BHARATI VIDYAPEETH
COLLEGE OF PHARMACY PALUS, SANGLI

INNOVISION

Technical Magazine 2023-24

Visionary Insights into Tomorrow's Tech

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Principal's Desk

Dear Readers,

It is with great excitement that I introduce you to the inaugural issue of *InnoVision*, our college's very own technology magazine. This publication represents a collective effort from our students and faculty, all united by a passion for innovation and discovery.

In today's rapidly changing world, the fusion of technology and creativity has become more critical than ever. *InnoVision* serves as a platform where the bright minds of our college explore the latest trends, ideas, and breakthroughs in the world of technology. Through the pages of this magazine, we aim to inspire you with thought-provoking articles, insightful analyses, and a celebration of the cutting-edge work happening within the Pharmacy field. This magazine showcases the ingenuity and potential that thrives here. It is a testament to the dedication and talent of our students and faculty, who are shaping the future of technology both within and beyond our campus.

As you delve into the contents of *InnoVision*, I encourage you to approach each article with an open mind and a curious spirit. Let the stories and ideas within these pages empower you to pursue your own path of innovation and discovery.

Finally, I want to express my gratitude to everyone who contributed to the creation of this magazine. Your hard work and dedication have brought *InnoVision* to life, and I am confident that it will become a cherished part of our college's legacy. I hope you enjoy this journey into the world of innovation.

Dr. Ashok A. Hajare
Principal

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EDITORIAL

Hello, Readers!

It is with great excitement and pride that I present to you the inaugural issue of *InnoVision*. As editor-in-chief, I'm thrilled to embark on this journey with you, exploring the captivating world of pharmaceutical science through insightful and thought-provoking technical articles. This first issue highlights breakthroughs ranging from advanced drug delivery and personalized medicine to AI-driven research and precision diagnostics, all of which are shaping the future of the field.

Launching this magazine is a collaborative effort, and I want to thank our talented contributors and dedicated team for their hard work and passion. We welcome your feedback and ideas for future issues, so please feel free to reach out with your thoughts, suggestions, or submissions. Together, we can make *InnoVision* a dynamic and inspiring source of knowledge in the world of pharma.

Thank you for joining us on this exciting journey. We hope you enjoy reading this inaugural issue as much as we enjoyed creating it.

Dr. Sameer J. Nadaf
Editor-in-Chief

Hello, Readers!

I'm delighted to connect with you as associate editor of *InnoVision*. As you explore this magazine, I invite you to dive into the innovations shaping the world of pharma today. This issue brings together diverse perspectives on the breakthroughs, trends, and research that are pushing the boundaries of pharmaceutical science.

I'm deeply grateful to everyone who made this publication possible, from our dedicated team to our thoughtful readers like you. Please keep your feedback and ideas coming; they guide us in crafting future issues that resonate with your interests.

May this magazine inspire your passion for learning and exploring the future of pharma sector.

Mr. Akshay M. Nalawade
Associate Editor

Technical Article

ACKNOWLEDGEMENT

Team *InnoVision* Technical Magazine (2023-24) extends its deepest gratitude to Bharati Vidyapeeth College of Pharmacy, Palus, and its management for providing us with an exceptional platform to showcase and refine our skills and knowledge. This initiative has allowed us to delve into and share the vast world of pharmaceutical science.

We express our sincere thanks to our Hon'ble Secretary, **Dr. Vishwajeet Kadam**, **Dr. Shivajirao Kadam** (Chancellor, Bharati Vidyapeeth (Deemed to be University)), **Dr. Asmita Tai Jagtap** (Executive Director, Health Sciences, Bharati Vidyapeeth), **Dr. K. D. Jadhav** (Joint-Secretary, Bharati Vidyapeeth) and **Dr. H. M. Kadam** (Regional Director, Bharati Vidyapeeth, Sangli region) for their continuous support and guidance. Their collective leadership and patronage have been fundamental in creating an environment that fosters creativity and innovation, providing our team with the confidence and resources to excel.

Their vision and unwavering belief in our capabilities have played a significant role in shaping the magazine and our overall experience. The mentorship and encouragement we have received from them have been instrumental in our growth, allowing *InnoVision* to thrive and achieve its potential.

A special acknowledgment goes to our beloved Principal **Dr. Ashok Hajare** for his invaluable advice on the importance of enhancing the visibility of our work, which inspired the creation of *InnoVision*. His guidance and insight have been pivotal in shaping our approach to this annual magazine, ensuring it meets the highest standards of quality and relevance.

We are also grateful to our dedicated colleagues and students who have contributed their time, effort, and expertise to make this technical magazine a reality. Their collaboration and enthusiasm have been key to the success of this project.

Lastly, we thank all those who have supported and believed in us throughout this journey. Your trust and encouragement have fueled our passion to bring forth *InnoVision* as a valuable resource in the world of pharma. Thank you for helping us make this vision come to life.

Editors

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Technical Article

Significant Innovations in Pharmacy Technology

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Technology is only becoming more advanced and accessible. You are able to communicate with your doctor via video chat in place of making an appointment for visiting them for a checkup. Need to track your medication routine? Simple, there's an app for that. Every piece of technology used in the healthcare industry aims to enhance the patient experience overall while streamlining and customizing the procedure. Beyond technologies for patients, such as step trackers and apps, pharmacy has been making significant strides to better the field as a whole. The initial significant developments in technology were centered on automating prescription refills, reducing paperwork, monitoring medications, and creating a new type of record keeping. In order to better monitor and manage a patient's overall health and safety, pharmacies can now use technology to establish programs that fully automate a patient's prescription refill history and check into other prescriptions purchased at multiple pharmacies. There, technology didn't end. These four developments in pharmacy are varied and cross-disciplinary.

Automated Dispensing Units/Cabinet (ADCs)

Hospitals are the target market for automated dispensing cabinets (ADCs), which are computerized drug storage cabinets. Medications can be kept and administered close to the point of care with the help of ADCs, which also manage and monitor drug delivery. This reduces the possibility of human error, increases fill time, and frees up staff time to interact with patients rather than fill prescriptions.

Prescription Drug Monitoring Programs (PDMP)

Most states have either implemented or are developing prescription drug monitoring programs (PDMPs), which gather prescription data particular to each state. In most states, obtaining a prescription for a prohibited substance before consulting the PDMP database is not required, but it is strongly advised. When prescribing and utilizing controlled medications, physicians and pharmacists can use the information found in a state's PDMP to assist ensure the safety of every patient.

This makes it possible for our pharmaceutical team to confirm patient safety as well as any possible abuse or overuse danger. Since 2011, we have reported to all PDMPs on a daily basis, going above and beyond the legally mandated weekly or monthly reporting.

Medication Therapy Management (MTM)

MTM is an online medication management platform that a patient receives from a pharmacist. In order to detect and handle medication issues, the pharmacist will examine all prescription drugs given to the patient by all healthcare providers, in addition to any over-the-counter and herbal items. Medication errors, medication duplication, medication overuse, and the necessity for treatment for an untreated or improperly managed ailment are some examples of potential issues. The pharmacist can then help ensure that medications are used properly by educating, consulting, and advising the patient or their caregiver on medication-related matters.

Medication Reminder Devices

Patients can receive sensible medication reminders via a variety of devices available on the market. The technology for these includes alarms and flashