitutes capable of restoring both mechanical stability and physiological balance. Although conventional substitutes including silicone oils (PDMS), perfluorocarbon liquids, and expandable gases remain widely used in clinical practice, they are frequently associated with complications such as cataract formation, secondary glaucoma, emulsification, and limited long-term biocompatibility.

A growing body of research has begun to explore biomimetic alternatives that more closely emulate the native vitreous microenvironment. Enzymatically crosslinked silk–hyaluronic acid composites, for instance, exhibit finely tunable rheological and optical behavior, achieving refractive indices (~1.336) that closely mirror those of the natural vitreous while offering improved structural integrity and controlled swelling dynamics. Parallel efforts in synthetic polymer engineering particularly using polyethylene glycol (PEG) and polyvinyl alcohol (PVA) have yielded cost-effective materials with excellent light transmittance and customizable mechanical profiles. In situ–forming smart hydrogels and foldable capsular vitreous bodies (FCVB) represent a conceptual leap in the field. These platforms are designed not merely to fill space but to actively support retinal health by regulating oxygen gradients, maintaining redox balance, and serving as sustained drug delivery depots that encourage tissue repair and cellular integration.

The evolution of vitreous substitutes reflects a broader transition from passive mechanical fillers toward biointegrative systems capable of interacting with the host environment. Polysaccharide-based and hybrid hydrogels, in particular, offer a compelling pathway toward achieving long-term physiological compatibility. Realizing this potential, however, will require addressing outstanding challenges in polymer stability, scalable GMP-compliant manufacturing, and alignment with evolving medical device regulations (MDR). Overcoming these translational hurdles will be essential to moving these promising materials from experimental platforms into routine clinical practice.

The Role of Structure-Activity Relationships in Drug Development

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Drug discovery relies on finding the "right" combination of molecules to create a drug. The Structure-Activity Relationship (SAR) principle is an important tool for connecting what a drug is made from chemically with how it works to treat disease. Medicinal chemists don't randomly try different combinations of molecules; they use SAR to analyze how making small changes in how a molecule is shaped, sized or what types of functional groups are present will change how well it will work to bind to the target that causes disease. The purpose of this abstract is to demonstrate that SAR is more than just a collection of numbers; it is a story of research and optimization. Researchers are able to improve the effectiveness of a drug while reducing its unwanted side effects by systematically optimizing a "lead" compound through its entire spectrum of possible modifications. Finding the right compromise in molecule design is challenging. The difference between an effective medicine and a non-working substance, for example, can be as small as changing the location of a single atom. As science and technology have evolved, SAR has turned from manual observations by chemists into a combination of chemistry and computational modeling. In summary, SAR is the fundamental science behind converting crude chemical materials into effective medicinal products, through refining the "key" of chemical structures into the "lock" of biological activity, creating the safest/effective product possible.

Keywords: Structure–Activity Relationship (SAR), Drug development, Medicinal chemistry, Lead optimization, Functional groups, Molecular modification, Drug design.

The Role of Thermodynamics in Drug Solubility and Stability

Sunil Gupta

Abstract:
Drug solubility and stability are crucial factors influencing the bioavailability, safety, and therapeutic efficacy of pharmaceutical products. Thermodynamics provides the fundamental scientific basis for understanding and predicting these properties by describing the energetic changes associated with drug dissolution, crystallization, polymorphism, and degradation. The application of thermodynamic principles plays a vital role in rational drug design and formulation development aimed at enhancing drug performance and shelf life. Drug solubility is governed by changes in Gibbs free energy (ΔG) during the dissolution process, where a negative ΔG indicates spontaneous solubilization. This process is influenced by the balance between enthalpy (ΔH) and

entropy (ΔS), as well as factors such as crystal lattice energy, solvation energy, temperature, and solvent–solute interactions. Thermodynamic analysis aids in understanding temperature-dependent solubility behavior and supports the selection of appropriate solvents, excipients, and formulation approaches. Additionally, thermodynamic evaluation of polymorphic and amorphous drug forms provides insight into metastable states that often exhibit improved solubility but reduced physical stability. Thermodynamics also plays a key role in drug stability, as both chemical and physical degradation processes are driven by energy changes. Chemical instability, including hydrolysis and oxidation, and physical instability such as recrystallization and phase separation, can be evaluated using thermodynamic parameters like free energy, enthalpy, and entropy. These parameters help predict the feasibility and extent of degradation reactions. Temperature-dependent thermodynamic studies are widely applied to estimate shelf life and establish optimal storage conditions. In conclusion, the integration of thermodynamic concepts into pharmaceutical research provides a systematic framework for predicting and controlling drug solubility and stability. This understanding supports the development of high-quality, stable, and effective pharmaceutical products and contributes significantly to advancements in formulation science.

The Function of Copper Complexes in Pharmaceutical Development: From Synthesis to Clinical Potential

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Abstract:
Copper complexes are attracting interest in pharmaceutical research because of their distinctive characteristics and possible uses across numerous therapeutic fields, especially in treating cancer and diseases that affect the nervous system. In contrast to conventional platinum-based medications such as cisplatin, which attach to DNA and frequently result in significant side effects and the development of resistance, copper complexes present different modes of action. They can improve how cells absorb them and trigger programmed cell death through various mechanisms, potentially re-sensitising cancer cells that have become resistant to platinum-based treatments. Moreover, copper's involvement in fostering tumour expansion and the formation of new blood vessels indicates its potential for treatment, as targeted chelators and ionophores can specifically affect cancer cells, offering a more beneficial therapeutic range with less toxicity. In the area of neurodegenerative disorders, research is ongoing to assess how copper complexes can influence copper balance in the body, which

is essential for averting neurodegenerative changes related to illnesses such as Alzheimer's. Thesecompounds can interfere with interactions between metals and Aβ proteins and help maintain redox balance, thereby decreasing neurotoxic effects. Additionally, innovative methods, including the development of peptoid-based chelators, focus on increasing the specificity of targeting copper over other metals such as zinc, which is also found in the synaptic cleft. The adaptability of copper complexes also includes their antimicrobial capabilities, which allow them to damage bacterial membranes and block protein production, thereby allowing them to combat various pathogens effectively. In summary, the continuous investigation into copper complexes emphasises their promise as powerful agents in tackling major health issues, such as cancer, neurodegenerative diseases, and infections resistant to multiple drugs, thus opening doors for new and advanced therapeutic methods in drug development.

Keywords: Copper Complexes, Drug Development, Neurodegenerative Diseases, Chelation Therapy, Antimicrobial Properties, Bioavailability**.**

To Formulate and Evaluate Photoshield Antioxidant Herbal Peel-off Mask

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Abstract:
In today's world, many people are becoming more conscious about what they apply to their skin. As a result, there has been a noticeable shift toward herbal and naturally derived skincare products. Among these, peel-off masks have gained great popularity. They are simple to apply, fun to use, and provide quick visible results. Unlike regular face washes that are rinsed off, peel-off masks form a thin layer on the skin as they dry. This layer sticks to dirt, dead skin cells, and excess oil. When you gently peel it away, it helps remove impurities and leaves the skin feeling fresh, smooth, and clean. Growing concerns about the harmful effects of synthetic chemicals, such as irritation or long-term damage, have further encouraged people to choose plant-based skincare options.
This research paper highlights four powerful herbal ingredients known for their skin benefits: *Vetiveria zizanioides* (vetiver root extract), *Camellia sinensis* (green tea), *Calendula officinalis*, and red raspberry (*Rubus idaeus*) seed extract. Each of these plants offers unique advantages. Vetiver provides a cooling and soothing effect while also acting as an antioxidant. Calendula is widely appreciated for calming irritated skin and supporting natural healing. Green tea is rich in antioxidants that help protect the skin from environmental damage and reduce signs of aging. Red raspberry seed extract helps maintain hydration and may offer mild natural UV protection.

When these herbal extracts are combined in a peel-off mask, they work together to nourish, protect, and rejuvenate the skin. Overall, such formulations provide a gentle, natural, and effective approach to skincare.

Keywords: Herbal cosmetics, Peel-off mask, Vetiveria zizanioides, Camellia sinensis, Calendula officinalis, Rubus idaeus, Antioxidant activity, Polyphenols, Skin rejuvenation, Natural UV protection, Botanical extracts, Herbal formulation.

Unveiling the Role of Glycoproteins in Hepatocellular Carcinoma: From Biomarkers to Therapeutic Interventions

Bhuvanesh B, Aqsa Nadeem, Dr. Sangeetha gupta

Abstract:
Hepatocellular carcinoma (HCC), which is mostly caused by chronic liver illnesses such cirrhosis, non-alcoholic steatohepatitis, and viral hepatitis, continues to be one of the major causes of cancer-related death globally. Serum alpha-fetoprotein (AFP) is frequently used for diagnosis, however because of its poor sensitivity and specificity, new trustworthy biomarkers must be found. According to recent data, glycoproteins show promise as a means of enhancing HCC diagnosis and treatment targeting. Changes in fucosylation and sialylation are examples of aberrant glycosylation that has a significant impact on immunological evasion, tumor development, and metastasis. Key glycoproteins, including hemopexin, endosialin, pentraxin 3, haptoglobin, and ceruloplasmin, are summarized in this study along with their structural traits, expression patterns, and functional functions in the pathophysiology of HCC. Although increased haptoglobin glycosylation improves early diagnostic potential, cereuloplasmin increases tumor cell survival by regulating ferroptosis. Endosialin promotes stromal remodeling and immune evasion in the tumor microenvironment, while hemopexin helps control oxidative stress. Pentraxin 3 has a dual, context-dependent activity as a pro-tumorigenic factor and a tumor suppressor. These glycoproteins have the potential to greatly enhance illness stratification and diagnostic accuracy when paired with conventional indicators like AFP. The precise mapping of glycosylation patterns made possible by emerging multi-omics and spatial technologies provides a clearer understanding of their mechanistic functions and translational significance. When combined, glycoprotein-based biomarkers and therapeutic targets offer new possibilities for early identification and individualized HCC treatment, hence representing a potential area for precision oncology.

Vaccination and immunoprophylaxis in Tuberculosis-preventive approaches to disease management

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Abstract:
India has the highest TB burden with ~2.2 million cases annually, accounting for about 20-25% of global TB cases. worldwide ~10.6 million develop TB each in a year, causing ~1.6 million deaths. Tuberculosis is a contagious bacterial infection caused by mycobacterium tuberculosis it affects the lungs and slowly to other organs it's spread through airborne droplets from an infected person. it causes the inflammation, tissue destruction, leading to cough, chest pain and breathless. Vaccination and Immunoprophylaxis are the preventive measures of TB in which the body strength the immune system .The vaccine (BCG) Bacillus calmette-Guèrins study aims to evaluate strategies to enhance the TB protection, Strength the immune system through immune modulating agents prevent latent TB from becoming active it control speed also, focusing on intravenous administration, revaccination and the development of novel candidates like MTBVAC.A study involving twenty one -wild boar piglets the subject were randomly allocated into five groups :control, homologous BCG, homologous heat-inactivated Mycobacterium bovis (IV) ,heterologous IV-BCG.protection was measured by evaluating total lesions scores and immune responses. In the wild boar model, vaccine efficacy is highly dependent on the administration sequence and the specific vaccine used. Homologous IV and heterologous IV-BCG proved most effective, achieving lesion reductions of ~ 67%. In other side BCG -IV sequence and standard BCG provide no protection. While BCG remains the global standard for systemic TB, newer candidates like MTBVAC are being developed to offer superior protection against pulmonary form of the disease. Al lasts the homologous regimes currently offers the most reliable method for controlling the TB in these population.

Key words: BCG revaccination, MTBVAC, Tuberculosis vaccine, vaccination and immunoprophylaxis, homologous regimes.

Molecular Interplay Between Microbial Dysbiosis–Induced Metabolic Reprogramming and Steatohepatitis Pathogenesis

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Abstract
Metabolic dysfunction-associated steatohepatitis (MASH), formerly known as non-alcoholic steatohepatitis (NASH), represents a severe liver disorder marked by excessive fat accumulation, progressive inflammation, and fibrosis, often culminating in cirrhosis and hepatocellular carcinoma. Emerging evidence implicates gut microbiota dysbiosis as a pivotal driver in MASH pathogenesis via the gut-liver axis, yet the causal links between specific dysbiotic signatures and hepatic metabolic reprogramming remain underexplored.

Dysbiosis typically depletes short-chain fatty acid (SCFA)-producing commensals (e.g., Faecalibacterium spp.) and mucin-degrading Akkermansia muciniphila, leading to reduced SCFA levels, impaired intestinal barrier integrity, and translocation of microbial products such as lipopolysaccharide (LPS). This triggers metabolic endotoxemia, hepatic lipid dysregulation, and inflammatory cascades. The present study addresses three key mechanistic gaps: (1) characterizing gut microbial compositional shifts in MASH progression; (2) delineating dysbiosis-induced metabolic reprogramming in hepatocytes, including altered lipid metabolism and mitochondrial dysfunction; and (3) elucidating molecular pathways—such as TLR4/NF-κB signaling and SCFA receptor-mediated epigenetics—that bridge microbial dysbiosis to steatohepatitis advancement.
Using high-fat diet-fed C57BL/6 mice and antibiotic-induced dysbiosis models, we employed 16S rRNA sequencing, metabolomics, and histological analyses to profile microbial alterations, quantify SCFA/LPS levels, and assess hepatic inflammation (e.g., ALT/AST, cytokines). In vitro co-cultures further validated causality. Preliminary findings reveal dysbiosis-specific depletion of SCFA producers correlating with upregulated de novo lipogenesis and fibrosis markers (e.g., α-SMA, collagen I). These insights propose microbiota-targeted interventions, such as SCFA supplementation or probiotics, as novel therapeutics to halt MASH progression.

Keywords: dysbiosis, gut microbiota, MASH, metabolic endotoxemia, short-chain fatty acids, 16S rRNA sequencing, hepatic inflammation, ATP kinase, NASH.

Track IV:
Phytopharmaceuticals and Regulatory Compliance and Practice

3D Bioprinting in Regenerative Medicine: Challenges and Pathways to Clinical Use

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Abstract

Three-dimensional (3D) bioprinting is an advanced technology in regenerative medicine that enables the precise fabrication of living tissue constructs through the layer-by-layer deposition of cells, biomaterials, and bioactive molecules. By combining tissue engineering, biomaterials science, and additive manufacturing, this technology offers innovative solutions for drug development, disease modeling, and personalized therapeutic applications. Bioprinted tissues can provide physiologically relevant in vitro models that improve preclinical drug screening, enhance predictive accuracy, and reduce dependence on animal testing, while also holding long-term potential for patient-specific implants, tissue repair, and organ regeneration. The integration of digital design and patient-specific imaging further strengthens its role in precision medicine.

Despite its significant promise, several scientific, manufacturing, and regulatory challenges hinder widespread clinical adoption. Critical concerns include bioink standardization, maintenance of cell viability during printing, mechanical stability of printed constructs, vascularization of complex tissues, sterility assurance, scalability, and batch-to-batch reproducibility. The personalized and small-batch nature of production further complicates quality control processes and Good Manufacturing Practice (GMP) implementation. Additionally, the hybrid character of bioprinted products, which integrate living cells with device-based printing systems, creates uncertainty in regulatory classification and approval pathways. Existing regulations for biologics, medical devices, and advanced therapy medicinal products offer partial oversight but lack dedicated guidelines specifically tailored for bioprinted constructs. Limited long-term clinical data also adds to regulatory complexity.

To support safe clinical translation, adaptive regulatory frameworks, standardized manufacturing protocols, and robust quality assurance systems are essential. Strengthened collaboration among researchers, industry stakeholders, clinicians, and regulatory authorities will help bridge existing gaps. With comprehensive scientific validation and regulatory clarity, 3D bioprinting has the potential to transform regenerative medicine, accelerate pharmaceutical innovation, and redefine future therapeutic strategies.

Keywords: 3D Bioprinting, Regenerative Medicine, Bioinks and Biomaterials, Regulatory Framework and GMP Compliance, Personalized Therapeutics.

AI in Pharmacovigilance, Challenges, Benefits

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Abstract
Medicines and vaccines have transformed the prevention and treatment of diseases, but along with their benefits they may also cause undesirable or unexpected side effects. Pharmacovigilance is the science related to the detection, assessment, understanding and prevention of adverse effects or any other medicine/vaccine-related problem. In India, Pharmacovigilance Programme of India safeguards the health of 1.27 billion people by monitoring adverse drug effects, but this process is challenging as it requires a trained workforce, technical expertise, time, and high cost. This also slows down the detection of rare or long-term ADRs. A major challenge faced in pharmacovigilance is the lack of awareness among patients, time constraints among healthcare professionals, fear of litigation and the absence of a strong reporting culture, all of which compromise patient safety. PvPI also deals with inconsistent data quality and limited ADR Monitoring Centers. With the growing use of modern technology, AI can help reduce some of these problems. AI tools such as Natural Language Processing, data mining and other automated processes can support PV by performing MedDRA coding, checking duplicate reports, categorizing cases, identifying serious reports, excluding non-serious ones, building unstructured data into readable form, and extracting text from incomplete reports. AI can also pull ICSR information from various published documents and electronic health records and automate several steps in case processing. However, AI also has challenges. Low sensitivity may cause it to miss important adverse events, while low specificity may lead to false-positive reports, creating confusion and additional workload. Thus, AI can assist pharmacovigilance but cannot replace human judgement.

Keywords: AI, ADR, Pharmacovigilance, MedDRA, Healthcare, Machine Learning , Data Mining.

A Feasibility Study and Design Analysis of Acid-Hydrolysed Starch Biopolymers: Sustainable Alternatives for Pharmaceutical Packaging

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Abstract
The pharmaceutical industry is facing a major environmental problem caused by the large volume

of non-degradable Polyvinyl Chloride (PVC) waste from blister packaging used for single-dose medicines. As global healthcare rules in 2026 move towards "Green Pharmacy" and circular economy models, there is a strong need for eco-friendly materials that are both good for the environment and meet strict safety standards. This research looks at the possibility of using plant-based thermoplastic starch (TPS) as a replacement for secondary packaging in the pharmaceutical sector. Using a "Formulation-by-Design" approach, the study identifies high-amylopectin cornstarch as the main source material. This choice is based on strict criteria that include being non-toxic, widely available, and made from plants. The method used to make the TPS involves an acid-catalysed hydrolysis process, where acetic acid breaks down the semi-crystalline structure of the starch granules, allowing the molecules to rearrange. Glycerol is added as a plasticiser to make the resulting biopolymer more flexible and strong. The study also looks at how well these films perform in a real-world pharmaceutical setting, focusing on how clear they are for identifying doses and how they break down. Early results show that the TPS-based materials can fully biodegrade in standard soil conditions within 30 days, which is a 99% reduction in environmental impact compared to traditional PVC. This research concludes that starch-based biopolymers offer a practical and scientifically supported way to reduce the carbon footprint of the pharmaceutical supply chain. The findings give a solid theoretical base for moving from petroleum-based plastics to sustainable, plant-derived packaging that does not affect the effectiveness of medicines.

Keywords: Green Pharmacy, Biodegradable Packaging, Starch Biopolymer, Feasibility Study, Acid Hydrolysis, Waste Management, Sustainable Healthcare.

A Review on Natural Antioxidant Delivered via Phytosomes

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Abstract:
Phytosomes are a new lipid-based drug delivery system that aims to improve the bioavailability, solubility, and stability of plant derived bioactives, especially natural antioxidants. Challenges related to drug delivery using traditional herbal formulations often arise. For example, poorly bioavailable natural bioactives may have low absorption, undergo rapid metabolism, and in some cases may have limited efficacy. Phytosomes address these challenges by creating molecular complexes between a phospholipid and a phytoconstituent, to facilitate better membrane permeability and alter pharmacokinetic characteristics. Studies have demonstrated recuperative and biological superiority of phytosomal solutions, such curcumin, silymarin, and quercetin, in biological systems relative to free formulations. Nonetheless, despite advances in formulation design and preclinical validation, to date, phytosomes have yet to be adopted into widespread industrial use and biomedical applications. It is expected that constant improvement in green

processing, hybrid nanocarrier generation, and regulatory alignment will enhance phytosomes as a viable delivery platform of natural antioxidants in pharmaceutical and nutraceutical markets. Moreover, phytosomes have some advantages, including better physicochemical stability, low doses, and consistency of therapeutic effects, which make them promising carriers for chronic applications. The integration of phytosomal formulations with advanced characterization tools and clinical validation studies may help in the rapid translation of these systems from the laboratory to the market. Standardization of the process of preparation will be important for scalability.

Keywords: Phytosomes, natural antioxidant, bioavailability, Curcumin, Silymarin, Quercetin, Centella phytosomes, Leucoselect. Ginkgo biloba phytosome, Meriva, Bilberry, Ginselect phytosomes, Fourier transform infrared spectroscopy (FTIR) analysis, Coriandrum sativum L.; Umbelliferae, Zingiber officinale (L.) Rosc.

Algorithmic Regulatory Compliance in AI-Driven Software as a Medical Device (SaMD): A Study and Insights on QRM-CAPA Practices for Global Alignment

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Abstract

The integration of Artificial Intelligence into Software as a Medical Device (AI-SaMD) introduces an evolving risk profile that challenges conventional regulatory oversight and quality assurance mechanisms. Key risks include algorithmic drift from continuous learning, data bias affecting clinical validity, limited model transparency, and increased cybersecurity vulnerabilities. These characteristics conflict with traditional post-market surveillance models based on static risk controls. Existing Quality Risk Management (QRM) and Corrective and Preventive Action (CAPA) systems governed by ISO 14971 and ISO 13485 were designed for deterministic medical devices and are therefore insufficient to manage the adaptive lifecycle of AI-driven technologies. This systematic review, conducted in accordance with PRISMA 2020 guidelines, synthesizes global evidence published between 2015 and 2025 to assess how QRM and CAPA frameworks are being adapted for algorithmic regulatory compliance in AI-SaMD. The analysis includes peer-reviewed literature, regulatory guidance, and grey literature from major authorities, including the U.S. Food and Drug Administration (FDA), European Union Medical Device Regulation (EU MDR), Pharmaceuticals and Medical Devices Agency (PMDA), and National Medical Products Administration (NMPA). Six predefined research questions were addressed, focusing on QRM tool applicability, CAPA integration, regulatory divergence, and the effectiveness of AI-specific risk mitigation strategies.

The findings demonstrate fragmented and inconsistent implementation of QRM-CAPA practices for AI-SaMD, revealing a misalignment between established quality systems and continuously

evolving algorithms. Regulatory approaches vary across regions, complicating global compliance, post-market surveillance, and patient safety assurance. Moreover, empirical evidence supporting effective AI-specific risk controls remains limited. To address these gaps, this review proposes a proactive and harmonized "Algorithmic Safeguard" framework integrating real-world performance monitoring, predefined change management, and adaptive risk controls within quality systems. The study highlights the urgent need for globally aligned lifecycle-oriented standards to ensure safety and effectiveness without constraining innovation.

Keywords: AI-SaMD, QRM-CAPA, Regulatory Compliance, Global Alignment, ISO 14971, ISO 13485, Algorithmovigilance.

Are Regulatory Policies Fit for AI-Enabled Cardiovascular Devices?

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Abstract

The rapid integration of artificial intelligence (AI) and machine learning (ML) into cardiovascular devices such as ECG analyzers for arrhythmia detection, echocardiography interpretation tools, coronary computed tomography angiography evaluators, hemodynamic monitors, and wearable cardiac rhythm devices has transformed cardiology by enabling earlier detection, more precise diagnostics, personalized risk stratification, and real-time monitoring to improve patient outcomes. As of early 2026, the U.S. Food and Drug Administration (FDA) has authorized over 1,200–1,300 AI-enabled medical devices overall, with cardiovascular applications representing approximately 9–10% (roughly 100–120 devices, including tools for heart failure risk assessment and arrhythmia monitoring). The vast majority over 95% have been cleared through the 510(k) pathway, which relies on demonstrating substantial equivalence to predicate devices, allowing swift market entry and supporting proliferation in clinical practice. Despite this progress, traditional regulatory frameworks, designed for static, non-learning hardware, struggle to accommodate the adaptive, data-driven, and iterative nature of intelligent systems. Heavy reliance on 510(k) clearance raises concerns about predicate creep, where approvals build on older devices with potentially limited evidence. Analyses indicate that only a minority of submissions include robust clinical studies often fewer than 10% feature prospective or randomized designs while many lack comprehensive reporting on training dataset demographics, subgroup performance, algorithmic biases, or real-world generalizability. Transparency gaps persist, including underreporting of biases, performance drift, diverse population representation, data privacy, and long-term safety monitoring. In the European Union, the Medical Device Regulation (MDR) combined with the AI Act phased in from 2024 with major high-risk obligations from 2026–2027 classifies most AI-enabled medical devices as high-risk, imposing stringent requirements for risk management, data governance, transparency,

human oversight, bias mitigation, and conformity assessments, creating a rigorous yet potentially burdensome framework. Recent FDA initiatives address these gaps via total product lifecycle approaches. The finalized guidance on Predetermined Change Control Plans (PCCPs), issued in 2025, allows pre-approval of specified adaptive modifications such as model retraining without repeated submissions, provided validated protocols and impact assessments are followed. Additional recommendations focus on lifecycle management, real-world performance evaluation, and post-market surveillance to monitor drift and sustain safety. Therefore, while current policies have enabled substantial market penetration and cardiovascular advancements, they are not fully fit for the unique risks of dynamic AI technologies, including opacity, bias amplification, equity issues, and continuous validation needs. Regulators must advance toward adaptive, enforceable, transparent, and harmonized standards prioritizing prospective evidence, bias mitigation, stringent oversight, and global alignment to ensure patient safety, trust, equity, and sustained innovation in AI-driven cardiovascular medicine.

Keywords: Machine Learning, Cardiovascular Devices, FDA Regulation, 510(k) Pathway, Algorithmic Bias

Ayushman Bharat and the Indian Pharmaceutical Industry: Impacts on Market Structure, Access to Medicines, and the Role of Intellectual Property Rights in Promoting Equity

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Abstract
Ayushman Bharat, particularly through its flagship component-the Pradhan Mantri Jan Arogya Yojana (AB-PMJAY)-constitutes one of the most ambitious publicly financed health assurance initiatives in the Global South. Beyond its immediate welfare objectives, the programme has emerged as a structural intervention with far-reaching implications for the Indian pharmaceutical industry, altering patterns of demand, procurement, pricing, and competition. This paper critically examines the interface between AB-PMJAY and the pharmaceutical sector, with a specific focus on how India's intellectual property rights (IPR) framework mediates the scheme's distributive consequences for access to medicines and health equity. Employing a systematic policy-analysis methodology, the study synthesises evidence from government datasets, procurement guidelines, utilisation reports, peer-reviewed empirical literature, industry disclosures, and landmark judicial decisions on pharmaceutical patenting. First, it maps the causal pathways through which a large-scale national health assurance programme reshapes market incentives for originator firms, generic manufacturers, and supply-chain intermediaries. Second, it evaluates empirical trends in service utilisation, drug procurement practices, and out-of-pocket expenditure under AB-PMJAY, highlighting the role of pooled purchasing, standardised treatment packages, and hospital

empanelment in concentrating buyer power. Third, it interrogates the institutional role of India's IPR regime-particularly Section 3(d) of the Patents Act, jurisprudence such as *Novartis AG v. Union of India*, price regulation by the National Pharmaceutical Pricing Authority (NPPA), and the latent threat of compulsory licensing-as mechanisms that temper market exclusivity in favour of public health objectives. The analysis reveals that AB-PMJAY has substantially expanded formal demand for secondary and tertiary healthcare, intensifying price competition in high-volume therapeutic segments and strengthening the market position of generic manufacturers and public generic-supply initiatives such as the Pradhan Mantri Bhartiya Janaushadhi Pariyojana. At the same time, access to patent-protected, high-cost therapies remains uneven, exposing the limits of insurance coverage in the absence of complementary price negotiation and subsidy strategies. The paper argues that India's IPR framework functions as a critical equity backstop, but its effectiveness depends on active alignment with procurement design, price transparency, and targeted public financing. The study concludes by offering policy recommendations aimed at harmonising health financing, pharmaceutical regulation, and IPR flexibilities to advance universal health coverage while sustaining incentives for domestic pharmaceutical innovation.

Keywords: Ayushman Bharat, PM-JAY, Indian pharmaceutical industry, access to medicines, intellectual property rights, compulsory licensing, drug pricing, pooled procurement, health equity, public health policy, India.

Cell & Gene Therapy Regulation in India: Are We Ready for Personalised Medicine?

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Abstract

Advances in cell and gene curatives have converted the geography of personalised drug, offering restorative eventuality for preliminarily untreatable inheritable and oncological diseases. In India, the translational development of advanced remedy medicinal products(ATMPs), including gene curatives, Auto- T cells, and stem cell – grounded products, is accelerating due to progress in biosciences, vector chemistry, and biomanufacturing technologies. still, the nonsupervisory preparedness to support safe and timely restatement of these coming- generation rectifiers remains uncertain. This abstract critically evaluates the current Indian nonsupervisory frame governing cell and gene curatives, with reference to CDSCO vittles, National Guidelines for Gene Therapy, and the medicines and Clinical Trials Rules, 2019. crucial translational challenges are analysed, including bracket inscrutability, limited guidance on chemistry, manufacturing and controls(CMC) for viral vectors and cell- grounded products, gaps in long- term safety monitoring, and structure constraints for GMP- biddable manufacturing. Ethical and biosafety considerations, particularly for first- in- mortal studies and paediatric operations, are also bandied. The evolving

role of real-world evidence and long-term patient registries in post-authorisation safety monitoring is also explored as a critical component of lifecycle regulation for personalised therapies. The review highlights the need for harmonised nonsupervisory pathways that integrate advances in chemistry, bioscience, and nonsupervisory wisdom to enable responsible invention. Strengthening specialised nonsupervisory moxie, developing clear ATMP-specific guidelines, enhancingpost-authorisation surveillance, and fostering academia – assiduity – controller collaboration are essential to ameliorate India's readiness for personalised drug. A robust, adaptive nonsupervisory ecosystem will be critical to insure patient safety while accelerating translational development of cell and gene curatives in India.

Keywords: Cell and Gene Therapy Regulation, Advanced Therapy Medicinal Products (ATMPs), Translational Development in India, Regulatory Framework and CMC Challenges, Post-Authorisation Safety Monitoring.

Clinical Status of Natural Compounds in Cancer

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Abstract
Since cancer is one of the main causes of morbidity and mortality globally there is a constant need to find safe ,effective, and reasonably priced treatment options. Natural substances obtained from microorganisms, plants and marine life have become attractive options because of their many bioactive properties and include anti-inflammatory, pro-apoptotic, anti-oxidant and anti-metastatic activities. Curcumin, resveratrol, quercetin, berberine, epigallocatechin gallate(EGCG) are among the phytochemicals that have been evaluated in clinical trials due to their strong anticancer action in preclinical models. These bioactive molecules- such as curcumin, resveratrol, epigallocatechin gallate(EGCG) ,genistein, cannabinoids and artemisinin- exhibit multitargeted mechanisms of action, including induction of apoptosis , inhibition of angiogenesis, suppression of metastatis,and modulation of critical signaling pathways such as NF Kb ,PI3K/Akt and MAPK. According to recent clinical research, these natural substances can improve treatment efficacy, lower toxicity and overcome medication resistance whether used alone or in conjuction with traditional chemotherapeutics. Their clinical translation is nevertheless hampered by issues such as poor bioavailability, pharmacokinetic variability and variable clinical results. Novel formulation technologies including a synergistic combinations and nano –delivery systems being investigated to improve therapeutic potential. Overall more thorough, extensive and prolonged clinical research is needed to prove the safety, effectiveness and therapeutic relevance of natural chemicals in oncology practice, even though they show great promise in cancer prevention and treatment. Recent advancements focus on improving the clinical utility of natural compounds through novel

drug delivery systems, structural modifications, and combination therapies with conventional anticancer drugs.

Keywords:- Clinical trials, Phytochemicals, Signal transduction pathways, Metastatis suppression, Antioxidant activity.

Comparative analysis and evaluation of selected *Withania somnifera* root from different Geographical regions

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Abstract
Withania somnifera, widely known as Ashwagandha, holds a special place in Ayurveda and traditional Indian medicine. For generations, it has been trusted as a natural remedy to boost energy, manage stress, strengthen immunity, and support both physical and mental health. Much of its healing power comes from naturally occurring compounds called withanolides, along with alkaloids, flavonoids, and glycosides. Together, these bioactive constituents contribute to its adaptogenic, antioxidant, anti-inflammatory, immunomodulatory, and neuroprotective properties. Despite its long history of use, not all Ashwagandha roots are the same. The plant's chemical composition can vary depending on where and how it is grown. Factors such as soil quality, climate, rainfall, and agricultural practices can influence the level of active compounds present in the roots. Keeping this in mind, the present study aimed to compare the phytochemical profile and biological activities of Ashwagandha root samples collected from different geographical regions of India. To ensure reliable results, the roots were extracted using standardized methods such as Soxhlet extraction and cold maceration. Modern analytical techniques including HPTLC, GC–MS, and HPLC were used to identify and measure important marker compounds like withaferin A and withanolide-A. The findings clearly showed regional differences in the concentration of withanolides and other phytochemicals. Some samples demonstrated higher levels of active constituents and stronger antioxidant, anti-inflammatory, immunomodulatory, and potential anti-alopecia effects. Overall, this study highlights the importance of geographical origin in determining the quality and therapeutic value of Ashwagandha. It reinforces the need for careful source selection, standardization, and quality control to ensure consistent and effective herbal formulations.

Keywords: Withania somnifera (Ashwagandha), Withanolides, Geographical variation, Phytochemical profiling, Standardization and quality control.

Comparative Evaluation of Different Marketed Brands of Medicine

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Abstract
The presence of numerous commercial brands containing the same pharmaceutical formulation requires careful evaluation to verify their quality, safety, and therapeutic consistency. This study focuses on a comparative assessment of various marketed brands of a selected tablet dosage form to identify possible differences in physicochemical characteristics, drug content uniformity, dissolution behavior, and cost variation. Even when products contain an identical active pharmaceutical ingredient (API), variations in excipients, formulation techniques, and manufacturing conditions may affect overall product performance and bioavailability.
The stduy was done different and examined according to the official standards established by the United States Pharmacopeia and the Indian Pharmacopoeia Commission. Standard quality control parameters were evaluated, including weight variation, hardness, friability, disintegration time, dissolution testing, and assay of the active ingredient. assay of active pharmaceutical ingredient (API) content was performed using validated analytical techniques such as UV–Visible spectrophotometry or high-performance liquid chromatography (HPLC). The observed results were compared with pharmacopeial specifications and subjected to statistical analysis to determine any significant inter-brand variation.
The results demonstrated that the majority of brands complied with prescribed pharmacopeial limits. Interestingly, certain lower-cost brands showed in vitro performance comparable to more expensive alternatives, indicating that economical substitution may be feasible without compromising therapeutic effectiveness.
In conclusion, although the evaluated brands generally met standard quality specifications, measurable variations in performance parameters and cost were observed. Continuous post-marketing surveillance and stringent quality control measures are essential to ensure therapeutic consistency and patient safety. The findings emphasize the importance of informed brand selection by healthcare professionals to optimize both clinical outcomes and treatment affordability.

Keywords: Comparative study, Marketed pharmaceutical brands, Quality evaluation, Dissolution testing, Pharmacopeial compliance, Cost comparison, Therapeutic equivalence.

Co-precipitation Synthesized Trimetallic Oxide Nanoparticles as Catalytic Platforms for Safer Chemical and Pharmaceutical Processes

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Abstract

The growing focus on safer chemical practices and sustainable catalytic systems has led to increased interest in multifunctional nanoparticles applicable in the areas of environmental protection, chemical safety, and pharmaceutical process development. Trimetallic oxide nanoparticles were synthesized using a simple, economical and scalable co–precipitation method in this study and assessed as catalytic platforms where their usage can be expanded across numerous applications. The following characterization was done using XRD, FTIR, FESEM, UV–Vis and BET surface area analyses in order to understand their structural, morphological and surface characteristics. XRD results showed the formation of crystalline nanoparticles with nanoscale dimensions, and the FTIR spectra indicated an presence of characteristic metal–oxygen bonding indicative of a mixed–metal structure. FESEM images exhibited long, rod-shaped forms, suggesting more surface accessibility and anisotropic growth. The results of BET measurements depicted a mesoporous structure with available pore networks, which provides a high concentration of surface–active sites favoring catalytic interactions. All these physicochemical properties form the basis of the catalytic capacity of the prepared nanoparticles. The trimetallic oxide nanoparticles demonstrated good catalytic activity of the dye-degradation activity in aqueous media. And also a weak magnetic response was noted which can easily separate catalysts in reaction mixtures and hence recyclability and sustainable use. In addition to environmental protection, catalytic activity and reactivity on the surface of these nanoparticles suggest possible applicability in pharmaceutical-related chemistry, where catalysts with high strength and reusability are essential to safe and controlled reactions. In the future, the catalytic use of these nanoparticles will be explored in the reduction of industrially important organic substrates that often occur during pharmaceutical synthesis process.

Keywords: Trimetallic oxide nanoparticles; Co–precipitation synthesis; Dye–degradation; Pharmaceutical processes.

Design And Characterization of Liposomal Gel System for Enhanced Transdermal Delivery of Lumiracoxib

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Abstract
Lumiracoxib is a selective cyclooxygenase-2 (COX-2) inhibitor commonly used in the treatment of pain and inflammatory disorders. However, its conventional oral administration is associated with gastrointestinal irritation and systemic side effects, which may limit long-term therapy. To overcome these limitations, the present study aims to design and characterize a liposomal gel system for enhanced transdermal delivery of lumiracoxib. In this study, lumiracoxib-loaded liposomes were prepared using the thin-film hydration technique and optimized by varying formulation parameters such as lipid composition and cholesterol concentration. The optimized liposomal formulation was subsequently incorporated into a suitable gel base to improve skin retention and patient compliance. The prepared liposomal gel was evaluated for physicochemical characteristics including pH, viscosity, spread ability, drug content uniformity, vesicle size, zeta potential, and entrapment efficiency. In-vitro drug release studies were performed to assess the release behavior of lumiracoxib from the liposomal gel system, while in-vitro permeation studies using Franz diffusion cells were carried out to evaluate transdermal delivery potential. The results demonstrated sustained drug release and significantly enhanced skin permeation compared to conventional gel formulations. Stability studies indicated that the formulation remained physically stable without significant changes in key parameters. The findings of this study suggest that the designed liposomal gel system is a promising transdermal drug delivery approach for lumiracoxib, offering improved therapeutic efficacy, reduced systemic side effects, and enhanced patient compliance. This delivery system may serve as an effective alternative to oral administration in the management of inflammatory conditions.

Keywords: Liposomal gel, Lumiracoxib, Transdermal drug delivery, COX-2 inhibitor, Characterization, In-vitro evaluation.

Design, Optimization, and Evaluation of Naringenin loaded Nanogel for Effective Eczema Management

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Abstract
This study aimed to develop and comprehensively characterize a naringenin-loaded nanogel for the topical management of eczema. Naringenin, a bioactive flavonoid with established anti-inflammatory and antioxidant potential, exhibits limited therapeutic performance due to poor aqueous solubility and restricted dermal penetration. To overcome these limitations, a nanogel system was formulated using a modified emulsion polymerization technique to enhance drug delivery efficiency. The optimized formulation produced nanoparticles with a mean particle size

of 142.6 ± 4.3 nm and a polydispersity index of 0.212, indicating a uniform and narrowly distributed particle population. The encapsulation efficiency was determined to be 81.4 ± 2.7%, confirming effective incorporation of naringenin within the polymeric nanogel matrix. Rheological evaluation demonstrated a gel strength of 34.2 ± 1.1 g/cm² and a viscosity of 1,280 ± 45 cP at 25°C, reflecting suitable mechanical strength, consistency, and spreadability for dermal application. These properties ensure adequate skin adherence and patient acceptability. In vitro drug release studies revealed a sustained release profile, with 72.6% of naringenin released over 24 hours compared to 98.3% from a conventional gel formulation, suggesting prolonged drug retention and controlled release behavior. Histopathological examination of treated goat ear skin showed preservation of the structural integrity of the stratum corneum and epidermis, whereas sodium dodecyl sulfate-treated samples exhibited significant barrier disruption. The findings indicate that the developed nanogel enhances drug stability, ensures sustained release, and demonstrates favorable skin compatibility, highlighting its potential as an effective and safe topical therapeutic system for eczema management.

Keywords: Naringenin, Nanogel formulation, Topical drug delivery, Eczema management, Skin permeation, Controlled drug release.

Development and analysis of herbal formulation for the Rosacea

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Abstract
Rosacea is a chronic inflammatory dermatological disorder characterized by persistent facial erythema, papules, pustules, telangiectasia, and, in severe cases, ocular or phymatous changes that significantly affect patients' quality of life. The present study was undertaken to develop and evaluate a herbal topical lotion for the management of rosacea using plant-derived bioactive compounds with established anti-inflammatory and antioxidant properties. Green coffee beans (*Coffea arabica*) were selected as a natural source of chlorogenic acids (CGAs), recognized for their free radical scavenging and anti-inflammatory potential, while chamomile flowers (*Matricaria recutita* / *Chamaemelum nobile*) were incorporated for their essential oil rich in α-bisabolol and chamazulene, compounds known for soothing, anti-inflammatory, and skin-calming effects. Chlorogenic acids were isolated using Soxhlet extraction, and chamomile essential oil was obtained through steam distillation. The extracted constituents were incorporated into a lotion-based formulation using appropriate excipients to ensure stability and skin compatibility. Comprehensive pre-formulation studies, including organoleptic evaluation, particle size analysis, pH determination, thermal analysis, partition coefficient measurement, hygroscopicity testing, and

wettability studies, were performed to confirm compatibility and stability of the active ingredients. A Box–Behnken experimental design was employed to optimize critical formulation variables and assess their impact on key quality attributes. The developed formulations were evaluated for homogeneity, spreadability, viscosity, washability, pH, and stability under both room temperature and accelerated storage conditions. The optimized formulation demonstrated satisfactory physicochemical characteristics, acceptable stability, and favorable topical performance. The synergistic action of chlorogenic acids and chamomile bioactives may help mitigate inflammation and oxidative stress associated with rosacea, indicating the potential of the developed herbal lotion as a safe, stable, and effective alternative for topical therapy.

Keywords: Rosacea, Chlorogenic acids (Coffea arabica), Chamomile essential oil (*Matricaria recutita*), Herbal topical lotion formulation, Box–Behnken experimental design.

Development and Evaluation of Phytochemical-Based Nano-structured Topical Drug Delivery System for Management of Diabetic Wound Healing

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Abstract

Diabetic wound healing represents a significant therapeutic challenge due to the presence of complex and interrelated pathological factors, including prolonged inflammation, excessive accumulation of reactive oxygen species (ROS), impaired angiogenesis and increased vulnerability to bacterial infections. These abnormalities disrupt the wound microenvironment and delay the normal healing cascade. In the present study, a dual ROS- and glucose-responsive quercetin-loaded supramolecular hydrogel (GLS hydrogel) was developed as an advanced therapeutic platform for diabetic wound management. The hydrogel was prepared by incorporating quercetin, a potent natural antioxidant and anti-inflammatory agent, into a guanosine phenylboronic acid (GPB) hydrogel network through dynamic borate ester linkages. Structural characterization confirmed the successful formation of a stable G-quadruplex architecture, which contributed to the structural integrity and functional performance of the hydrogel. The GLS hydrogel demonstrated dual responsiveness to elevated ROS and glucose levels, enabling controlled and sustained release of quercetin in response to the pathological diabetic wound environment. This smart release behaviour helped restore microenvironmental balance and promoted favourable conditions for tissue repair. In vitro studies revealed that the hydrogel possessed excellent antibacterial, antioxidant, anti-inflammatory and pro-angiogenic properties, all of which are essential for effective wound healing. Furthermore, in vivo evaluation using a full-thickness excisional wound model in streptozotocin-induced diabetic rats showed that treatment

with the GLS hydrogel significantly accelerated wound closure compared to control and GPB hydrogel treated groups. Enhanced re-epithelialization, increased collagen deposition and improved angiogenesis were observed, indicating accelerated tissue regeneration. Additionally, immunofluorescence analysis confirmed enhanced antioxidant activity and increased formation of new blood vessels in the wound tissue treated with the GLS hydrogel. Overall, these findings suggest that the dual-responsive quercetin loaded supramolecular hydrogel is a promising multifunctional biomaterial with significant potential for improving diabetic wound healing through targeted microenvironment modulation and sustained therapeutic action.

Keywords: Diabetic wound healing, Dual ROS- and glucose-responsive hydrogel, Quercetin-loaded supramolecular hydrogel, G-quadruplex borate ester network, Microenvironment-responsive drug delivery.

Digital Governance of Plant-Derived Therapeutics in India: Regulatory Differentiation, Prescription Boundaries, and Consumer Safety

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Abstract

Introduction The consumption of plant-based health products in India has recently shown a significant increase, and this is largely attributed to the fact that more people incline towards natural treatments, and due to the fact that they are readily available online to purchase. However, the same does not apply to these products. Phytopharmaceuticals are classified as drugs under the Drugs and Cosmetics Act and must demonstrate safety, quality, and efficacy prior to making it to market. Nutraceuticals are food products and typically do not require a prescription. Due to the similarity of the two online, the customers are easily confused about the true medical values of the items and how they should be used effectively. *Objectives* To determine how phytopharmaceuticals and nutraceuticals are categorized in India, examine how they are presented to customers on Internet pharmacies, and identify the hazards that may arise due to the interchangeability between them or self-treatment. *Methodology* We performed a regulatory and literature review by searching Indian laws and academic articles. The Food Safety and Standards Regulations of 2016 and the Drugs and Cosmetics Act of 1940 were analyzed in parallel. Another way we conducted a study of the plant-based products presented on online pharmacies is by scouting their appearance to identify the gaps in the ways various products are presented and controlled. *Results and Discussion* We have discovered that the legal classification is not consistent with consumer perceptions of such products on the internet. Phytopharmaceuticals (which may require a prescription) tend to be positioned next to nutraceuticals. Since nutraceuticals are being promoted as health enhancement agents, consumers are inclined to regard them as therapeutic agents. The absence of distinction in labelling, advertising attempts, and

platform classification allows inappropriate self-medication and false promises of effectiveness. *Conclusion* The digital channels create a blurry line between prescription drugs and non-prescription supplements. The key to keeping plant-based therapeutic products safe and well-understood is better labeling, stronger oversight of the platform, and increased awareness of the population.

Keywords: Plant-derived therapeutics; Phytopharmaceuticals; Nutraceuticals; Digital health governance; E-pharmacy regulation; Consumer safety; Indian pharmaceutical regulations.

Effect Of Herbal Drug Alone or In Combination Against Methicillin-Resistant Staphylococcus Aureus: A Systematic Literature Review

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Abstract
Background The methicillin resistance of S. aureus is confirmed by an oxacillin minimum inhibitory concentration (MIC) of 4 micrograms/mL or higher. High rates of mortality, morbidity, length of stay, and financial burden are often associated with MRSA infections, one of the primary causes of hospital-acquired infections. Two subtypes of MRSA infections include hospital-associated (HA-MRSA) and community-associated (CA-MRSA). In addition to differences in clinical features and molecular biology, they also differ in treatment and antibiotic susceptibility. This activity highlights the value of the interprofessional team in recognising and treating MRSA in addition to evaluating its evaluation and management. *Aim* Effect of herbal drugs alone or in combination against MRSA (Methicillin Resistant S. aureus): A systematic literature review. *Methods* All published evidence from January 1, 1967, to January 31, 2025, as retrieved using the web resource https://pubmed.ncbi.nlm.nih.gov/, is included in this Systematic Literature Review. Eligible publications were selected from regular publishing data and focused on infected patients treated with MRSA infection on randomised clinical-based outcomes. To distinguish suitable publications from the remainder, this approach involves establishing search-eligible criteria. *Results* Out of the 1,629 citations discovered by the Systematic Literature Review, 11 publications representing 10 unique studies—met the eligibility parameters. Herbal drugs, whether taken alone or in combination, can be used to treat MRSA infections or symptoms. A majority of the papers that qualify are single blind and double-blind trials, but many are hospital patients or volunteers. *Conclusion* This study concludes that herbal drugs alone or in combination can be used against MRSA as a potent treatment for MRSA infection and symptoms.

Keywords: SLR, MRSA, Herbal drugs.

Engineered Nanomedicine for Targeted Intervention and Diagnostics in Ischemic Stroke Management

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Abstract

Stroke is a leading cause of global mortality and long-term disability, resulting from the interruption of cerebral blood flow. Annually, approximately 15 million people suffer a stroke worldwide. The current first-line therapy is the intravenous administration of tissue plasminogen activator (tPA), supported by mechanical thrombectomy for large vessel occlusions. However, this conventional treatment is severely limited by a narrow therapeutic time window (3-4.5 hours for tPA) and an inability to address subsequent reperfusion injury and neuronal damage. This narrow window is primarily due to the heightened risk of cerebral hemorrhage following tPA administration beyond this timeframe, which can exacerbate neurological damage. Clinical trials have failed due to safety and efficacy issues in delivering neuroprotective agents across the blood-brain barrier (BBB). Ischemic stroke pathophysiology is multifaceted, involving interrelated mechanisms such as oxidative stress caused by reactive oxygen species, profound neuroinflammation mediated by microglial activation, programmed cell death via apoptosis, and excitotoxicity triggered by glutamate overload. To overcome the limitations of conventional therapies, nanotechnology-based drug delivery systems (DDSs), particularly nanoparticles, offer a promising solution. These systems enhance drug stability, facilitate BBB penetration via active targeting mechanisms, and allow targeted delivery of the drug to the ischemic penumbra. For instance, nanoparticles can be functionalized with ligands or antibodies that specifically bind to overexpressed receptors on activated endothelial cells in the ischemic region, such as the transferrin receptor or integrins. Intranasal administration of nanoformulations emerges as a particularly effective non-invasive route for direct brain targeting. This strategy bypasses the BBB entirely by utilizing the olfactory and trigeminal nerve pathways directly connecting the nasal mucosa to the central nervous system, thereby reducing systemic side effects. In conclusion, while challenges in clinical translation remain, nanomedicine represents a transformative approach for developing effective therapies. It holds the potential to create combination strategies that address both acute revascularization and sustained neuroprotection, ultimately improving outcomes for patients with ischemic stroke.

Keywords: Ischemic Stroke, Blood–Brain Barrier (BBB), Nanoparticle-Based Drug Delivery, Intranasal Brain Targeting, Neuroprotection.

Ensuring Drug Quality: A comprehensive approach to medication safety Modulator: A Review

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Abstract
The main concerns in ensuring the safety of medication therapy are managing and reducing the adverse effects of medications. Drug analyzers cannot affect side effects because they are intrinsic characteristics of the drug ingredient. medication analyzers are also heavily involved in ensuring the quality of medication formulations and bulk drug materials,Which is intimately linked to the safety issue. Identity, strength, and purity are the three primary characteristics of medication quality. Among these, purity is crucial when it comes to bulk medicinal materials: by identifying (elucidating the structure) and quantitatively determining the contaminants and degradation products.The Food and medication Administration's (FDA) current medication safety regulation system has to be changed because it has significant flaws. The following are some of the main issues: manufacturers fail to fulfill most of their postmarketing safety study commitments; the FDA lacks the authority to pursue sponsors who violate regulations and disregard postmarketing safety study commitments; the FDA's safety oversight structure is suboptimal; the FDA's expertise and resources in drug safety and public health are limited; and the design of initial preapproval studies allows uncommon, serious adverse events to go undetected.Modern pharmaceutical companies are using sophisticated analytical methods including High Performance Liquid Chromatography (HPLC), Gas Chromatography (GC), UV-Visible spectroscopy, and Mass Spectrometry in addition to traditional quality testing to accurately evaluate drugs. Higher medication safety standards are ensured by these procedures, which aid in the detection of degradation products, residual solvents, and trace level contaminants. The uniformity, dependability, and reproducibility of drug quality throughout the manufacturing and testing procedures are also greatly aided by Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP). Additionally, after a medicine is approved for sale, pharmacovigilance programs play a major role in monitoring its safety. Regulatory agencies can take prompt action, such as changing the label, issuing safety warnings, or withdrawing a product if necessary, by continuously monitoring adverse drug responses.Drug inspectors and regulatory specialists play a critical role in keeping an eye on manufacturing facilities, guaranteeing adherence to legal requirements, and safeguarding the public's health. Thus, maintaining high standards of drug quality and guaranteeing patient safety worldwide required.

Keyword: Modulator ,Pharmaceutical Analysis ,Identity Strength Purity ,Contaminant Analysis ,Drug Quality ,Drug Safety.

Ethical and legal challenges in Personalized Medicines

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Abstract

Personalized medicine (PM) is reshaping modern healthcare by using genomic and molecular information to tailor prevention, diagnosis, and treatment to the individual. Personalised health care is based on the dynamics of systems biology, uses predictive tools to evaluate health risks and to design personalised health plans to help patients mitigate risks, prevent disease and treat it with precision when it occurs. The concepts of personalised health care are receiving increasing acceptance, with the Veterans Administration committing to personalised, proactive patient-driven care for all veterans. While this approach promises more precise and effective care, it also raises complex ethical and legal challenges that must be addressed to ensure its responsible and equitable implementation. This review critically examines these challenges across clinical practice, research, data governance, and public policy. We explore how the foundational principles of bioethics, like autonomy, beneficence, non-maleficence, and justice, are tested in the genomic era. The predictive, familial, and permanent nature of genetic information complicates informed consent, challenges traditional models of privacy and confidentiality, and creates tensions between individual choice and family responsibilities. The review highlights growing concerns about genetic discrimination in insurance and employment, the limits of existing legal protections, and the urgent need for stronger regulatory safeguards. Particular attention is given to issues of equity. High costs, limited access to genomic services, underrepresentation of diverse populations in research, and the risk that algorithmic bias will widen existing health disparities and create a "genomic divide". Ethical concerns in personalized medicine research, including the return of incidental findings, data sharing, commercialisation, and post-trial responsibilities, are also examined. Finally, the paper situates these challenges within the Indian context, emphasising the need for a dedicated regulatory framework, improved oversight of genetic testing, and policies that prioritise justice and inclusion. We conclude that the success of personalized medicine depends not only on scientific innovation but on proactive governance, public trust, and a firm commitment to equity. Without deliberate ethical stewardship, personalized medicine risks deepening inequality; with it, it holds the potential to transform healthcare in a way that is both precise and profoundly humane.

Keywords: Personalized Medicine, Genomic Ethics, Genetic Data Governance, Health Equity and Access, Regulatory Framework in India.

Exploring the Phytochemicals for Pain Management by *In silico* Approach

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Abstract

Pain remains a major clinical problem worldwide and the long-term use of conventional analgesics is often associated with adverse effects, tolerance, and dependence. Pain management is a fundamental component of modern medicine that focuses on the prevention, assessment, and treatment of pain to enhance patient comfort and overall quality of life. Pharmacological methods remain the cornerstone of pain control. These include non-opioid analgesics such as non-steroidal anti-inflammatory drugs (NSAIDs) such as acetaminophen, opioid analgesics like morphine and fentanyl or adjuvant medications such as antidepressants, anticonvulsants and corticosteroids that target specific pain pathways. The choice of drug depends on the type, intensity, and underlying cause of pain as well as patient-specific factors such as age, comorbidities, and risk of addiction. This has encouraged the exploration of safer and more effective alternatives derived from natural sources. Phytochemicals such as- Myricetin (source- Myrica cerifera), Parthenolide (source- Tanacetum parthenium), Corydaline (source- Corydalis yanhusuo), Convicine (source- Vicia faba) and many more phytochemicals showing to their structural diversity and broad pharmacological activities represent promising candidates for pain management. The present study aims to explore the analgesic potential of selected phytochemicals using an *in silico* approach. A library of bioactive plant-derived compounds was screened against key molecular targets involved in pain and inflammation such as cyclooxygenase enzymes, opioid receptors, and inflammatory mediators. Molecular docking was employed to predict binding affinities and interaction patterns between phytochemicals and target proteins providing insights into their possible mechanisms of action. In addition *in silico* pharmacokinetic and toxicity predictions including absorption, distribution, metabolism, excretion, and toxicity (ADMET) profiling were performed to assess the drug-likeness and safety of the selected compounds. These findings suggest that phytochemicals may serve as potential lead compounds for the development of novel analgesic agents. Overall this *in silico* investigation highlights the significance of computational tools in accelerating natural product-based drug discovery and provides a scientific basis for further *in vitro* and *in vivo* validation of phytochemicals for pain management.

Keywords: Pain management, Phytochemicals, *In silico* approach, Molecular docking, ADMET analysis, Analgesic agents.

Fly Ash as a Low-Cost Adsorbent for Amoxicillin Removal from Real Pharmaceutical Wastewater: Process Optimization and Reusability Studies

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Abstract

The widespread presence of amoxicillin in pharmaceutical wastewater poses significant environmental and public health risks, including the development of antibiotic-resistant bacteria and ecotoxicological effects on aquatic ecosystems. The persistent nature of antibiotics in the environment disrupts microbial communities, affects aquatic organisms at various trophic levels, and contributes to the global antimicrobial resistance crisis. Conventional wastewater treatment technologies, such as activated sludge processes and biological treatment systems, are often inefficient in removing these persistent micropollutants due to their recalcitrant chemical structures and low biodegradability, necessitating the development of cost-effective and sustainable remediation strategies. This study investigates the application of fly ash, an abundant industrial waste material generated from coal-fired power plants, as a low-cost adsorbent for amoxicillin removal from real pharmaceutical wastewater. The utilization of fly ash addresses two critical environmental challenges simultaneously: managing industrial solid waste and remediating pharmaceutical contamination. Response Surface Methodology coupled with Central Composite Design (RSM-CCD) was employed to systematically optimize critical process parameters including initial amoxicillin concentration, adsorbent dosage, pH, contact time, and temperature. The RSM-CCD model demonstrated excellent predictive capability with high coefficient of determination and low residual errors, enabling the identification of optimal operating conditions for maximum removal efficiency while minimizing experimental runs. Results revealed that fly ash exhibited remarkable adsorption capacity, achieving high removal efficiencies under optimized conditions. The adsorption process followed favorable kinetic and isotherm models, indicating efficient amoxicillin uptake through chemisorption mechanisms. This research highlights the dual benefits of valorizing industrial waste while addressing pharmaceutical pollution, offering a sustainable and economically feasible solution for antibiotic removal from wastewater in alignment with circular economy principles and environmental regulatory frameworks.

Keywords: Amoxicillin, Fly ash, Adsorption, RSM-CCD, Pharmaceutical wastewater, Reusability, Process optimization

Formulation and evaluation of herbal mouth dissolving tablets with Antioxidant Efficacy

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Abstract
Aim The present study aims to formulate fast-dissolving tablets of different herbal constituents, i.e., lycopene extract, liquorice bark powder, and tulsi seed powder, and evaluate their in vitro and antioxidant potential. *Material and Methods* The direct compression technique was used to develop the tablets using superdisintegrant at different concentrations, i.e., sodium starch glycolate. Three formulations of each herbal constituent were separately prepared with varying concentrations of sodium starch glycolate as a superdisintegrant, hydroxypropyl methylcellulose (HPMC), and sodium alginate as a binder, and mannitol as a diluent to investigate its impact on tablet disintegration and overall performance. The powder mixture was subjected to precompression, like flow properties, and post-compression studies such as disintegration time, weight variation, hardness, friability, and physical appearance. Furthermore, each herbal ingredient's antioxidant activity was evaluated using the DPPH free radical scavenging test in the optimized batch. *Results* The developed formulations showed acceptable physical characteristics with smooth, intact surfaces and weight variation within acceptable limits. Friability values ranged from 0.80% to 1.0%, while tablet hardness was between 5.0 and 7.0 kg/cm². The disintegration time for all batches was rapid, ranging from 1.28 min to 1.49 min. The free radical scavenging activity demonstrated a significant percent inhibition of DPPH radicals. *Conclusion* The developed tablets could be a promising solution for anxiety management in youngsters and adults.

Keywords: Fast dissolving tablets, Lycopene, Liquorice, Tulsi, Superdisintegrant, Binders, DPPH assay, Antioxidant activity

Green Analytical Chemistry Approach for Estimation of Drugs

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Abstract
Green Analytical Chemistry (GAC) is an emerging approach in pharmaceutical analysis that aims to make analytical methods safer, simpler, and more environmentally friendly. Conventional drug estimation techniques often require large amounts of toxic solvents, high energy input, and generate considerable chemical waste, which can harm both analysts and the environment. To

overcome these issues, Green Analytical Chemistry focuses on reducing hazardous chemicals, minimizing solvent and sample consumption, lowering energy use, and developing sustainable analytical procedures. In recent years, several green strategies have been applied for the estimation of drugs in bulk materials, pharmaceutical formulations, and biological samples. These include the use of eco-friendly solvents such as water and ethanol, miniaturized extraction techniques, and solvent-free or low-solvent methods. Instrumental techniques like UV-Visible spectrophotometry, High Performance Liquid Chromatography (HPLC), capillary electrophoresis, and electrochemical methods have been modified to reduce analysis time, solvent flow rates, and waste generation while maintaining accuracy and precision. The adoption of Green Analytical Chemistry not only reduces environmental pollution but also improves laboratory safety and decreases operational costs. Tools such as the Analytical Eco-Scale and Green Analytical Procedure Index (GAPI) are used to evaluate the environmental impact of analytical methods and help in selecting greener alternatives. Overall, the application of Green Analytical Chemistry in drug estimation supports sustainable laboratory practices without compromising analytical performance. This approach is increasingly important in modern pharmaceutical quality control laboratories and contributes to safer, cost-effective, and environmentally responsible drug analysis.

Keywords: Green Analytical Chemistry, Drug Estimation, Eco-friendly Methods, Pharmaceutical Analysis, Sustainable Analytical Techniques

Natural Bioactive Compounds for the Management of Parkinson's Disease

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Abstract
Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by selective dopaminergic neuronal loss in the substantia nigra pars compacta, α-synuclein aggregation, mitochondrial dysfunction, oxidative stress, and chronic neuroinflammation. Although levodopa remains the gold-standard therapy, long-term treatment is associated with motor complications and fails to halt disease progression and highlighting the need for disease-modifying strategies. This review synthesizes recent preclinical and clinical evidence on natural bioactive compounds as multi-target therapeutic candidates for Parkinson's disease management. Accumulating studies demonstrate that plant-derived phytochemicals including polyphenols (curcumin, resveratrol, epigallocatechin gallate), flavonoids (quercetin, luteolin, baicalein), alkaloids (berberine, caffeine, L-DOPA from Mucuna pruriens), and terpenoids (ginkgolides, cholesterol) exert neuroprotective effects through complementary mechanisms. These compounds attenuate reactive oxygen species generation, suppress NF-KB–mediated neuroinflammation, preserve mitochondrial bioenergetics, enhance autophagic clearance of misfolded α-synuclein, and modulate apoptosis-related signalling

pathways. Emerging evidence further implicates regulation of the gut–brain axis, where natural products restore microbial homeostasis, strengthen intestinal barrier integrity, and reduce systemic inflammatory signalling. Several agents, notably Mucuna pruriens, caffeine, and green tea catechins, demonstrate clinical or epidemiological support, whereas others show robust efficacy in vitro and in vivo PD models. Limitations include poor bioavailability and blood–brain barrier permeability, prompting investigation into nano formulations and targeted delivery systems. Natural bioactive compounds represent promising adjunct or disease-modifying candidates capable of addressing multiple pathogenic pathways simultaneously. Standardized formulations and rigorously designed clinical trials are essential to translate these mechanistic benefits into evidence-based therapeutic interventions for Parkinson's disease.

Keywords: Parkinson's disease; Natural bioactive compounds; Neuroprotection; Dopaminergic neurodegeneration; Nano-delivery systems

Nyctanthes arbor-tristis : An Emerging Phytopharmaceutical for the Management of Rheumatoid Arthritis

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Abstract
Rheumatoid arthritis (RA) a chronic inflammatory and systemic autoimmune disease. Rheumatoid arthritis affects about 1% of people worldwide and is two to three times more common in women than in men. Synovial hyperplasia, inflammation, degeneration of the bones, joints and angiogenesis are the hallmarks of rheumatoid arthritis. Current anti-inflammatory chemotherapeutic medications provide short-term comfort but have unfavourable side effects. Herbal remedies have demonstrated beneficial impact on RA symptoms. Traditionally, rheumatism and inflammatory conditions have been treated using Nyctanthes arbor-tristis (NAT). It is a critically endangered species in India and is frequently referred to as "Parijat". It appears to be a promising phytopharmaceutical alternative, which draws upon its vast pool of iridoid glycosides, flavonoids and phenolics to target the pathogenesis of RA. Preclinical studies have shown that leaf, bark, and flower extracts of N. arbor-tristis possess strong anti-inflammatory, antioxidant and immunomodulatory actions. Preclinical studies of arthritis show decreased paw swelling, pro-inflammatory cytokines (TNF-α, IL-1β, and IL-6), oxidative stress, and cartilage lesions, indicating the modulation of prominent inflammatory pathways like NF-κB and COX/LOX. The multi-mechanism of action emphasizes its efficacy not only in managing symptoms but also in arresting the progression of the disease. Additionally, the favourable safety profiles demonstrated in animal models make it suitable for chronic administration. The diverse mechanisms make N. arbor-tristis a potential adjunct for RA management, reducing the toxicities

of conventional drugs. However, clinical trials are necessary to confirm its efficacy, dose, and safety in human subjects. Standardization of plant extracts and purification of lead compounds may expedite its development from traditional medicine to conventional phytotherapy, providing long-term relief to millions of patients suffering from this debilitating disease.

Keywords: Nyctanthes arbor-tristis, rheumatoid arthritis, phytopharmaceuticals, anti-inflammatory, medicinal plants.

Online tools in pharmaceutical in marketing

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Abstract
In recent years, the pharmaceutical industry has phonetic change in marketing practices due to the rise of online tools and digital technologies. These tools, such as corporate websites, social media platforms, mobile applications, email campaigns, webinars, and digital analytics, are essential for promoting pharmaceutical products, engaging healthcare professionals (HCPs), and educating patients. They permit companies to communicate clearly with their audiences, provide personalized content, and gather useful feedback in real time. Social media platforms enable interactive engagement, which builds awareness and trust between pharmaceutical brands and their stakeholders. Mobile applications and digital platforms offer easy access to drug information, reminders, and patient support programs, improving adherence and satisfaction. Moreover, digital analytics enable marketers to track customer behaviour, enhance campaigns, and make decisions based on data while following regulatory requirements. However, challenges such as data privacy concerns, digital literacy, and strict rules for pharmaceutical advertising limit the full potential of online marketing. Still, the use of online tools in pharmaceutical marketing has made strategies more efficient, measurable, and patient-focused. Companies that leverage these digital solutions can enhance brand visibility, foster professional connections, and contribute to improved patient outcomes. As the digital world continues to evolve, online tools are poised to play a more significant role in shaping the future of pharmaceutical marketing global. Pharmaceutical brands can reach the right audience at the right time with the aid of online advertising and search engine optimization (SEO). Businesses can increase the visibility of their goods and services by employing keyword strategies and targeted advertisements.

Keywords: Pharmaceutical marketing, online tools, digital marketing, social media, mobile applications, healthcare professionals, patient engagement, digital analytics, regulatory compliance, e-marketing

Phytochemical Profiling And Translational Evaluation Of *Datura Metel* Extracts Against Breast Cancer

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Abstract
Breast cancer remains one of the leading causes of cancer-related mortality worldwide, necessitating the exploration of novel therapeutic agents with improved efficacy and safety profiles. Natural products continue to represent a valuable source of bioactive compounds for anticancer drug discovery. *Datura metel*, a medicinal plant enriched with diverse secondary metabolites such as tropane alkaloids, withanolides, and flavonoids, has attracted considerable attention due to its pharmacological potential. The present review highlights the significance of phytochemical profiling and pharmacological evaluation of *Datura metel* extracts in the context of breast cancer research. Advanced analytical techniques, including high-performance liquid chromatography (HPLC) and mass spectrometry-based approaches, have enabled the comprehensive identification and characterization of bioactive constituents. These techniques play a crucial role in establishing chemical fingerprints, ensuring extract standardization, and supporting reproducibility, which are essential for translational development. Preclinical investigations have demonstrated that *Datura metel* extracts exhibit significant cytotoxic and antiproliferative effects against breast cancer cell lines. The anticancer activity is primarily attributed to the presence of withanolides and alkaloids, which are reported to induce apoptosis, arrest the cell cycle, and modulate oxidative stress pathways. Despite promising in vitro findings, the translational potential of *Datura metel* is limited by concerns related to toxicity, variability in phytochemical composition, and lack of standardized formulations. Future research should focus on metabolomics-driven profiling, isolation of active constituents, and mechanistic validation using advanced in vitro and in vivo models. Integration of analytical chemistry, bioscience, and regulatory perspectives will be critical for the development of safe, effective, and standardized plant-based therapeutics. Such an approach may facilitate the translation of *Datura metel* from traditional medicine to evidence-based breast cancer therapy.

Keywords: *Datura metel*; Phytochemical profiling; Breast cancer; Cytotoxicity; Apoptosis; Translational research.

Phytotherapeutic Agents For Jaundice And Hepatoprotection – Evidence Based Advances And Mechanistic Insights

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Abstract

Introduction: Jaundice, defined by elevated serum bilirubin levels due to hepatocellular injury or cholestasis, remains a prominent manifestation of acute and chronic liver disease globally. Conventional management focuses on addressing underlying causes but lacks safe, broadly effective adjunctive hepatoprotective agents. Traditional medicinal plants such as *Phyllanthus niruri*, *Silybum marianum* (milk thistle), *Andrographis paniculata*, and *Picrorhiza kurroa* have been extensively investigated for antioxidant, anti-inflammatory, and cytoprotective effects on hepatic tissues. The aim of this review is to evaluate recent original research evidence on these herbal drugs for jaundice and correlated liver dysfunction, elucidating mechanistic pathways and clinical relevance.

Methods: A comprehensive appraisal of recent original studies (2022–2025) was conducted using PubMed and clinical trial registries. Included evidence spans randomized interventional trials, controlled clinical studies, and translational mechanistic research evaluating liver enzyme modulation (ALT, AST), bilirubin levels, histopathological markers, oxidative stress indices, and bile flow parameters in human subjects and validated experimental models following administration of standardized herbal extracts or formulations.

Results: A recent phase II, randomized, double-blind, placebo-controlled clinical trial of a standardized phytopharmaceutical combining *Phyllanthus niruri* and *Silybum marianum* extracts (Heptex®) demonstrated statistically significant reductions in alanine aminotransferase and aspartate aminotransferase levels after 36 weeks of administration in patients at risk of non-alcoholic steatohepatitis, with favourable safety profiles. Preclinical evidence supports antioxidant and anti-inflammatory mechanisms: *Andrographis paniculata* exhibits potent free radical scavenging and modulation of detoxification enzymes, while *Picrorhiza kurroa* extracts enhance bile secretion and reduce hepatic inflammation in experimental hepatotoxicity models. *Phyllanthus* species have been shown to regulate liver enzymes, mitigate fibrosis pathways, and exert antiviral activity in vitro.

Conclusion: Emerging evidence supports the hepatoprotective potential of select herbal drugs in jaundice and liver dysfunction through multimodal mechanisms including antioxidant defense enhancement, cytokine modulation, and cytoprotective signalling pathway regulation. While clinical translation remains limited by standardization challenges and the need for larger controlled trials, evidence-based Phytotherapeutics agents hold promise as adjunctive treatments for jaundice and broader liver disease management.

Keywords: Hepatoprotective Phytotherapeutics; Jaundice treatment; *Phyllanthus niruri*; *Silybum marianum*; Antioxidant liver mechanisms

Potential Inhibitors Of Cdk5 In Phytoconstituents

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Abstract
Cyclin Dependent Kinase 5 (CDK5) is a proline-directed serine/threonine kinase predominantly expressed in the nervous system and plays a critical role in neuronal development and function. Dysregulation of CDK5 activity has been strongly associated with several neurological disorders, including Alzheimer's disease and Parkinson's disease, making it a promising therapeutic target. The present study focuses on the in-silico screening of potential CDK5 inhibitors derived from phytoconstituents to identify novel therapeutic candidates. The native structure of CDK5 (PDB ID: 4AU8) was obtained from the RCSB Protein Data Bank and remodeled using Swiss Model to complete missing sequences. A library of over 5000 phytochemical compounds from the IMPPAT database was screened using InstaDock software. The top 50 compounds were selected based on docking scores and binding affinity. These hits were further evaluated for pharmacokinetic and toxicity profiles through ADMET analysis using SwissADME and pkCSM tools, ensuring selection of non-toxic and drug-like molecules. Subsequently, PASS analysis was performed to predict biological activity, leading to the identification of three promising compounds: Desmodin, Isopongachromene, and Glaberene. Interaction analysis using Discovery Studio confirmed their binding affinity at critical active sites, particularly Lys33 (ATP binding site) and Asp126 (active site). The study concludes that these phytoconstituents demonstrate significant inhibitory potential against CDK5 and may serve as promising candidates for further experimental validation in the treatment of neurological disorders.

Keywords: Cyclin-Dependent Kinase 5 (CDK5), In-silico Molecular Docking, Phytoconstituents, ADMET and PASS Analysis, Neurodegenerative Disorders.

Precision and Personalized Hypertension Management - A Review of Emerging Drugs Strategies and Guideline Updates

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Abstract
Introduction Hypertension effects over 1.28 billion adults globally and it is responsible for approximately 10.8 million deaths annually, large due to cardiovascular and renal complications. Despite established therapies, blood pressure, control rates are still below 45%, highlighting pristine, and gaps in management. Recent advance in clinical trials, pharmacotherapy, and risk stratification have driven a shift towards precision and personalise hypertension management, influencing major, international guideline updates. This review aims to synthesise emerging drug

strategies and evaluate their impact on contemporary hypertension guidelines. *Methodology* A narrative review was conducted using PubMed, Scopus and Web of science, focusing on peer-reviewed publication and international guideline published between 2023 and 2026. Sources include European American and global hypertension, guidelines, randomised control trials, systematic reviews, and high impact pharmacotherapy reviews. Evidence was analysed with emphasises on individualise treatment strategies, novel antihypertensive agents, and guideline-directed care. *Results* Updated guidelines emphasis individualised blood pressure target based on cardiovascular risk, with intensive systolic control (<130 mmHg) associated with 20-25% reduction in Major cardiovascular events. Early initiation of fixed dose, combination therapy improves blood pressure controlled by 15-20% compared with monotherapy. Novel agents targeting the aldosterone pathway, including aldosterone synthase inhibitors, demonstrate additional systolic reduction of 10-15mmHg in resistance hypertension. Recent trials of Renal Denervation report sustained systolic blood pressure reduction of 5-10mmHg at 12-24 months in carefully selected patients. Expanded use of home and ambulatory Blood pressure monitoring, reduce diagnostic Misclassification by nearly 30%, supporting personalised treatment. *Conclusion* Contemporary hypertension management is increasing guided by precision-based strategies, integrating patient specific risk, profile, emerging pharmacological therapy, and evolving guideline recommendations. This evidence driven approaches offer substantial potential to improve blood pressure control, and long-term cardiovascular outcomes.

Keywords: hypertension; precision medicine; antihypertensive therapy; clinical guidelines; personalised treatment.

Preliminary Screening of Excipients for Development of Nanoemulsion Gel in the Treatment of Periodontitis

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Abstract
Background Periodontitis, a prevalent chronic inflammatory disease affecting over 50% of adults worldwide, arises from polymicrobial dysbiotic biofilms, dominated by *Porphyromonas gingivalis* and other anaerobes, triggering sustained immune-inflammatory response, leading to progressive gingival inflammation, and alveolar bone resorption. Polyphenols (quercetin, resveratrol) have emerged as a promising agent in periodontal therapy due to their antimicrobial, anti-inflammatory, anti-oxidant, and immune-modulatory properties. However, their poor aqueous solubility, limited permeation across buccal mucosa restrict their clinical use. Nanoemulsion-based gels offer advantages such as enhanced solubilisation, improved penetration, sustained local retention, and reduced systemic exposure, rendering them suitable for periodontal therapy.

Objective To screen oils, surfactant and co-surfactants for the formulation of a polyphenol-loaded nanoemulsion gel intended for buccal delivery in the treatment of periodontitis. Methodology Solubility of polyphenols was assessed in different oils, surfactant and co-surfactant to identify suitable formulation components. Surfactant and co-surfactant (Smix) was prepared at different ratios and analysed using pseudo ternary diagram, to facilitate formulation of a clear and thermodynamically stable nanoemulsion using the water titration method. Result Clove oil was selected as oil phase based on its solubility. *Eugenol (clove oil), as reported in the literature, demonstrates anti-inflammatory and anti-microbial action in the treatment of periodontitis.* The S-mix ratio of 4:1 (Tween 80 and PEG 400) was selected based on pseudo ternary diagram for producing a stable and clear nanoemulsion system. *Conclusion Solubility parameter is an effective strategy for screening of oils. The HLB of selected Smix was in accordance with the HLB of the selected oils. Hence, the prepared nanoemulsion was more stable.*

Keywords: Periodontitis, Polyphenols, Excipients, Nanoemulsion gel, Pseudo-ternary phase diagram

Preventive Approaches to Disease Management & Phytopharmaceuticals: Scope in Extensively Drug-Resistant Tuberculosis (XDR-TB) in India

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Abstract

Extensively drug-resistant tuberculosis (XDR-TB) poses a serious public health threat in India, significantly challenging national tuberculosis control programs and disease elimination efforts. The increasing burden of TammXDR-TB is primarily driven by delayed diagnosis, inadequate treatment adherence, irrational use of anti-tubercular drugs, and prolonged exposure to toxic second-line therapies. Preventive approaches to disease management are therefore critical for limiting transmission, improving therapeutic outcomes, and reducing long-term morbidity.

This work discusses preventive disease management strategies for XDR-TB with a focused emphasis on the emerging role of phytopharmaceuticals. Preventive interventions such as early molecular diagnostics, patient-centered adherence strategies, infection control measures, nutritional support, and host-directed therapies are highlighted in the Indian healthcare context. In parallel, phytopharmaceuticals derived from medicinal plants exhibit notable anti-mycobacterial, immunomodulatory, anti-inflammatory, and hepatoprotective properties, offering potential benefits as supportive or adjunct therapies during prolonged XDR-TB treatment.

India's traditional medicinal knowledge provides a substantial reservoir of bioactive phytoconstituents that may contribute to preventive tuberculosis care when scientifically validated. The integration of standardized phytopharmaceuticals with conventional anti-tubercular regimens

may enhance treatment tolerance, improve patient compliance, and strengthen host immunity. This approach aligns with preventive disease management principles and offers a complementary strategy to combat XDR-TB.
The abstract emphasizes the need for rigorous clinical validation, standardization, and regulatory evaluation of phytopharmaceuticals to effectively integrate them into national XDR-TB preventive frameworks.

Keywords: XDR-TB, preventive disease management, phytopharmaceuticals, tuberculosis, India, host-directed therapy

Preventive Disease Management Through Phytopharmaceuticals: Therapeutic Prospects of *Andrographis paniculata*

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Abstract
The accelerating incidence of chronic, metabolic, and immune-associated disorders has emphasized the need for preventive strategies that are safe, accessible, and scientifically validated. Preventive approaches increasingly focus on phytopharmaceuticals, which integrate traditional medicinal knowledge with modern pharmacological evidence and regulatory standardization. Among emerging candidates, *Andrographis paniculata* (Burm. f.) Nees has gained attention for its broad-spectrum therapeutic potential and established ethnopharmacological relevance. Rich in bioactive diterpenoid lactones, particularly andrographolide, *Andrographis paniculata* exhibits anti-inflammatory, antioxidant, immunomodulatory, hepatoprotective, and metabolic regulatory activities. These properties support preventive healthcare by targeting early pathogenic mechanisms, including oxidative stress, chronic inflammation, immune dysregulation, and metabolic imbalance. Preclinical and emerging clinical studies indicate its potential in reducing susceptibility to recurrent infections, metabolic syndrome, hepatic dysfunction, and inflammatory disorders, thereby contributing to physiological homeostasis and long-term health resilience. From a phytopharmaceutical perspective, standardized extracts, marker-based quality control, and regulatory compliance are essential to ensure reproducibility, safety, and therapeutic consistency. Advances in extraction methods, pharmacokinetic evaluation, dose optimization, and bioavailability enhancement further strengthen its translational relevance in preventive medicine. In conclusion, *Andrographis paniculata* represents a promising phytopharmaceutical candidate in preventive disease management. Its integration into evidence-based healthcare requires continued pharmacological validation, well-designed clinical studies, and regulatory alignment, supporting its contribution to sustainable and preventive therapeutic strategies.These findings support it's

potential inclusion in preventive phytopharmaceuticals development and evidence-based integrative healthcare strategies globally today,particularly for strengthening preventive interventions and promoting long-term public health outcomes through safe, standardized herbal therapeutic approaches

Keywords: *Andrographis paniculata*; Phytopharmaceuticals; Preventive healthcare; Andrographolide; Immunomodulation; Regulatory compliance.

Preventive Health Potential of *Morinda Citrifolia L.* Fruit as a Phytopharmaceutical Resource

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Abstract
The increasing burden of chronic and lifestyle-associated disorders has highlighted the importance of preventive healthcare strategies, particularly those involving plant-derived phytopharmaceuticals. *Morinda Citrifolia L.* (Noni), a tropical medicinal plant belonging to the family Rubiaceae, has gained scientific attention due to its rich phytochemical composition and potential role in supporting physiological homeostasis. The fruit of *Morinda Citrifolia* serves as an important source of biologically active compounds, including iridoid glycosides, phenolic constituents, flavonoids, and coumarins, which contribute to its functional and protective properties.From a phytopharmaceutical perspective, the therapeutic value of *Morinda Citrifolia* lies in its ability to influence multiple cellular pathways involved in maintaining normal biological function. The presence of natural antioxidants plays a critical role in minimizing oxidative imbalance, which is a key contributing factor in the initiation and progression of various pathological conditions. Additionally, its bioactive constituents have demonstrated potential in regulating inflammatory responses, supporting immune function, and preserving cellular integrity under physiological stress conditions. These properties highlight the importance of *Morinda Citrifolia* fruit as a natural intervention for reducing disease susceptibility.Furthermore, the increasing emphasis on standardization, quality evaluation, and scientific validation of plant-based products has strengthened the position of *Morinda Citrifolia* in phytopharmaceutical research. Its favorable safety profile and long history of dietary and traditional use support its suitability for long-term health applications. The integration of such plant-derived products into preventive healthcare frameworks offers a promising approach for promoting health and reducing disease burden.Thus, *Morinda citrifolia L.* fruit represents a significant phytopharmaceutical resource with considerable potential in preventive health management and future therapeutic development.

Keywords: *Morinda Citrifolia L.*, Phytopharmaceuticals, Preventive healthcare, Phytochemical standardization, Medicinal plants, Bioactive compounds.

Preventive Phytopharmaceutical Strategies for the Management of Mouth Ulcers: Development of Standardized Herbal-Based Targeted Drug Delivery Systems

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Abstract
Mouth ulcers is a painful, open sore that forms inside your mouth. It's an erosion or break in the delicate lining of the mouth. We need research focuses on the development of evidence-based, clinically safe phytopharmaceutical strategies for the development of formulation. Plant-based medicines are preferred because they generally cause fewer adverse reactions, cost effective, easily available, sustainable, bio compatible and fit well within cultural healthcare practices. Herbal remedies make use of bioactive plant constituents with anti-inflammatory, analgesic, antimicrobial, wound-healing properties key factors in the recovery of oral lesions. Several herbs studied for managing mouth ulcers including guava, aloe vera, tooth ache plant, amla, turmeric, tulsi, licorice, giloy stem, all of which have demonstrated beneficial effects. Advances in pharmaceutical research underline standardization of extracts and innovation in drug delivery systems, which include mucoadhesive gels, films coating, nanocarrier (Liposomes, Polymeric Nanoparticles) to optimize dose, enhance mucosal retention, enhance bioavailability in the oral cavity. This approach not only reduces localized pain and accelerates recovery but also minimizes systemic exposure, providing a robust translational framework for the development of evidence-based herbal interventions in oral healthcare.

Keywords: Mouth ulcers; Mucoadhesive gel; Herbal drug delivery systems; Phytochemical bio actives.

Real-World Evidence in Regulatory Decision-Making: Applications and Challenges

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Abstract
Real-world data (RWD) and real-world evidence (RWE) are progressively being added to randomized controlled trials (RCTs) in regulatory decision-making throughout the drug development lifecycle. Electronic health records, claims databases, patient registries, patient-reported outcomes, and technology of digital health are among the typical clinical practices that give Real World Data. In oncology and uncommon disorders, where traditional randomized clinical trials may not be possible, research using Real World Data (RWD) can fulfill the evidence gaps at different steps of a treatment lifecycle and supplement data obtained from clinical trials. Regulatory agencies including the Food and Drug Administration (FDA) in the USA, the European Medicines Agency (EMA), and Chinese regulatory bodies are actively working to maximize the utility of RWD and RWE in order to assist regulatory judgments. Therapeutic efficacy, label expansions, post-marketing surveillance, and post-approval research needs including conditions in which clinical trial data were scarce or not available have all been supported by RWE. Real-world data has been utilize throughout the product lifecycle to instruct reimbursement talks, improve illness understanding, drive trial designs, and help regulatory decisions. Despite all these benefits, Real World Evidence (RWE) evaluation must take into account few constraints, such as inconsistent electronic data collection, missing data, selection bias, confounding, and decreased internal validity, underscoring the importance of data quality and methodological rigor. In the future, Real World Data (RWD) and Real-World Evidence (RWE) will continue to act as a significant role in regulatory decision-making, potentially increasing beyond oncology and rare diseases to other therapeutic areas and capturing patient-relevant outcomes.

Keywords: Real-world data, Real-world evidence, Randomized controlled trials, Post-Marketing surveillance, European Medicines Agency, Food and Drug Administration.

Recent Advancement in Treatment of Lung Cancer: Silibinin-loaded Nanocarrier-based Delivery System for Enhanced Efficacy and Bioavailability

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Abstract
Background Among all cancer-related deaths, lung cancer is the leading cause. Conventional Chemotherapy and immunotherapy treatment has poor tumour targeting, low bioavailability and development of resistance. Silibinin, a naturally occurring flavonolignan exhibits anticancer activity in the treatment of Lung cancer. However, due to its poor water solubility its bioavailability is limited. Nanocarrier-based drug delivery system has the potential to overcome this limitation and improve the bioavailability of Silibinin. *Objective* This review examines the

most recent advancements in Silibinin-based nanoparticle drug delivery systems, highlighting its enhanced therapeutic efficacy relative to conventional treatments. *Methodology* A comprehensive literature review was conducted focusing on nanoparticles like solid nanoparticles, polymeric nanoparticles, and chitosan nanoparticles of Silibinin in lung cancer, using databases like Google Scholar, PubMed, and ResearchGate. *Result* Numerous studies showed that Silibinin-loaded nanocarrier-based drug delivery system resulted in increased cellular uptake, better release profile, and drug deposition. Various nanocarriers, such as solid nanoparticles and chitosan nanoparticles, have demonstrated promising results in studies investigating the treatment of lung cancer. These nanocarriers enhanced the bioavailability of silibinin, along with increased cytotoxicity, decreased viability, and marked apoptosis in the tested models. *Conclusion* Nanocarrier-based delivery system is a promising approach via which the bioavailability and tumour targeting of Silibinin can be improved for the treatment of lung cancer, leading to improved therapeutic efficacy and bioavailability of Silibinin.

Keyword: Flavonolignan, Lung cancer, Silibinin, solid nanoparticles, Targeted Delivery

Regulation of Fertility Tracking Apps for Women's Health

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Abstract

The rapid expansion of fertility tracking applications has transformed how women monitor reproductive health, offering unprecedented convenience and personalization. However, this technological growth has simultaneously exposed significant vulnerabilities in data privacy, regulatory oversight, and consumer protection. This review analyzes the regulatory landscape governing fertility tracking applications across major jurisdictions, including United States, European Union, and India, with a focus on how existing legal frameworks address privacy risks in FemTech.

Despite their health-related functions, approximately 90% of fertility tracking applications operate outside traditional healthcare regulatory systems. In the United States, many applications fall beyond the scope of clinical oversight because they are categorized as lifestyle tools rather than medical devices. Similarly, regulatory enforcement varies across jurisdictions, creating fragmented protections for users' sensitive reproductive data. While comprehensive data protection regimes exist in some regions, enforcement challenges and classification ambiguities allow many applications to evade strict compliance obligations.

Recent enforcement actions by the Federal Trade Commission against companies such as Premom and Flo Health signal growing regulatory attention to privacy violations in the FemTech sector. These cases highlight recurring concerns, including unauthorized third-party data sharing, opaque

privacy policies, inadequate user consent mechanisms, and insufficient breach notification practices. Such issues underscore systemic weaknesses in how reproductive health data is governed, particularly when applications collect highly sensitive personal information without robust safeguards.

The review identifies key policy gaps and proposes evidence-based recommendations to strengthen regulatory frameworks. These include mandatory classification of fertility tracking applications as medical or health-related digital products, enhanced transparency requirements regarding data collection and sharing practices, and the establishment of specialized regulatory bodies focused on FemTech oversight. Additionally, harmonization of international data protection standards is recommended to reduce jurisdictional inconsistencies and improve cross-border enforcement.

Overall, the findings contribute to ongoing global policy discussions on digital health governance and reproductive privacy. As fertility tracking technologies become increasingly integrated into everyday healthcare decision-making, strengthening regulatory oversight is essential to protect user autonomy, ensure accountability, and safeguard women's reproductive data within an evolving digital health ecosystem.

Keywords: Fertility Tracking Applications, FemTech Regulation, Reproductive Data Privacy, Digital Health Governance, Regulatory Oversight and Consumer Protection

Point-Of-Care Manufacturing: A Regulatory Perspective On 3d Printed Medical Implants

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Abstract

The rapid evolution of personalized medicine has transformed expectations in surgical care, particularly in orthopedics, pediatrics, and craniofacial reconstruction. Conventional implants are standardized, but human anatomy is not standardized. This mismatch often leads to suboptimal fit, surgical modifications, prolonged operative time, and compromised outcomes. Three-dimensional (3D) printing, or additive manufacturing, offers a solution by enabling the fabrication of patient-specific implants tailored to individual anatomical requirements. In healthcare, this process typically involves CT/MRI imaging, image processing, computer-aided design (CAD), layer-by-layer printing, sterilization, and subsequent implantation. Examples include customized cranial plates, dental implants, spinal cages, and patient-specific orthopedic devices—each designed for a single patient and unsuitable for mass production.

Traditionally, medical devices are manufactured in centralized industrial facilities under batch-based production systems, followed by distribution to hospitals. However, the integration of 3D printing within hospital settings shifts manufacturing from factory to clinic. This transition, known

as Point-of-Care (PoC) manufacturing, refers to the production of medical devices at or near the site of patient treatment, effectively transforming hospitals into mini manufacturing units. In such workflows—Patient → Imaging → Design → Printing → Sterilization → Implantation—no external manufacturer may be involved.

This decentralization raises critical regulatory questions. Existing frameworks developed by bodies such as the U.S. Food and Drug Administration, under the EU Medical Device Regulation (MDR), and India's Central Drugs Standard Control Organization through the Medical Device Rules 2017 were designed for centralized, repeatable manufacturing systems. Challenges include defining the "manufacturer," determining licensing requirements, applying Good Manufacturing Practices (GMP) to single-patient production, ensuring quality validation without batch testing, and establishing effective post-market surveillance. GMP is built around repeatability, while 3D printed implants are inherently unique.

This research critically examines the regulatory, quality, and materiovigilance implications of hospital-based 3D printed implants, emphasizing the need for adaptive, risk-based regulatory models to ensure patient safety in decentralized healthcare manufacturing.

Keywords: Decentralized manufacturing, custom-made medical devices, regulatory harmonization, risk-based regulatory framework and advanced manufacturing technologies.

Reconciling ISO 13485:2016 and 21 CFR Part 11 Technical Controls for Electronic Device History Records under the FDA QMSR Framework

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The Food and Drug Administration Quality Management System Regulation formally supersede legacy 21 CFR Part 820 by incorporating the international consensus standard ISO 13485:2016. While this harmonization standardizes global parameters and retires nomenclature like the Device History Record in Favor of ISO mandated traceability records, it creates acute technical friction regarding electronic data governance. The Quality Management System Regulation aligns the scope of quality management with ISO 13485, yet the Food and Drug Administration retains strict jurisdictional authority over digital compliance via 21 CFR Part 11 and newly codified record controls under section 820.35. Manufacturers digitizing production workflows face the dual burden of mapping ISO 13485 Clauses 7.5.1 and 7.5.9 while engineering software that enforces Part 11 Subpart B and C mandates. Reconciling the broad ISO framework with prescriptive controls demanding cryptographic time stamped audit trails and bound electronic signatures requires advanced system architecture methodologies. Strategic application of the Computer Software Assurance paradigm satisfies ISO 13485 Clause 4.1.6 validation requirements through risk proportionate testing. Establishing a robust technical roadmap ensures an inspection ready

infrastructure achieving global ISO interoperability while maintaining uncompromising Part 11 compliance for digital product realization records.

Keywords: FDA QMSR, eDHR, Data Integrity, Risk-Based Validation, Incorporation by Reference (IBR)

Role of Herbal Drugs in Ocular Therapeutics

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Abstract
Ocular disorders are among the most common health problems affecting people of all age groups. Along with modern ophthalmic medicines, herbal drugs have gained significant attention due to their long history of use, natural origin, and better safety profile. Traditional systems of medicine such as Ayurveda, Unani, and Traditional Chinese Medicine describe numerous herbs for maintaining eye health and treating eye diseases. Herbal drugs play an important role in ocular therapeutics through their anti-inflammatory, antioxidant, antimicrobial, and soothing properties. Herbs like Amla, Turmeric, Neem, Aloe vera, Triphala, Bilberry, and Ginkgo biloba have shown beneficial effects in conditions such as conjunctivitis, dry eye syndrome, cataract, glaucoma, and age-related macular degeneration. Antioxidant-rich herbs protect ocular tissues from oxidative stress, while anti-inflammatory herbs help reduce redness, irritation, and swelling of the eye. Antimicrobial herbs assist in controlling mild eye infections and maintaining ocular hygiene. The use of herbal drugs in eye care offers advantages such as fewer side effects, better patient compliance, and suitability for long-term use. However, scientific validation, standardization, and clinical studies are essential to ensure their safety and efficacy. In conclusion, herbal drugs serve as a valuable adjunct in ocular therapeutics and hold promising potential for the development of safer and more effective ophthalmic formulations.

Keywords: Eye disorders, Antioxidant activity, Anti-inflammatory activity, Antimicrobial activity, Ayurveda, Glaucoma, Cataract, Dry eye syndrome.

Role of Phytopharmaceuticals in Radioprotection: Current Trends and Therapeutic Potential of Tulsi and Ashwagandha

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Abstract

New developments in plant-based medicine are mostly about finding active substances in plants that can fight oxidative stress, lower inflammation, help the immune system work better, and shield cell DNA from harm. Among medicinal plants, Ocimum sanctum, also known as Tulsi, has received a lot of attention for its possible ability to protect against radiation damage. Tulsi has many different chemicals from plants, like eugenol, ursolic acid, rosmarinic acid, flavonoids, and other types of phenolic compounds. These ingredients have powerful abilities to fight against harmful free radicals and reduce the damage caused by oxidative stress. This helps lower the harmful process of lipid peroxidation, strengthens the body's own defense systems against oxidation, protects the tissues that make blood cells, and increases the chances of survival in animals that have been exposed to radiation. Similarly, Withania somnifera, also known as Ashwagandha, has shown great potential in protecting against the harmful effects of radiation. The plant has special active parts, especially withanolides and withaferin A, that help fight against harmful free radicals, reduce inflammation, and support the body's immune system. Experimental studies show that Ashwagandha can help reduce oxidative stress caused by radiation, keep bone marrow cells healthy, prevent a drop in white blood cell numbers, and improve survival rates in people exposed to radiation. Combining traditional herbal practices with modern medicine standards has made it easier to scientifically support the benefits of these plants. Improvements in methods for extracting plant compounds, identifying their chemical components, setting quality standards, and testing their effects in laboratory studies have made plant-based substances that protect against radiation more dependable and consistent. Together, Tulsi and Ashwagandha show promise as affordable and safer options for reducing damage caused by radiation, and they could be useful as supportive treatments during radiotherapy or in cases where someone is exposed to radiation.

Keywords: radioprotection, DNA protection, phytochemicals, herbal radioprotective agents, radiotherapy support.

Screening and Selection of Excipients for Fabrication of a Vaginal Nanoemulgel for Polycystic Ovary Syndrome: A Phytopharmaceuticals based Combinatorial approach

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Abstract

Background PCOS is a common endocrine-metabolic disorder characterized by insulin resistance, hyperandrogenism, and irregular menstruation. Flavonoids have shown antioxidant and insulin-sensitizing properties which can be helpful in the treatment of metabolic diseases and PCOS. However, its therapeutic application is hampered by its poor water solubility leading to poor bioavailability. Nanocarrier based drug system such as nanoemulsion has shown to increase the solubility of poorly water soluble drugs, due to its small size leading to better therapeutic efficacy, minimize adverse effects, and improve bioavailability. Further vaginal drug delivery systems allow prolonged drug release through a localized mode of administration that avoids first-pass metabolism , increases drug concentration at the target site and lowers systemic adverse effects which improves therapeutic efficacy. *Objective* The main aim of this study was to screen suitable excipients for the formulation and development of nanoemulsion gel in the management of PCOS. *Methodology* Screening of oils were conducted on the basis of therapeutic activities and their with the drugs. Miscibility studies were performed between selected oils and surfactant systems to assess clarity, homogeneity, and absence of phase separation. Smix ratio was selected based on pseudoternary diagram. *Results* Among the screened oils, long-chain triglycerides, showed highest solubility and was selected. Pseudo ternary phase diagrams showed that 4:1 ratio of Smix had maximum amount of nanoemulsion region compared to 3:1, 2:1, 1:1 and 5:1. Selected oil–surfactant combinations exhibited good miscibility with clear and stable mixtures without phase separation. The optimized oil system showed high drug solubilization efficiency and uniform dispersion characteristics. *Conclusion* Preliminary screening confirmed the suitability of selected oil and surfactant systems for the development of flavonoid-loaded nanoemulsion, providing a promising platform for enhanced PCOS therapy.

Keywords: PCOS, Phytopharmaceuticals, Nanoemulsion, Flavonoid, Quality by design (QbD).

Section 3(d): India's Anti-Evergreening Shield: Fostering enablement of Generic Drug Exports in the Pharmaceutical Landscape

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Abstract

India, previously dubbed the ‘Pharmacy of the World’, supplies around 20 per cent of generic drugs globally. This is driven by the strict Intellectual Property Rights (IPR) regulation in the country, specifically under section 3(d) of the Patents Act, 1970. This section of the act prohibits the patenting of new forms of previously known substances, such as salts, polymorphs and formulations, unless they have been found to express an enhanced therapeutic effect. This has

been effective in reducing evergreening practices as well as in restricting monopoly without actual innovation.

In 2025, the High Court of Delhi ruled to invalidate Novo Nordisk's semaglutide patent, deeming the chemical modifications to be 'obvious' and absent of any augmentation in efficacy. This subsequently allowed Dr Reddy's to manufacture and export generics to non-patented markets before the patent even expired in 2026, via Bolar exemptions. The Central Drugs Standard Control Organisation have complementary policies that facilitate rapid approval of generic drugs and their export, unlike the Hatch-Waxman delays in the U.S.

This framework has allowed India's generic exports to amount to 25 billion dollars annually, increasing access to affordable drugs globally. The challenge, however, lies in the data exclusivity (DE) of clinical data of innovator drugs, which could hinder generics. DE would force Indian firms to redo full clinical trials (costly/unethical), delaying launches and raising prices, extending innovator monopolies. India views DE to be beyond the WTO 'minimum', a 'backdoor monopoly' reducing accessibility to affordable drugs.

Keywords: Intellectual Property Rights (IPR), Section 3(d) of the Indian Patents Act, 1970, Generic Drug Manufacturing in India, Data Exclusivity (DE), Evergreening and Patent Monopoly

Sol–Gel synthesized Trimetallic Oxide Nanoparticles as Catalytic Nanoplatforms: Bridging Environmental Chemistry and Pharmaceutical Innovation.

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Abstract

Sustainable nanotechnology demands safer chemical synthesis strategies that minimize hazardous reagents, reduce energy consumption, and ensure environmental compatibility without compromising material performance. In this study, mixed-metallic oxide nanoparticles were synthesized via the Pechini method, a modified polymeric sol–gel approach recognized for its molecular-level homogeneity, controlled stoichiometry, and relatively eco-friendly processing conditions. This safer chemical route promotes uniform metal ion distribution, reduces secondary contamination, and enables precise tailoring of physicochemical properties, thereby offering a rational platform for multifunctional applications in both environmental and pharmaceutical sectors.

The prepared trimetallic oxide nanoparticles exhibited compact, polygonal morphology as observed through FESEM analysis, reflecting controlled nucleation and structural uniformity. X-ray diffraction (XRD) confirmed high crystallinity and phase purity, while FTIR spectroscopy validated the formation of stable metal–oxygen bonding networks. Brunauer–Emmett–Teller

(BET) surface area analysis demonstrated that the Pechini-derived samples possessed significantly enhanced surface area and porosity, resulting in improved exposure of catalytically active sites. Such structural advantages directly contribute to superior electron transfer dynamics and enhanced catalytic efficiency.

Optical characterization using UV–Visible spectroscopy and Tauc plot analysis revealed a reduced band gap energy of 1.87469 eV, indicating strong visible-light absorption and improved charge carrier mobility. Band gap narrowing minimizes electron–hole recombination, thereby enhancing photocatalytic performance under visible light irradiation. The synthesized nanoparticles demonstrated excellent photocatalytic activity, achieving rapid methylene blue degradation within 35 minutes. The outstanding performance is attributed to the synergistic effects of high surface area, optimal crystallinity, engineered band structure, and efficient redox activity.

Beyond environmental remediation, these trimetallic oxide nanostructures hold promising potential in pharmaceutical innovation. Their tunable surface chemistry, stability, and redox properties make them suitable for antimicrobial coatings, drug delivery carriers, and bio-catalytic interfaces. The safer synthesis approach further supports biocompatibility considerations and sustainable material integration in biomedical systems. Overall, this work underscores the significance of safer sol–gel-derived nanoplatforms that effectively bridge environmental chemistry with pharmaceutical advancements, contributing to sustainable wastewater treatment and next-generation therapeutic technologies.

Keywords: sol-gel method, trimetallic oxide nanoparticles, dye degradation, bridge environmental chemistry.

Solvent-Dependent Variation in Phytochemical Composition and In Vitro Antibacterial Activity of *Achyranthes aspera*

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Abstract

Conventional medical and ethnomedicinal systems of knowledge remain a hugely important reservoir of new therapeutic agents, especially in the era of increasing antimicrobial resistance. Medicinal plants used in traditional indigenous healthcare systems provide a scientifically sound basis for bioactivity-based studies. *Achyranthes aspera* is a ubiquitous ethnomedicine weed that has been traditionally used in the treatment of infections, inflammation, and wound healing, implying the availability of bioactive secondary metabolites that have antimicrobial properties. The current study aimed to analyse solvent-dependent variation in phytochemical composition and its effects on in vitro antibacterial activity. Different solvents of varying polarity were used to investigate how solvent selection affects the phytoconstituent recovery, extract yield and

biological efficacy. Extraction yield analysis demonstrated a difference in yield percentage, indicating polarity-dependent solubilisation of phytochemicals. Phytochemical profiling revealed polarity-dependent compositional variation and the distribution of secondary metabolites, including alkaloids, terpenoids, flavonoids, phenolics, and other bioactive constituents. Antibacterial activity was evaluated against clinically relevant strains *Escherichia coli, Enterobacter hormaechei, Bacillus subtilis* and *Staphylococcus aureus.* Among the tested extracts, chloroform and acetone extracts demonstrated comparatively higher antibacterial activity against *Enterobacter hormaechei*. The enhanced activity of these extracts implies enriched bioactive components with potential therapeutic significance. Overall, the results highlight the importance of the extraction solvent with regard to phytochemical yield and antibacterial potency. This study scientifically validates the ethnomedicinal importance of *A. aspera* and supports solvent-dependent strategies in optimising the recovery of phytoconstituents for the development of standardised phytopharmaceutical formulations and supports scientific therapeutic validations in natural product-based drug discovery endeavours.

Keywords: *Achyranthes aspera*, ethnomedicine, phytochemical profiling, antibacterial activity, bioactive-secondary metabolites.

Supply Chain Management in the Pharmaceutical Industry

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Abstract

Supply Chain Management is a very important and strategic function in the pharmaceutical industry owing to its direct impact on cost efficiency, quality of products, regulatory compliance, and the smooth availability of products in the market. The Pharmaceutical Supply Chain can be termed complex since it encompasses various sections such as procurement of materials, manufacturing, quality control, inventory control, warehousing, transportation, and distribution of the products to the end customers and healthcare institutions. Any disparity or lack of efficiency in any of the above sections may result in enhanced operating costs.

This study tries to give a holistic idea regarding the concept of supply chain management in the context of the pharmaceutical industry with a focus on the importance it holds for the improvement of operational efficiency and organizational competitiveness. This paper tries to cover the important aspects of the pharmaceutical supply chain, the challenges faced by the pharmaceutical industry, and the role it holds in cost minimization, quality assurance, and the improvement of service efficiency. This study concludes with a suggestion that for the sustenance and success of the pharmaceutical industry, it is very important to have a strong supply chain management system

in place. Thus, effective supply chain strategies enhance efficiency, reduce risks, and support sustainable growth in pharmaceutical industries

Keywords: Supply Chain Management, Pharmaceutical Industry, Inventory Control, Logistics, Distribution, Operational Efficiency better healthcare delivery and patient safety.

Sustainability in the Pharmaceutical Sector and Its Economic Role

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Abstract
Sustainability in the pharmaceutical industry is really important now. This is because the pharmaceutical industry and the environment are facing a lot of challenges. We need to make sure that healthcare practices are sustainable. The pharmaceutical industry plays a role in keeping people healthy. It also helps national and global economies grow, either directly or indirectly. Sustainability in the pharmaceutical industry is crucial, for the health of people and the economy. The pharmaceutical industry uses a lot of energy and natural resources. This also creates a lot of waste and increases carbon emissions. This poster is about how important sustainability's in the pharmaceutical industry. It also talks about how sustainability can help with health care costs. Some things that can help the pharmaceutical industry be more sustainable include using chemistry and making manufacturing processes more energy efficient. We also need to minimize waste and use packaging. The pharmaceutical industry needs to manage its supplies in a way. Sustainability is very important, in the industry. Sustainable innovations are good for the market. They help companies save money and be more competitive. This is a deal because it means they can make more money and be around for a long time. Sustainable pharmaceutical practices are also good for business. They create ways for people to invest and they help build a strong brand. This means companies can grow and make money over time. They can also keep up with rules and what people want. Sustainable innovations also help make medicines. They make it possible to balance the cost of making medicines with how easy it's for people to get them and how well they work. This is important for the market. Sustainable innovations are important, for the market because they help make new medicines and keep costs down.

Keywords: Sustainability, Pharmaceutical sector, Green chemistry, Economic growth, Sustainable manufacturing, Healthcare industry

Therapeutic Potential of Gymnema sylvestre in Diabetes Mellitus: A Phytopharmaceutical Approach

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Abstract
Diabetes Mellitus including both Type 1 and Type 2 is a life threatening chronic long lasting metabolic Disorder characterized by Hyperglycemia with associated to multi organ disabilities. There are many disadvantages as well as adverse effects of oral hypoglycemic drugs which raised the interest in phytopharmaceutical treatments. *Gymnema sylvestre* that was recently used as traditional Ayurvedic drug due to its control blood sugar regulating and hyperglycaemia prevention. The active triterpene saponins, primarily gymnemic acids, gymnemasaponins, and a polypeptide known as gurmarin, are responsible for the plant's pharmacological effect.
Gymnemic acids that controls glucose homeostatis by different methods. It binds to the taste receptors that reduces intestinal glucose absorption which boosts insulin productions and prevemting the perception of sweet flavours that influence the regeneration of Pancreatic Islet Cells.
Many researches on animal models of diabetes due to Streptozotocin and Alloxan demonstrates the significant reduction in fasting blood glucose, correction of metabolic enzymes with improvement in insulin level. Gymnemic Acid IV showed remarkable blood glucose level reduction which is comparable to popular antidiabetic drugs. Antioxidants assays revealed decrease lipid peroxidation in serum as well as tissues which demonstrates the protective role against oxidative, stress-related Diabetes consequences.
Other benefits beyond to glycemic management includes antihyperlipidemic, anti-inflammatory, antibacterial, immunomodulatory, hepatoprotective and wound healing qualities, are indicated by related investigations with enhanced absorption.
As per some recent Systemic review and Meta-analysis done by using *Gymnema sylvestre* supplementation was statically significant improvements in major glycemic parameters such as Reduced FBG, PPBG, HbA1c with decrease Triglycerides and Total Cholesterol.

Keywords: Islet Cells, Triterpene saponins, Gymnemasaponins, Gymnemic Acid

Therapeutic Potential of Laminarin in Wound Healing Applications

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Abstract

Wound healing is a complex process that involves haemostasis, inflammation, cell proliferation, and tissue remodelling. Conventional wound dressings include gauze or synthetic dressing etc. It has various drawbacks including slow healing, no ability to prevents loss of moisture, infection risks and bioactivity is also compromise . Therefore, new biomaterials are needed that are not only protect the wound but also allow the wound tissue to regenerate. Seaweeds are clad with a lot of different bioactive molecules, and they may be capable of promoting health among human beings. One of the seaweeds is a β-glucan called laminarin derived as a result of use of brown seaweed and possesses special advantages over the traditional materials. As, Laminarin is biocompatible, biodegradable, anti-inflammatory, immunomodulatory and non-toxic in nature. Recent studies also highlight the possibility of developing laminarin into novel systems of delivery such as hydrogels, nanoparticles, and chemically functionalized derivatives, which enhance its biological capability. Hydrogels made of laminarin exhibit superior swelling, mechanical strength, and blood clotting characteristics and therefore are effective in maintaining the environment wet and providing rapid haemostasis. Gold and silver nanoparticles prepared by the use of laminarin exhibits antibacterial and anti-biofilm laminarin also shows low cytotoxicity, thereby reducing the risk of infection and helping to heal wounds. Moreover, chemical modification through esterification or conversion of dialdehydes can significantly increase laminarin biologic activity to generate improved antioxidant, anti-wrinkling and tissue-engineering properties. The novelty of laminarin-based phytopharmaceuticals lies in combining natural polysaccharide benefits with advanced nanotechnology and polymer science to create multifunctional wound healing platforms. Unlike traditional dressings, such preparations play an active role in faster wound healing, reduction in infection, and regenerative healing of tissues. Thus, laminarin is an excellent candidate natural biomaterial to next-generation wound healing products with potential translational applications in clinical practice.

Keywords: Laminarin, Seaweed-derived biomaterials, Wound healing, Hydrogels, Nanoparticles, β-glucans, Tissue regeneration, Anti-inflammatory, Antibacterial activity, Biomaterials, Hemostasis, Phytopharmaceuticals

Unsupervised Access to Over-the-Counter Medicines: Emerging Patterns of Abuse Among Adolescents and Young Adults:

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Abstract

Over the counter (OTC) medicines aim to make healthcare more accessible and encourage self-care for minor health issues. However, easier access to these medications without supervision has led to signs of misuse and abuse among adolescents and young adults. Many people believe that OTC drugs are completely safe. The easy availability in local pharmacies and online contributes to their improper use. Commonly misused categories include antihistamines, cough and cold medicines with dextromethorphan, pain relievers like paracetamol and NSAIDs, laxatives, and certain herbal supplements.

From a public health point of view, OTC drug misuse is a growing but often overlooked issue. Taking these medications repeatedly or in high doses can lead to liver damage, kidney damage, stomach problems, mental health effects, and possible dependency. Additionally, self-medicating can delay the diagnosis of serious medical conditions and may increase resistance to antibiotics when people obtain them without a prescription in some cases.

Young adults, especially university students, are at risk due to academic pressures, peer influence, misinformation from social media, and a reluctance to seek help from medical professionals. The lack of organized awareness programs and inconsistent enforcement of regulations worsens the situation.

To tackle OTC drug misuse, we need a broad public health approach. This should include stricter monitoring of regulations, better counseling from pharmacists, improved systems for reporting side effects, and focused education efforts in schools and universities. Raising awareness about the proper use of medications and encouraging responsible self-medication are vital to prevent long-term health issues. Acknowledging OTC drug abuse as a developing public health challenge is essential for creating effective prevention strategies and protecting the health of young people.

Keywords: *Over the counter drugs, NSAIDs, Laxatives, Healthcare, Kidney*

Design of Experiment-based Formulation and Evaluation of a Topical Emulgel of a BCS-class III drug

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Abstract

The present study focuses on the design, formulation, and preliminary evaluation of a topical emulgel containing colchicine, a Biopharmaceutical Classification System (BCS) Class III drug, with the aim of enhancing its skin permeability and local therapeutic efficacy. Emulgels combine the advantages of emulsions and gels, offering improved spreadability, controlled drug release, stability, and patient acceptability, making them suitable for topical drug delivery. The emulgel formulation was prepared by incorporating a drug-loaded oil-in-water emulsion into a gel base

using Carbopol 940 as the gelling agent. Eucalyptus oil, oleic acid, and dimethyl sulfoxide (DMSO) were employed as components of the oil phase and as penetration enhancers to facilitate transdermal drug transport. Span 20 and Tween 20 were used as surfactants to stabilize the emulsion system and ensure uniform drug distribution. A Design of Experiment (DoE) approach was adopted to systematically optimize formulation variables influencing critical quality attributes. A 2^3 full factorial design, implemented using Design-Expert® software, was employed to study the effect of three independent variables on two key responses, namely in-vitro drug release and spreadability. A total of twelve experimental runs were carried out with varying concentrations of penetration enhancers to identify the optimized formulation. Preliminary evaluation parameters such as appearance, homogeneity, and pH were assessed to ensure formulation stability and suitability for topical application. The study demonstrates that emulgel formulation is a promising and effective approach for topical delivery of colchicine, providing enhanced drug release and improved physicochemical properties, thereby supporting its potential for localized therapeutic applications with improved patient compliance and safety.

Keywords: Emulgel, Colchicine, Topical drug delivery, BCS Class III drug, Penetration enhancers, In-vitro drug release.

Scaling Innovation: Bridging the Gap Between Digital Tools and Global Regulation

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Abstract
The clinical research industry is rapidly transitioning to a patient-centric, digitally driven model. This shift, necessitated by challenges in patient recruitment and retention, integrates Digital Health Technologies (DHTs) like wearable sensors, telemedicine, and Electronic Data Capture (EDC) as core operational requirements. However, implementing these tools globally presents a significant "regulatory synchronization" challenge, requiring compliance with varied international regulations from bodies such as the FDA, EMA, PMDA, and CDSCO.
This paper outlines a practical roadmap for scaling digital trial technologies while maintaining audit-ready compliance across diverse jurisdictions. Key components include integrating wearable sensors for continuous data collection, telemedicine for virtual patient interaction, and eSource for direct data capture, all aimed at improving data accuracy and patient diversity. Successfully navigating the global regulatory landscape involves harmonizing expectations from different agencies and managing "Hybrid Protocols" to adapt to varying regional digital maturity.
The roadmap emphasizes moving from pilot studies to scalable processes, including early regulatory engagement, rigorous vendor management for data privacy, and comprehensive participant support to overcome the "Digital Divide." Case studies illustrate the benefits, such as higher retention rates and faster enrollment in hybrid decentralized clinical trials. Ultimately,

maintaining data integrity and audit readiness, ensuring data adheres to ALCOA+ principles, is crucial. By aligning digital workflows with evolving global regulatory guidance, sponsors can build more resilient, efficient, and patient-centric trials, bridging technology with established clinical compliance.

Keywords: Patient-Centric Clinical Trials, Digital Transformation in Clinical Research, Decentralized Clinical Trials (DCTs), Hybrid Clinical Trial Models

Track V:
Emergency Healthcare and Combat Casualty Management

Artificial Intelligence in Pharmacy Practice and Drug Development

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Abstract

Artificial Intelligence (AI) is transforming many areas of healthcare, including pharmacy. AI refers to computer systems that can perform tasks that normally require human intelligence, such as learning, problem solving, and decision making. In pharmacy, AI helps improve patient care, increase efficiency, and reduce medication errors. One important application of AI in pharmacy is drug discovery and development. Traditional drug development is time-consuming and expensive. AI can analyze large amounts of biological and chemical data to identify potential drug candidates faster and more accurately. This reduces the time needed to bring new medicines to market. AI models can also predict how different compounds will interact with the human body, helping researchers choose safer and more effective options. AI is also used in medication management. In hospitals and community pharmacies, AI-powered systems can review prescriptions to detect possible drug interactions, allergies, or incorrect dosages. This improves patient safety and supports pharmacists in making better clinical decisions. Automated dispensing systems use AI to organise and distribute medicines accurately, reducing human error. Another key area is personalized medicine. AI can analyze patient data, such as medical history, genetic information, and lifestyle factors, to recommend the most suitable medications and dosages. This approach helps ensure that each patient receives treatment tailored to their individual needs. In addition, AI-powered chatbots and virtual assistants provide patients with information about their medications, remind them to take their doses, and answer common health questions. This improves medication adherence and patient engagement. Although AI offers many benefits, challenges remain. Data privacy, ethical concerns, and the need for proper training are important issues that must be addressed. Overall, AI has great potential to enhance pharmacy practice and improve healthcare outcomes worldwide.

Keywords:- Antimicrobial resistance: Pharmacy Practice, personalised medicine,, Drug discovery, Global health.

Antibiotic-resistant bacteria and their work with reference to NDM-1

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Abstract

Antibiotic resistance poses a critical global threat, reducing the effectiveness of standard treatments for many infections in humans. One of the primary reason for this is the transmit of enzymes that destroys strong antibiotics called carbapenems, which are often used as the last option to treat serious infections, mainly when other antibiotics no longer work. One of the most dangerous of these enzymes is New Delhi Metallo-β-lactamase-1 (NDM-1).

NDM-1 helps bacteria break down many β-lactam antibiotics, including carbapenems, culminating in the drug failing to deliver its intended effect. It has been found in several Gram- negative bacteria, which incorporates *Escherichia coli*, *Klebsiella pneumoniae*, and *Acinetobacter baumannii*. Plasmids which are small circular pieces of DNA, helps the bacteria adapt and spread survival advantages quickly by carrying the gene that produces NDM-1. Plasmids can not only be shared between bacteria but also between different species.This makes it possible for resistance to spread rapidly across different bacterial species and geographic regions.

NDM-1 is capable of attacking various kinds of antibiotics which makes infections by these bacteria difficult to treat. A variety of water sources like waste water and rivers may contain NDM-1 producing bacteria, highlighting that environment can help in spreading resistance.

The worldwide spread of NDM-1-carrying bacteria at such a magnitude presents a major challenge for infection control and effective treatment. Gaining a deeper understanding of how the NDM-1 works, how it spreads, and where it is found is of critical importance not only for controlling the disease better but also for developing new treatment options and reinforcing responsible use of antibiotics.

Keywords : Antibiotic resistance, Carbapenem-resistant bacteria, New Delhi Metallo-β-lactamase-1 (NDM-1), β-lactam antibiotics, Plasmids, Wastewater & rivers, Multidrug resistance

Biomaterial Framework for Traumatic Fracture Management

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Abstract

Traumatic fractures occur due to a disruption in the skeletal integrity as a result of sudden high-energy impact on the bone. Statistical evidence indicates that morbidity due to these high impact energy traumatic fractures increases by ~40% in case of femoral fractures due to several associated life-threatening sequelae such as, fat embolism syndrome massive haemorrhage, traumatic organ damage, respiratory failure (thoracic injury), the trauma triad of death (hypothermia, acidosis, coagulopathy) etc. These conditions account for most trauma-related deaths apart from the fracture itself. Rapid stabilization and damage-control resuscitation (prevention of haemorrhagic shocks)

reduce early mortality by ~35%, while haemostasis lowers the mortality to ~25%. Effective management of traumatic fractures depends on three mechanisms-1) mechanical load bearing, 2) tissue regeneration and 3) haemostasis. Meta-analysis reveals that PLA (polylactic acid), collagen and PCL (polycaprolactone) are the most widely used active biomaterials in treating fractures. Collagen mimics the native bone extracellular matrix (scaffold for osteogenic differentiation) but lacks mechanical strength and flexibility. PLA–PCL composites provide rapid mechanical stabilization and load-sharing support, leveraging the exceptional mechanical strength, biocompatibility and controlled biodegradability of PLA, and slow degradation rate, flexibility, and long-term mechanical stability exhibited by PCL. Synergistically, the integrated PLA–PCL–collagen framework initiates haemostasis and enhances bone regeneration by acting as a matrix for sustained osteogenesis and angiogenesis. Traumatic fractures remain a major cause of mortality across age groups, with outcomes largely determined by associated life-threatening injuries rather than the fracture alone, emphasizing the critical need for rapid stabilization, effective haemorrhage control, and timely biological intervention.

Keywords- bio composite scaffolds, osteogenesis, trauma care, fracture, haemorrhage

Comparison of HMGB1, B2M, TMAO, and Claudin-5 Biomarker Concentrations in Serum and Plasma: Assessment of Interchangeability

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Abstract

Introduction: HMGB1, B2M, TMAO, and Claudin-5 represent distinct inflammatory, immune, metabolic, and endothelial pathways involved in the pathology of T2DM and may be differentially affected by clot formation, anticoagulant type, and pre-analytical handling. Serum and plasma are commonly used matrices for biomarker measurement; however, matrix-specific effects and anticoagulants may influence measured concentrations and limit comparability. Because paired serum–plasma comparative studies within the same individuals remain very limited, systematic evaluation using correlation, ratio, and agreement analyses is required to establish matrix interchangeability.

Objectives: To assess the correlation between biomarker concentrations measured in serum and plasma (EDTA and fluoride); quantify serum-to-plasma concentration ratios of each analyte and to evaluate the interchangeability of serum and plasma measurements for each biomarker.

Methodology: This study used paired serum, EDTA plasma, and fluoride plasma samples collected from adult participants during a single venous blood draw at the Al Shifa Hospital, New Delhi. Samples were processed using standardized pre-analytical procedures and stored at −80 °C until analysis. Concentrations of trimethylamine-N-oxide (TMAO), high-mobility group box-1

(HMGB1), beta-2 microglobulin (B2M), and claudin-5 were measured using ELISA. Correlation between serum and plasma concentrations was assessed using Pearson correlation. Serum-to-plasma ratios were calculated for each participant. Interchangeability was evaluated using Bland–Altman analysis to estimate bias and 95% limits of agreement, along with percent difference analysis using predefined acceptability criteria.
Results: Correlation was strong for HMGB1, Claudin-5, and for TMAO but weakly negative for B2M. Serum-to-plasma ratios showed large, biomarker-specific matrix effects, with highest serum for B2M (~8.5-fold) and Claudin-5 (~4.8-fold), and lower serum levels for TMAO (<0.3-fold). Bland–Altman analysis demonstrated large positive serum bias for HMGB1 and B2M across anticoagulants. TMAO exhibited consistent negative serum bias, indicating higher plasma concentrations and anticoagulant-dependent behavior. Claudin-5 showed a smaller bias.
Conclusion: Serum and plasma measurements are not universally interchangeable highlighting the importance of matrix selection and validation in biomarker studies.

Keywords: High mobility group box-1(HMGB1), Trimethylamine N- oxide (TMAO), Beta 2 microglobulin (B2M)

CRISPR-Cas Based Precision Antimicrobials Against Multidrug Resistant Superbugs

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Abstract
Introduction: The global rise of multidrug-resistant (MDR) bacterial infections has become a major clinical and public health emergency, driving increased mortality in hospital-acquired pneumonia, bloodstream infections, complicated urinary tract infections, and chronic wound sepsis. High-priority pathogens such as methicillin-resistant Staphylococcus aureus (MRSA), carbapenem-resistant Klebsiella pneumoniae, multidrug-resistant Pseudomonas aeruginosa, and vancomycin-resistant enterococci (VRE) frequently exhibit resistance to last-line antibiotics, severely limiting therapeutic options. Conventional broad-spectrum antimicrobials also disrupt commensal microbiota and accelerate resistance selection. In this context, CRISPR-Cas systems have emerged as programmable precision antimicrobials capable of selectively targeting bacterial genomes or plasmid-borne resistance determinants. The aim of this review is to evaluate the translational potential of CRISPR-Cas–based antimicrobial strategies for combating MDR superbugs in severe clinical infections.
Methods: A structured synthesis of recent experimental and translational studies was conducted, focusing on CRISPR-Cas antimicrobial platforms, delivery modalities, bacterial target specificity, resistance gene disruption, microbiome effects, and preclinical efficacy against MDR pathogens relevant to critical care settings.

Results: Recent advances demonstrate that engineered bacteriophage vectors, conjugative plasmids, and nanoparticle-based carriers can deliver CRISPR payloads into clinically important MDR organisms. Targeting chromosomal essential genes induces lethal double-strand DNA breaks, enabling strain-specific bacterial eradication. Plasmid-directed CRISPR approaches achieve resistance gene excision and plasmid curing, restoring susceptibility to last-line agents such as carbapenems and polymyxins. Preclinical infection models report reduced pathogen burden, enhanced antibiotic responsiveness, and microbiome-sparing effects compared with conventional therapies. However, translational challenges persist, including delivery inefficiency in vivo, immune neutralization of vectors, horizontal gene transfer risks, and the emergence of CRISPR escape mutants.
Conclusion: CRISPR-Cas precision antimicrobials represent a paradigm-shifting strategy for targeted eradication and resistance reversal in MDR bacterial infections. Further optimization of delivery systems, biosafety frameworks, and clinical validation is essential for future integration into antimicrobial stewardship and next-generation infectious disease therapeutics.

Keywords: CRISPR-Cas systems; Precision antimicrobials; MRSA; Carbapenem-resistant Enterobacter ales; Antibiotic desensitization.

Demystifying Ebola

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Abstract
Ebola Virus Disease (EVD) is a highly infectious and often fatal viral haemorrhagic fever that has repeatedly posed serious challenges to global public health systems. The disease is caused by the Ebola virus, a negative-sense, single-stranded RNA virus belonging to the family Filoviridae. Since its first identification in 1976, Ebola has been associated with severe outbreaks characterised by high mortality rates, widespread fear, and significant socio-economic disruption. The perceived mystery and panic surrounding Ebola often stem from limited public understanding of its biological nature, transmission pathways, and mechanisms of disease progression.
The Ebola virus exhibits a filamentous morphology and encodes proteins that play critical roles in viral entry, replication, and immune evasion. Transmission primarily occurs through direct contact with the blood or other bodily fluids of infected individuals or contaminated materials, rather than through airborne routes, a common misconception associated with the disease. Following entry into the host, the virus targets immune cells such as macrophages and dendritic cells, leading to immune dysregulation, cytokine imbalance, vascular damage, and multi-organ failure.
Molecular biology and immunological research have greatly improved the understanding of Ebola virus replication and host–pathogen interactions. These developments have facilitated the creation of sensitive diagnostic techniques, including RT–PCR–based assays, which enable the early

detection and effective containment of outbreaks. Furthermore, the development and deployment of vaccines and experimental antiviral therapies have significantly reduced mortality and improved disease management during recent outbreaks. Public health interventions, such as contact tracing, infection control measures, and community engagement, have proven crucial in limiting the spread of the virus.
Demystifying Ebola is essential not only for reducing fear and stigma but also for strengthening global surveillance and response mechanisms, thereby improving resilience against future viral outbreaks.

Keywords - Ebola Virus Disease (EVD), viral haemorrhagic fever, Ebola virus, negative-sense single-stranded RNA virus, Filoviridae, outbreaks, high mortality rate

Detection of Hair and Scalp Diseases using Artificial Intelligence

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Abstract
Background: The frequency of hair and skin problems such as baldness, eczema, and acne significantly impacts overall health and mood worldwide. However, an often-delayed diagnosis occurs due to symptoms appearing gradually and being obscured by scalp issues. Despite advancements in evaluating various types of dermatological conditions using deep learning technology, its effectiveness for precise diagnosis on the scalp remains constrained due to insufficiently curated data sets and challenges associated with analyzing hair-covered regions.
Aim: This study creates an automatic diagnosis system utilizing a CNN algorithm tailored via the AutoKeras toolset; its aim includes assessing 25 different models designed specifically for identifying diseases affecting the scalp region.
Methods & Methodology: Dataset description: A selected collection comprising 150 photographs taken from reliable medical journals. A rigorous pre-processing workflow was established to improve data accuracy by applying techniques such as non-local means denoising. The data set was divided into 70% for training and 30% for validation. An enhanced convolutional neural network algorithm was trained using the Adam optimization technique to categorize conditions such as hair loss due to alopecia, skin disorders like psoriasis, and inflammation of the hair follicles called folliculitis.
Results & Discussion: The study's findings indicate that the designed algorithm demonstrated an accurate rate of 97% during the training phase and 92% in the validation process. The apparatus exhibited robust diagnostic prowess, especially for detecting folliculitis cases.

Conclusion: The results indicate that deep-learning-driven automatic systems have great promise in serving as efficient and precise diagnostic instruments for conditions affecting hair and skin health.

Keywords: Deep Learning, Convolutional Neural Network (CNN), Dermatological Imaging. Automated Diagnosis, AI

Development of Internal Wound Sealant

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Abstract

Statistically, 30-40% of deaths occur every year due to untreated haemorrhage (including internal and external wounds). Internal wounds are generally penetration/ perforation wounds inflicted by stab wounds, gunshot wounds, surgical interventions etc. Although numerous haemostatic agents have been developed, less research has been conducted on the haemostatic management of internal wound. Commercially available internal sealants like Coseal (PEG hydrogel) and TachoSil (collagen fibrin patch) have been widely employed clinically for leak prevention and haemostasis. However, these agents have critical limitations such as weak muco-adhesive strength, minimal mechanical strength and durability, lack of antimicrobial properties, and abnormal mucosal adhesion with neighbouring tissues. The development of internal wound sealant requires a thorough understanding of biomaterials and medical devices to be developed. A systematic meta- analysis revealed that effective internal wound sealants must integrate both physicochemical and biological properties - rapid haemostasis, resistance to microbial contamination, wet tissue adhesion and mechanical strength within a single system. Chitosan promotes rapid clot initiation through electrostatic interactions with negatively charged RBCs while providing antimicrobial activity. Collagen acts as a biomimetic scaffold, supporting cell adhesion and tissue regeneration. PEG forms mechanically stable hydrogels with tuneable swelling and low tissue adhesion. Design strategies such as tuning hydrophilicity, adding hydration layers, optimizing cross-link density for mechanical strength, and functionalizing the polymer network with reactive moieties enable strong tissue bonding, controlled degradation and biocompatibility. This hybrid approach simultaneously achieves hemostatsis, leak prevention, reduced postoperative adhesion, and creates a favourable microenvironment for tissue regeneration rather than simple physical occlusion.

Such a formulation has universal potential for internal wound management across

gastrointestinal, pulmonary, hepatic, and pancreatic tissues mitigating complications such as organ contents leakage, infection, haemorrhage, and organ damage.

Keywords: Internal wound, Hydrogel sealant, Collagen-Chitosan-PEG, Biomaterials, Antimicrobial

Efficacy and Implementation of Auto-Injectable Tranexamic Acid for Accelerated Prehospital Hemorrhage Control

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Abstract
Tranexamic Acid (TXA) belongs to the class of antifibrinolytics or simply, is a clot stabilizer which works by preventing fibrin breakdown. Despite the multiple proven mortality benefits of TXA in trauma and severe haemorrhages, there is still a significant implementation gap which persists between clinical guidelines and pre-hospital conditions. Thus, haemorrhage remains as the leading cause of preventable deaths in both civilian Mass Causality Incidents (MCIs) and combat environments. The current protocols limit the usage of TXA to Intravenous (IV) route only, which often fails due to reasons including need for a trained medic for administration, delay in establishing IV access exceeding the therapeutic window (Golden Hour), collapsing of veins in haemodynamically unstable patients and inability to provide rapid medical evacuation (MEDVAC). Recent studies proving the efficacy of delivery of the drug through Intramuscular (IM) route (IM TXA achieves nearly ~100% bioavailability, reaching the therapeutic threshold of >10 mg/L within a median of 4 to 11 minutes) has brought forward the idea of development of an Auto-Injectable TXA, ensuring that lifesaving haemostatic therapy is initiated at the point of injury rather than requiring a controlled environment.
This analysis aims to examine the shortcomings of trauma care protocols that rely heavily on IV administration and highlight how auto-injector technology can be utilized in emergency healthcare by enabling lifesaving interventions without the need for specialized clinical training. Major issues explored include accuracy and reliability of bystander administration (self-aid/buddy-aid SABA), the cost-effectiveness of prehospital haemostatic agents, and the regulatory changes needed to include an additional item- Auto-Injectable TXA into public accessible trauma kits.
Adopting auto-injector based delivery is not simply a pharmacological improvement, but a necessary systemic change needed to improve survival percentage in MCIs, combat related, transit accidents and rural settings where timely professional medical response is often limited.

Keywords: Tranexamic Acid (TXA), Auto-Injector Technology, Mass Casualty Incidents (MCIs), Intramuscular Delivery, Antifibrinolytic Therapy, Public Access Trauma Kits, Emergency Medical Systems

Emergency Use Authorization of Medical Devices Regulatory Challenges and Evidence- A Systematic Review and Meta Analysis

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Abstract
Emergency Use Authorizations (EUAs) play a pivotal role in enabling the rapid accessibility of critical medical devices during public health emergencies by streamlining regulatory pathways for diagnostic, therapeutic, preventive, and protective interventions. However, significant variability in the standards of evidence, assessment criteria, and regulatory practices among global health authorities has raised concerns regarding the safety, performance, and accountability of these devices—particularly highlighted during the COVID-19 pandemic. The present study aims to evaluate the levels of evidentiary support, regulatory standards, and policy challenges associated with EUA medical devices across major international frameworks. A systematic review was conducted comparing the expedited approval mechanisms implemented by the U.S. Food and Drug Administration (FDA), the European Union's derogation provisions, and the World Health Organization (WHO) Emergency Use Listing (EUL) procedures. Data were collected from peer-reviewed scientific literature, regulatory databases, and official government reports. The analysis revealed that while EUA frameworks ensured timely access to high-demand devices, there were marked inconsistencies in premarket evidence requirements, clinical validation protocols, and post-market performance surveillance. Meta-analytic evaluation demonstrated variability in device reliability, withdrawal frequency, and patterns of adverse event reporting. Strengthening emergency response preparedness requires enhanced international coordination, standardization of evidence thresholds, and greater transparency in regulatory decision-making. Incorporating sunset clauses, continuous re-evaluation, and adaptive regulatory science-based strategies can improve accountability. Furthermore, fostering global harmonization through interconnected data-sharing systems, regulatory training, and equitable capacity building—especially in low- and middle-income countries—will ensure a balanced approach between rapid access, scientific integrity, and sustained public trust in future global health crises.

Keywords: Emergency Use Authorization; Medical devices; World Health Organization (WHO); U.S. FDA; European Union derogation; Public health emergency; Health technology assessment; Rapid authorization mechanisms

Emerging Nano Vaccine technologies to overcome antimicrobial resistance

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Abstract

Antimicrobial resistance (AMR) has emerged as a critical global health challenge, recognized by the World Health Organization (WHO) as one of the top ten threats to public health. It results from the adaptation of bacteria, fungi, viruses, and parasites to antimicrobial agents, which enables these microorganisms to evade antimicrobial therapies and renders conventional treatments progressively ineffective. While traditional strategies aim to prevent infections or preserve antimicrobial efficacy, they rarely address the molecular mechanisms underlying resistance. Resistance-targeting nano-vaccines offer a next-generation strategy by inducing immune responses against specific resistance-associated antigens, such as β-lactamases, efflux pump proteins, and biofilm-stabilizing factors. These nanoparticle (NP)-based platforms enhance antigen stability, promote uptake by antigen-presenting cells, and facilitate robust activation of T and B cells. Moreover, their modular design conceptually enables the co-delivery of therapeutic agents, such as β-lactamase inhibitors, quorum sensing blockers, and gene-silencing systems, that could synergistically disrupt bacterial defense mechanisms. However, these integrated co-delivery strategies remain largely untested in experimental vaccine models. This review explores the therapeutic potential of resistance-targeting nano-vaccines as an innovative approach to overcome AMR, emphasizing their immunological advantages, design principles, and the key translational challenges that must be addressed for clinical advancement.

Antimicrobial resistance (AMR) represents a critical global health challenge, undermining the effectiveness of conventional antibiotics and threatening the control of infectious diseases. Traditional vaccine platforms have made impactful contributions to disease prevention; however, their limitations against rapidly evolving pathogens and drug-resistant strains necessitate innovative strategies. Nanovaccine technologies—which leverage nanoscale materials as antigen carriers and immunomodulators—have emerged as a promising solution to overcome AMR by enhancing immune responses, improving antigen stability, and enabling targeted delivery. This review summarizes recent advances in nanovaccine design, including lipid-based nanoparticles, polymeric nanocarriers, inorganic nanostructures, virus-like particles, and self-assembling protein nanoparticles. These platforms facilitate co-delivery of antigens and immune stimulants, promote mucosal and cellular immunity, and address challenges of antigen degradation and suboptimal immunogenicity.

Keywords: Nanovaccines, β-Lactamases, Drug-Resistant Pathogens, Lipid Nanoparticles, Immunomodulation, Gene Silencing

Future perspectives on biomaterials for haemorrhagic wounds

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Abstract

Death due to uncontrolled bleeding in case of traumatic wounds and battlefield injuries is still a major concern which requires advanced haemostatic device. The next generation of haemostatic biomaterials demands simultaneous bioactivity, mechanical resilience, and rapid clot induction under high-pressure bleeding. Natural polymers provide intrinsic haemostatic signaling: alginate (anionic polysaccharide) undergoes Ca^{2+}-mediated ionic crosslinking, forming hydrogels with swelling ratios of 300–800% w/w that concentrate clotting factors and establish immediate barrier function. Chitosan (85–95% deacetylated; ζ-potential ≈ +35–45 mV; pKa ~6.3–6.5) induces factor XII contact activation and electrostatically drives erythrocyte and platelet aggregation independent of fibrinogen pathways. Gelatin (collagen-derived biopolymer) enhances fibrin stabilization and cellular adhesion via hydrogen bonding and integrin-mediated interactions, promoting rapid clot consolidation. However, standalone matrices exhibit limited wet tensile strength (E <0.3 MPa), structural collapse under dynamic flow, and accelerated enzymatic degradation.

To overcome these constraints, microcrystalline cellulose (MCC; crystallinity index ~60–80%) was incorporated as a reinforcing phase. Through hydrogen bonding and interfacial entanglement, MCC enhances network density, capillary-driven absorption, and compressive modulus (>1.5–2 MPa), while increasing surface area for platelet anchorage. Alginate–MCC systems demonstrate improved gel integrity and fluid uptake kinetics; chitosan–MCC composites exhibit electrostatic–capillary synergy with significant clotting acceleration and blood loss reduction in preclinical liver injury models; ternary gelatin–chitosan–MCC constructs optimize three-dimensional platelet entrapment and bioadhesion, enhancing haemostatic efficiency by 20–40% compared to single-polymer systems.

By engineering biomaterial-specific physicochemical and biological interactions within a reinforced composite architecture, this platform advances scalable, single-use haemostatic patches tailored for trauma and battlefield deployment, while highlighting the need for optimized crosslinking control and long-term biocompatibility validation for clinical translation.

Keywords: battlefield injuries, haemostatic biomaterials, alginate hydrogels, chitosan, gelatin, microcrystalline cellulose, composite haemostatic patches, rapid clot induction, platelet aggregation, factor XII activation, wet mechanical strength

Glucagon Like Peptide-1 receptor agonists. The wonder molecules of the 21st century

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Abstract
Type 2 Diabetes Mellitus (T2DM) is a chronic and progressive metabolic disorder characterized by insulin resistance, β-cell dysfunction, and persistent hyperglycaemia, and is closely associated with obesity and heightened cardiovascular risk. Although conventional antidiabetic therapies effectively reduce blood glucose levels, they are frequently accompanied by adverse effects such as hypoglycaemia, weight gain, and declining long-term efficacy. In this evolving therapeutic landscape, glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have emerged as ground-breaking agents that address multiple pathophysiological components of T2DM while offering broader metabolic and cardiovascular benefits. This provides a comprehensive overview of the mechanisms of action, clinical efficacy, safety considerations, formulation advancements, and emerging therapeutic applications of GLP-1 RAs. A structured literature survey of peer-reviewed studies published over the past decade was conducted using databases including Google Scholar, PubMed, and ScienceDirect. GLP-1 RAs improve glycaemic control through glucose-dependent stimulation of insulin secretion, suppression of inappropriate glucagon release, delayed gastric emptying, and enhanced satiety mediated via central pathways. These mechanisms collectively contribute to significant reductions in glycated haemoglobin (HbA1c) levels, typically ranging from 0.8–1.5%, alongside clinically meaningful weight loss of approximately 5–15%. Importantly, their glucose-dependent action confers a low intrinsic risk of hypoglycaemia. Large cardiovascular outcome trials further demonstrate reductions in major adverse cardiovascular events and slowing of renal disease progression, benefits that appear partially independent of glycaemic control. Despite manageable gastrointestinal adverse effects and economic considerations, ongoing innovations including long-acting injectables, oral formulations, and dual or triple incretin agonists are expanding therapeutic potential. Overall, GLP-1 RAs represent a transformative advancement in 21st-century management of diabetes, obesity, and cardiometabolic disease.

Keywords: Type 2 Diabetes Mellitus (T2DM), hypoglycaemia, β-cell dysfunction, Glucagon-like peptide-1 receptor agonists (GLP-1 RAs)

Haemostatic Biomaterials

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Abstract
Haemostasis is a highly intricate and regulated physiochemical process that focuses on arresting bleeding due to a traumatic injury. In cases of pre-hospital traumatic injuries, ~60% of the fatalities occuring prior to hospital arrival, are due to *ex-sanguination*. Therefore, researchers throughout the world have focused on technological advancements, resulting in the development of novel haemostatic agents. These haemostatic agents are developed using certain biomaterials involving major mechanisms such as- platelet activation and clot formation (e.g.chitosan, gelatin etc.), adhesion and mechanical barriers or simulation of ECM (e.g. self-assembly peptides like RADA16-I, catechols etc.). The biomaterials are selected in such as way that they exhibit robust haemostatic efficacy in severe haemorrhagic models, and exhibit minimal immunogenic and thrombotic risks. Although a lot of research has been conducted, a lot of these biomaterials have significant drawbacks including low yields, immunogenic effects, pH sensitivity, stability. Additionally,these materials require synnergistic effects from other biomaterials to boost their activity. This highlights the significance of combinational haemostatic agents, that employ the interactions of both synthetic and natural biomaterials, which can be tuned to suit the desired properties. Moreover, there has been a significant decline in the research on novel bio-inspired materials and mechanims. Our research involves a directional focus on the identification of biomaterials, for e.g., herbal moieties from coniferous trees (with high yield rates, haemostatic properties, mechanical properties etc.) and combining them with synthetic polymers (with tunable physical properties and biocompatibility) for the developement of next-gen haemostatic agents. The developed haemostatic agent was observed to exhibit quick haemostatic activity (~80 secs), significant adhesion to wet tissues (~23 kPa), tolerance to arterial pressure (~135 mmHg), minimal toxicity and self-administrability, allowing for applicability in various pre-hospital scenarios.

Keywords: Haemostasis, traumatic haemorrhage, haemostatic biomaterials, bio-inspired materials, combinational polymers, wet tissue adhesion, rapid clotting, pre-hospital trauma care

India's Fight Against MDR-TB: Recent Advances and Challenges

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Abstract
MDR-TB is infection with M. Tuberculosis strains that are resistant to isoniazid and rifampicin, two potent 1st-line anti-TB drugs. Resistance is caused by genetic mutations (katG for INH and rpoB for RIF), showing drugs are not effective against the disease anymore . MDR-TB is the main barrier for the WHO's "End TB" Strategy & India's National Strategic Plan for TB elimination. India has the largest global TB burden – 25 % of all TB cases & 32 % of MDR/RR-TB cases. The main reasons for this challenge are spontaneous genetic mutations, long complex treatment regimens reducing adherence, & limited diagnostic infrastructure. Earlier, MDR-TB treatment involved prolonged regimens lasting 18-24 months, often including injectable treatments like kanamycin/amikacin with various oral medications. Patients had difficulty with adherence due to the longer duration, complicated dosing & severe side effects , like hearing loss/renal damage. Treatment success rates around 60%, highlighting the need for more effective & tolerable treatments. The transition to newer regimens like BPaLM has altered MDR-TB management, improving results and reducing treatment duration to 6 months. Few herbal drugs like Ashwagandha, Licorice, Neem can be used as adjunctive therapies for TB as they help boosting immunity & protect liver from antibiotic toxicity. However, they can't substitute the conventional medication, but can be used alongside. India has improved diagnostic facilities, reducing "missing cases" <100,000. Initiatives like Pradhan Mantri TB Mukt Bharat Abhiyan and the Ni-kshay Poshan Yojana support treatment success. As a result, overall TB incidence has dropped by 21% since 2015, and MDR-TB treatment success rate rose to 77%.

Keywords: MDR-TB, TB , MDR-TB Treatment

Insights into novel Immunological biomarkers in rheumatoid arthritis

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Abstract
Rheumatoid arthritis (RA) is a persistent autoimmune disease, which is accompanied by inflammation of synovium and connective tissue of joints. The underlying cause of Rheumatoid arthritis is due to the presence of autoantibodies, such as anti-citrullinated protein antibodies (ACPAs), particularly anti-cyclic citrullinated peptide (anti-CCP) antibodies, which are widely used as specific serological biomarkers in clinical practice. Other biomarkers associated with RA include anti-mutated citrullinated vimentin (anti-MCV), anti-perinuclear factor (APF) and C-reactive protein (CRP). Moreover, there are pro-inflammatory cytokines, including Tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and interleukin-17A (IL-17A), that play a significant role in contribution of inflammation and accelerating disease progression. This study

aims to evaluate and explore emerging biomarkers that can be used in early diagnosis, disease prognosis and treatment outcomes. Online databases of PubMed, Medline, Scopus, Web of Science, and Google Scholar were used to conduct the literature survey with relevant keywords including rheumatoid arthritis, immunological biomarkers, anti-CCP, autoantibodies, inflammatory cytokines, proteomics, and multi-omics. According to the findings, conventional biomarkers, such as Rheumatoid factor (RF) and Anti-Citrullinated Protein Antibodies (ACPA) have limited specificity and sensitivity, which can complicate accurate diagnosis and treatment outcomes in patients with disease heterogeneity. The use of a single biomarker remains insufficient to reflect the complex immunopathology. Thus, combining several biomarkers with molecular information from metabolomics, plasma proteomics, and clinical parameters can help in identifying unique molecular patterns in patients with ACPA-negative RA, who are frequently challenging to diagnose with conventional biomarkers. These findings indicate that there is a necessity to introduce multi-omics technology to eliminate the limitations of traditional biomarkers. Multi-omics techniques provide a more detailed and personalised method of diagnosing, monitoring, and treating rheumatoid arthritis by combining data on a molecular level, a cellular level, and a tissue level.

Keywords: Rheumatoid Arthritis, Immunological biomarkers, anti-CCP, Autoantibodies, Inflammatory cytokines, Proteomics, Multi-omics.

Mechanisms of Microbial "Escape": Adaptations and Implications

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Abstract
Microbial "escape" is the capability of microorganisms to overcome host immune responses, environmental stresses, or antimicrobial agents, thereby ensuring their survival and proliferation. Microbial Escape is a critical aspect of microbial pathogenesis, resistance, and persistence. The mechanisms underlying escape are complex and varied and include genetic mutations and horizontal gene transfer, formation of biofilms and immune modulation. These mechanisms enable microorganisms to overcome host defences and survive in hostile environments, complicating treatment efforts and leading to the development of antibiotic resistance.
One of the most successful mechanisms of microbial escape involves the genetic evolution of pathogens through mutations, which enable them to resist the action of antibiotics or medications. Additionally, horizontal gene transfer, through processes such as conjugation, transformation or transduction, facilitates the rapid spread of resistance traits across microbial populations. Biofilm formation is another mechanism of microbial escape that shields microorganisms from immune recognition and increases their resistance to antimicrobial agents.

Developing successful treatment plans requires an understanding of the molecular mechanisms underlying microbial escape. We can enhance treatment approaches and create focused interventions to fight resistant strains by concentrating on the genetic, biochemical, and environmental elements that contribute to escape. This study emphasizes how urgently new therapeutic strategies are needed to combat the growing risk of microbial escape in clinical settings.

Keywords: microbial escape, antibiotic resistance, genetic mutations, horizontal gene transfer, biofilm formation, therapeutic strategies

Microsponges for Haemostats: Advancing Porous Biomaterial Technology

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Abstract

Micro-sponges, originally developed as controlled release carriers in topical pharmaceutical systems have recently gained attention as versatile platforms for haemostatic intervention (especially in surgical and accidental scenarios). This is due to their characteristic properties such as high surface area, interconnected porosity, ability to rapidly absorb fluids and conform to wound geometry (by completely filling the wound cavity). Although there are commercially available sponge-type haemostats, their efficacy decreases drastically due to poorly controlled pore architecture, non-tunable degradation kinetics, and limited multifunctionality, resulting in reduced blood absorption capacity, minimal clot stabilization, and uncontrolled degradation (toxicological effects). Specifically engineered micro to nano porous microsponges rapidly absorb blood through capillary action and polymer swelling abilities to form a mechanical seal, surface functionalized and drug loaded microsponges actively triggers the intrinsic coagulation cascade while enabling multifunctional, antimicrobial and regenerative haemostatic performance. Precise control over the nano porous architecture is achieved by advanced fabrication statergies like 3D printed microfiber leaching, directional freeze templating, microfluidic droplet templating, two photon polymerisation, shape memory cryoregulation, electrospinning electrospray hybrids, porogen templating and multiscale 3D bio printing helps to enable hierarchal and tunable pore control across multiple length scales. Additionally, these sponges can be functionalized with positive/negative charge such as Ca^{2+} (formation of coagulation complexes) and $-PO^{4-}$ (promote the intrinsic clotting cascade by activating Factor XII). They can also be incorporated with biomaterials such as chitosan (electrostatic interactions with the negatively charged RBCs for rapid clot activation) or thrombin/fibrinogen (direct fibrin formation). These loaded microsponges are economical, eco-friendly and portable acting as advanced candidates for next-generation topical

haemostats. These multifunctional microsponges have applications as field-ready wound dressings, absorbent matrices for waste management of industry effluents etc. proving to be the future of sustainable absorbents with wide utility.

Keywords: Microsponges, topical haemostasis, intrinsic coagulation pathway, factor XII activation, pro-coagulant surfaces

Mycotoxin-Induced Oxidative Stress: Implications for Wound Healing and Immune Resilience in Combat Casualties

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Abstract
The modern medical and damage control resuscitation have achieved historic survival rates for combat casualties, a distinct subset of wounds exhibits “inexplicable inertia," characterized by progressive tissue necrosis (PTN) and susceptibility to invasive infections. The injuries that soldiers sustain while in combat have greatly benefited from newer techniques in evacuation and damage control. However, there are still many injuries that do not heal in a timely manner and present as something that has an "inertia" of dying tissue and has a high risk of advanced infections. In this paper we are proposing a "Two-Hit Hypothesis", Which states that soldiers, before being injured, become very ill due to the effects of toxins. The toxins include T-2 toxin commonly found in fungi and satratoxins in Stachybotrys, which are often located inside living quarters of service members and many dry fighting zones. These toxins induce a state of "Oxlnflammation" in the body, which continues to inhibit the function of cells and result in the weakening of the innate defences of the body. This creates a very difficult situation for the body to heal from an injury and presents the opportunity for further damage and infection. we have also observed that when these toxins are present, they are capable of working together with multidrug-resistant organisms such as Acinetobacter baumannii in order to create a larger issue with infections. Acinetobacter baumannii is able to thrive in low oxygen environments, such as within a wound that is not receiving any oxygen. Because of this, we need to re-evaluate how we treat combat injuries considering metabolic resuscitation, providing the cells of the body with the needed metabolic components to function properly, and promote healing.

Keywords: Rogressive Tissue Necrosis, Wound Healing Failure, Two-Hit Hypothesis, Mycotoxins, T-2 Toxin, Satratoxins, Stachybotrys, Oxinflammation, Immune Suppression, Multidrug-Resistant Infections, Acinetobacter Baumannii

Navigating the Regulatory Challenges: Global Oversight of AI-Enabled Hemorrhage Prediction Tools in Combat and Emergency Medicine

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Abstract

Background: In high-stakes environments like active combat zones or overcrowded emergency departments, the speed of clinical decision-making is often the difference between survival and preventable death. Emerging AI-driven Software as a Medical Device (SaMD), such as the APPRAISE-HRI system, now offers clinicians the ability to anticipate internal bleeding by detecting physiological signals long before a patient's vital signs actually collapse (1). However, as these technologies evolve from static programs into "black-box" adaptive algorithms, they push the boundaries of current regulatory frameworks in the USA, Europe, Australia, and India (2).

Objective: This study evaluates the growing tension between rapid digital innovation and patient safety. By comparing the US FDA, EU MDR, TGA (Australia), and India's Medical Device Rules (2017), the paper identifies systemic regulatory gaps that could compromise the deployment of life-saving AI in crisis medicine (3).

Case Studies and Critical Gaps:

- The Validation Crisis: Despite the surge in FDA clearances, real-world data is often missing. A review of nearly 1,000 AI devices revealed that 43% lacked published clinical validation data, while only 28% underwent prospective testing (4). For hemorrhage prediction, this means a device might miss up to 66% of critical injuries when used on a demographic different from its original training set (1, 4).
- Cyber-Physical Vulnerabilities: The human cost of regulatory lag was underscored by the Düsseldorf University Hospital ransomware event, which resulted in a patient fatality during an emergency transfer (5). This highlights a major gap in the Indian and Australian frameworks: the failure to treat cybersecurity as a dynamic clinical risk rather than a static IT issue (3, 6).
- Adversarial Risks: Recent research into "subtle perturbations" proves that altering just 0.001% of an image's pixels can deceive an AI into misdiagnosing a life-threatening hemorrhage as healthy tissue (7). Current global standards lack the "stress-testing" protocols necessary to defend against such digital manipulation (8).

Conclusion: While Western regulators are testing "Change Control Plans" (PCCP), Indian and Australian policies remain largely designed for hardware, leaving no clear pathway for "continuously learning" algorithms. This paper argues for a harmonized, risk-based "regulatory sandbox" to ensure that the next generation of trauma diagnostics is both resilient and globally compliant.

Keywords: AI Medical Devices, Hemorrhage Prediction, Combat Medicine, Regulatory Science, India MDR, SaMD.

Operational Role and Strategic Importance of CBRN Protective Gears in Emergency Response, Healthcare and Casualty Management

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Abstract

Chemical, Biological, Radiological and Nuclear (CBRN) threats are a complex global security challenge involving exposure to various chemical, biological, radiological and nuclear threats and hazards. These threats require effective preparedness strategies and advanced protective technologies to combat the situation. CBRN protective gear serves as a critical frontline defence mechanism designed to safeguard first responders and healthcare professionals during hazardous exposure scenarios by playing a critical role in minimizing exposure to hazardous agents during emergency response, military operation and public health crises.

CBRN protectives gears typically include respirators, impermeable suits, gloves, boots and integrated detection and decontamination support systems. These components are engineered to prevent the intake of toxic industrial chemicals, warfare agents, pathogenic microorganisms and radioactive particulates. Modern developments focused not only on impermeability and filtration efficiency but also on factors such as breathability, designs, thermal stress management and extended wear performance, while maintaining fundamental principles of barrier protection, filtration and contamination control. The importance of reliable protective equipment has been reinforced by the global health emergencies, industrial chemical accidents and radiological incidents, which highlights the need for preparedness and rapid response mechanisms.

Efficacy and toxicity testing of CBRN protective gear are essential to ensure effective barrier performance against hazardous agents and biocompatibility of materials to prevent adverse health effects in users. Critical parameters include chemical permeation resistance, working efficiency, breakthrough time, cytotoxicity, dermal reactivity and inhalation safety.

This work aims to provide a comprehensive overview of CBRN protective gear, including its functioning, components, operational significance and emerging technological advancements. By examining current developments and implementation challenges, this discussion highlights the importance of efficacy and toxicity of the protective gear's materials to provide effective protection during emergency situations and combat them efficiently.

Keywords: CBRN protective gears, CBRN threats, emergency situation handling, cytotoxicity and efficacy testing.

Overcoming The Translation Barriers Of Neuroprotective Agents

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Abstract
Neuronal damage, resulting in neurological disorders/diseases (central and peripheral nerve injuries) cause ~11 million deaths annually. Neuroprotective agents are pharmacological compounds designed to preserve neuronal structure or reverse the damage caused by injury or degeneration. These agents include NMDA blockers, antioxidants, neurotropic factors, etc. that target mechanisms like, excitotoxicity, neuroinflammation, and mitochondrial dysfunction, thereby preventing neuronal apoptosis. Despite promising preclinical results, neuroprotective agents suffer over 90% attrition in clinical trials primarily due to critical translational gaps, including flawed rodent models with minimal reproducibility in humans, genetic disparities, inadequate blood-brain barrier (BBB) penetration (differences in transporters such as P-glycoprotein), comparative mismatch in dosage timings, etc. On a design level, the trials lack rigorous randomization, and adequately powered, stratified cohorts. Additionally, studies hyper-focus on monotherapy targeting single pathways (e.g., amyloid) in multifactorial disorders. Further, developing countries lag due to poor infrastructure, limited resources and trial capabilities, hindering market approvals. This disparity underscores the need for global harmonisation to boost translation success. Successful translatability requires IND-enabling studies (ICH M4), promoting traceability, transparency, model alignment and streamlined stratified study with translatable endpoints. Further, research should focus on human iPSC-derived neurons, organoids, and microfluidic BBB chips for realistic pathology modelling, pharmaco-interaction studies, imaging/biomarkers (e.g. tau, amyloid) to refine dosage timings, and combination therapies (e.g., anti-amyloid + anti-inflammatory) to boost efficacy, potentially halving failure rates and accelerating approvals. In conclusion, refining preclinical strategies, embracing advanced human-centric tools, and fostering international regulatory convergence can dramatically enhance translation success, reduce attrition, and deliver effective neuroprotective therapies to patients worldwide.

Keywords: Translational barriers, mimetic modelling , neuroprotection, neurological disease, clinical trials, regulations

Perceived Palliative Care Need and Medication Accessibility Barriers: An Institutionalized Study

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Abstract

Background: Based on Amartya Sen's capability approach, Angus Deaton's research on health inequalities and preventable suffering, current study carried out to evaluate the perceived palliative care need along with the exploration of medication accessibility barriers in end-of-life patients in government hospitals situated in Ghaziabad district.

Material & Methods: The quantitative cross-sectional survey conducted in seven government hospitals of Ghaziabad district using structured questionnaire to collect demographics, knowledge, perspective and opinion of doctors and pharmacists regarding need of palliative care, opioids and medicinal cannabis use in end-of-life patients. Data was described using descriptive statistics. For opioids and medicinal cannabis, composite score of knowledge and perspective was generated; Fisher's exact test explored associations between levels of categorized knowledge and perspectives, and Pearson correlation analysed associations between continuous scores.

Results: Cancer and end-stage diseases shown to have highest need of palliative care and "capability loss". Despite significant need for palliative care, training and experience were limited to a few doctors, with pharmacists largely unexposed, suggesting a large training service gap. For opioids, knowledge and perspective scores had a weak, non-significant correlation, suggesting that increased knowledge did not lead to more favourable attitudes towards prescribing. Whereas knowledge and perspective had a moderate, statistically significant positive correlation, for medicinal cannabis indicating increased knowledge led to more favourable perspectives. The major accessibility barriers for controlled medications included concerns about addiction, regulatory and administrative issues, lack of awareness about medicinal cannabis regulations and formulations, and lack of patient-initiated discussions.

Conclusion: In keeping with Sen's focus on the deprivation of capability and Deaton's work on health inequality, our study recognizes a substantial perceived need of palliative care with a significant gap between need and healthcare professionals' readiness, particularly pharmacists. The weak alignment between opioid knowledge and perspectives, contrasted with a stronger alignment for medicinal cannabis, combined with prominent attitudinal and regulatory barriers, restrict the accessibility of controlled medication in end-of-life. To overcome this, there is a need for palliative care training, stigma- and fear-reducing opioid education, and clear government policies to provide effective relief to terminally ill patients.

Keywords: palliative care, opioids, medicinal cannabis, barriers, perspective

Pharmacological and Non- Pharmacological Preventive Approaches For The Management Of COPD

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Abstract
Objectives: This review aims to evaluate pharmacological and non-pharmacological preventive approaches in COPD management, with a focus on reducing exacerbations, improving functional capacity, and enhancing patient-centered outcomes.
Methodology: A narrative review was conducted using selected peer-reviewed articles, including the 2023 GOLD Report on inhaled pharmacological therapy and systematic reviews addressing non-pharmacological interventions such as pulmonary rehabilitation, respiratory support therapies, smoking cessation, and long-term oxygen therapy. Evidence from randomized controlled trials and meta-analyses was synthesized.
Results and Discussion: Pharmacological prevention primarily involves inhaled bronchodilators (LABA, LAMA) and inhaled corticosteroids, with triple therapy demonstrating significant reductions in exacerbations and mortality in high-risk patients [1,3] pharmacological interventions complement drug therapy by addressing functional impairment and modifiable risk factors. Pulmonary rehabilitation significantly improves exercise capacity, dyspnea, and health-related quality of life. Respiratory support therapies, particularly non-invasive positive pressure ventilation during exercise, enhance rehabilitation outcomes in severe COPD patients. Smoking cessation remains the most effective preventive strategy for slowing disease progression, while long-term oxygen therapy and care coordination programs reduce hospitalization rates.
Conclusions: An integrated preventive strategy combining optimized pharmacological therapy with evidence-based non-pharmacological interventions is essential for effective COPD management. Personalized, multidisciplinary approaches are key to reducing disease burden and improving long-term clinical outcomes.

Keywords: COPD, Prevention, Pharmacological therapy, non-pharmacological management, Pulmonary rehabilitation

Preparation And Characterization Of Chitosan-Based Hemostatic Fabrics.

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Abstract

Hemorrhage is still on top of the chart regarding preventable death from both civilian trauma and combat-related injuries, which highlights the strong need for effective and easily accessed hemostatic materials. While conventional cotton gauze is widely used, it only passively absorbs blood, not helping to actively form a clot. To address this shortcoming, this study developed and characterized a chitosan-based hemostatic fabric that combines low cost with better clinical efficacy. The fabric was made with a cotton cloth base material that has been treated with a coating of chitosan and kaolin. Chitosan is a positively charged biopolymer that comes from chitin and was selected because of its ability to promote platelet attachment and its known antimicrobial properties. Kaolin is a naturally occurring aluminosilicate mineral that was chosen because it activates the intrinsic coagulation cascade through factor XII. Chitosan was first solubilized in an acidic medium to create a uniform deposit and to enhance bonding to the cotton fibers and to evenly distribute the kaolin particles during application to the cotton fabric. The treated fabrics were then dried and stabilized before evaluation. The assessors used absorbency testing, in vitro blood coagulation assay to measure coagulation time of blood samples, as well as tensile strength testing to evaluate clot integrity, and antimicrobial testing on a broad spectrum of pathogenic microorganisms to assess the performance of the treated fabrics. Compared with untreated cotton gauze, the chemically modified fabrics showed a statistically significant increase in blood absorption, a statistically significant reduction in the time to clot formation, and an increase in mechanical stability of the formed clot. In addition, the treated samples exhibited an effective bacteria growth inhibitory effect due, at least in part, to the bioactivity of the chitosan. The statistical analysis results confirm the significance of these results. Together, these results suggest that cotton fabrics which are treated with chitosan and kaolin have potential as low-cost, biocompatible alternatives for traditional wound dressings, with potential for use in treatment of emergency trauma-related bleeding, as well as in the management of advanced wound healing.

Email: hemorrhage control, chitosan, kaolin, hemostatic dressing, rapid clotting, antimicrobial activity, trauma care, biocompatible materials

Role Of Artificial Intelligence In Dermatology

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Abstract

Background: AI's growing impact spans various sectors, including healthcare and cosmetics, through enhanced precision and tailored assistance. Within dermatology, AI has several roles, including the identification of melanoma through dermoscopic images, categorizing basal cell carcinomas, and assessing skin texture after a laser resurfacing procedure. The recent advancements in technology are impacting the skincare industry, where personalized regimens play a key role in achieving optimum results.

Aim: This study aims to explore how AI and its different models in skincare help us in giving more accurate and personalized results.

Materials and Methodology: Relevant studies across multiple databases such as PubMed, Scopus, and Google Scholar, deep learning-based skin analysis, predictive modeling, and AI-assisted dermatologic assessment were analyzed to determine how different technologies enable personalized treatment plans. Advanced technology employs image recognition for tailoring skincare regimens based on visual assessment, much as L'Oreal's acquisition of Modiface positioned them at the forefront through augmented reality and AI innovations. The "Skin Genome Project" is another pioneer in developing hyper-personalized formulations through wide-ranging data analysis. Besides customization, AI extends its role to real-time skin monitoring. A deep learning model developed by Yoon et al that accurately detects skin morphology and enhances the customization of features like wrinkles and pores. Additionally, platforms like Haut.AI apply various machine learning algorithms to scrutinize uploaded photographs and offer solutions derived from instantaneous dermatological information.

Results and discussion: These findings reveal how advancement in AI has demonstrated its capability to enhance medical diagnostics by improving therapeutic results and redirecting cosmetic treatments towards more adaptive and individualized approaches.

Conclusion: Further investigation is crucial for enhancing application effectiveness while addressing moral concerns and ensuring that AI-driven solutions remain accessible to everyone.

Keywords: artificial intelligence, skincare.

Simulation-Based Investigation of Gamma Radiation Shielding in Metal–Polymer Composites

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Abstract

The increasing use of ionizing radiation in nuclear power generation has heightened concerns about potential radiological accidents or attacks. This has led to a growing demand for effective radiation shielding solutions for first responders and military personnel. Lead shields are the most commonly used and effective material for gamma radiation attenuation. However, lead is a known toxic metal and poses significant risks to human health and the environment. Thus, the development of lead-free alternatives has become essential. Based on a thorough literature review, polymer matrices embedded with high atomic number (high-Z) metals were selected and evaluated for their effectiveness as γ-radiation shielding materials using Monte Carlo simulation techniques. A systematic Monte Carlo simulation study under controlled narrow-beam conditions was carried out using the GEANT4 toolkit to screen and assess these materials. The geometry of the source, shield, and detector was computationally defined. Mono-energetic γ beams corresponding to ^{133}Ba (356 keV) and ^{137}Cs (662.5 keV) were simulated under narrow-beam geometry using lead collimators to generate a well-collimated photon beam, with detection performed using a NaI (Tl) scintillation detector. Subsequently, γ-attenuation parameters such as the linear attenuation coefficient (μ), mass attenuation coefficient (μ/ρ), half-value layer (HVL), quarter-value layer (QVL), and tenth-value layer (TVL) were evaluated and compared with those of conventional lead shielding materials. The metal–polymer composites demonstrated effective gamma radiation attenuation. The results reveal a strong dependence of shielding effectiveness on both photon energy and metal-filler concentration. This simulation-based framework provides valuable guidance for material selection and practical insights into composition optimization in advanced shielding material development.

Keywords: Gamma-radiation attenuation; Monte Carlo simulation; Polymer-based shielding materials; Lead-free radiation shielding; Heavy-metal fillers; Attenuation coefficients; GEANT4

Synthesis of Sr^{2+}-doped calcium phosphates from avian eggshell assisted with ball milling and hydrothermal process for bone regeneration

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Abstract

Calcium phosphate (CaP) is one of the most studied biomaterials due to its excellent biocompatibility and structural similarity to natural bone. In this study, calcium phosphate was synthesized from avian eggshell, doped with strontium ions (Sr^{2+}) for enhanced bioactivity and mechanical properties, providing a sustainable and cost-effective resource for tissue regeneration applications, particularly for bone. The synthesis was assisted with ball milling and a hydrothermal combined approach, followed by calcination at (750°C-950°C) to achieve high purity and

improved homogeneity. The crystalline phase and microstructural properties of the Sr-CaP were analyzed by X-ray diffraction (XRD), showing the biphasic nature with a broad peak observed between 24° and 36° (2θ). Field-emission scanning electron (FESEM-EDS) revealed the incorporation of $Sr^{2+,}$ confirmed with X-ray photoelectron spectroscopy (XPS). ATR-FTIR spectra identified the existence of functional groups of amides, phosphate, and –OH, while the thermal behaviour for stability and decomposition of synthesized samples was evaluated by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). The cytocompatibility studies demonstrated the cell viability, emphasising the non-toxic nature of Sr-doped HAp. The findings highlight the significant sustainability of the ball-milling and hydrothermal method for synthesizing eggshell-derived Sr-doped CaP, and the influence of Sr^{2+} doping concentration on the material's physicochemical and biological properties, suggesting its potential as a promising candidate for bone regeneration applications.

Keywords: Eggshell, Calcination, Calcium phosphate, Strontium doping, Biomaterials, Bone regeneration

The Future of Nanomaterial-Enhanced Electrochemical Biosensors in Early Diagnosis of Cardiovascular Diseases

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Abstract

The cardiovascular diseases are the major cause of mortality in the world, with atherosclerotic and coronary artery diseases being the major causes. The early diagnosis of myocardial injury is highly important to avoid the negative clinical outcomes and permanent cardiac damage. Nanomaterial-based electrochemical biosensors have become widely used in recent years as an improved diagnostic system that can recognize cardiac biomarkers in extremely low concentrations in biological fluids, thus, allowing the detection of the pathological alterations at the earliest disease stages. These systems are sensitive, selective, responsive, economical, and relevant to point-of-care diagnostics. A detailed literature review on peer-reviewed articles demonstrate the presence of important innovations in nanomaterials engineering and biomolecular recognition approaches to sensitively detect various cardiac biomarkers, such as brain-type natriuretic peptide (BNP), cardiac troponin I (cTnI), cardiac troponin T (cTnT), myoglobin (Myo), creatine kinase-MB (CK-MB), N-terminal pro -bitpeptide (NT-proBNP), heart-type fatty acid- The nanostructured electrode modifications (gold nanoparticles, carbon nanotubes, derivatives of graphene, and hybrid nanocomposites) have significantly increased the efficiency of electron transfers and active surface area, which led to significantly lower detection limits relative to traditional electrodes. Such enhancements make it easier to identify biomarkers at earlier stages of pathology, prior to a marked

clinical presentation. Moreover, the combination with wearable technologies, microfluidic integration, and multiplexed detection plans reinforced their suitability in pre-hospital diagnostics and continuous cardiovascular care. All in all, electrochemical biosensors with nanomaterials have a great potential in early myocardial injuries and cardiovascular risk; though, further refinement in materials and critical clinical testing is required to ensure their use in both the context of precision and preventive cardiovascular diagnostics.

Keywords: Nanostructured electrodes, Cardiac troponins, Early diagnosis, Multiplexed detection, Microfluidic integration, Point-of-care diagnostics.

Architectural Design Paradigm for CBRN Protective Textiles

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Abstract

Chemical, Biological, Radiological, and Nuclear (CBRN) hazards cause mass destruction through toxic chemicals, infectious agents, ionizing radiation, and nuclear accidents. CBRN-protective textiles act as the first line of defence by forming a primary contact barrier that limits penetration, adsorption, and transfer of hazardous agents to the wearer. Existing solutions include activated-carbon composites, laminated barrier films, and reusable military-grade suits, regulated under EN/ISO and NFPA standards. However, these systems exhibit severe limitations such as, excessive weight, poor breathability, carbon saturation, degradation, high logistical and economic burdens. The functional efficacy of CBRN protective textiles depends on breakthrough time, permeation resistance, adsorption capacity, biological barrier efficiency, and wearability. To validate reproducibility and efficacy, compliance to standards such as ISO 11612, ISO 6530, ISO 6964, ASTM D543, ISO 10993-1, ISO 20743, ISO 9237, and ISO 13934-1 are crucial. Within this framework, a performance-oriented multi-layered CBRN-protective textile architecture can be developed. The outer layer can be designed using meta-aramid (aromatic rings, amide linkages), and PVDF polymers (densely packed polymer chains), functionalized with metal–organic frameworks, for mechanical strength, radioactivity attenuation, thermal tolerance, and liquid-splash protection. A hydrophobic liquid-resistant interlayer supplemented with Activated Carbon Fibre layer [high microporosity (>2000 m^2/g)], traps hazardous particulates and enables rapid adsorption–desorption kinetics for toxic gas and vapour filtration. The inner comfort layer comprising of viscose or lyocell fibres functionalized with silver ions or quaternary ammonium compounds provides antimicrobial activity, UV protection, and prolonged wearer comfort. The

successful integration of these composites provides enhanced multi-hazard protection, durability, and wearer comfort.

Keywords: CBRN protective textiles, multilayer barrier systems, chemical and biological protection, radiological shielding, activated carbon composites

Portable Point-of-Care Ultrasound in Emergency and Combat Medicine: Advancing Rapid Diagnostic Decision-Making

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Abstract
Rapid and reliable diagnosis is fundamental in emergency medicine and combat casualty care, where minutes often determine survival. In such high-pressure settings, the ability to identify internal injuries at the point of care can directly shape treatment decisions and outcomes. Portable Point-of-Care Ultrasound (POCUS) systems have significantly advanced this capability by providing real-time imaging at the bedside or even at the site of injury. These compact devices allow clinicians and trained medics to quickly assess life-threatening conditions, including internal bleeding, pneumothorax, pericardial tamponade, and abdominal trauma.
Unlike conventional imaging modalities that depend on fixed radiology infrastructure, portable ultrasound units are lightweight, battery-operated, and designed for field use. Their integration of high-resolution probes with simplified interfaces makes them suitable for prehospital environments, ambulances, rural healthcare centres, and battlefield scenarios. Recent technological developments, such as device miniaturization, wireless data transmission, and artificial intelligence-assisted image interpretation have improved image quality, supported clinical decision-making, and facilitated remote expert consultation when specialist access is limited.
Evidence from emergency departments and military field operations demonstrates that early ultrasound assessment shortens time to intervention and enhances triage accuracy, particularly during mass casualty incidents. By guiding procedures and enabling continuous monitoring, POCUS also supports more efficient resource utilisation in constrained settings. As healthcare systems increasingly emphasize decentralized and technology-enabled models of care, portable POCUS systems stand out as a practical and impactful innovation, strengthening diagnostic capacity across civilian emergencies, military medicine, and global health contexts.

Keywords: Trauma assessment, prehospital care, mass casualty incidents, artificial intelligence-assisted imaging, resource-limited settings, clinical decision support.

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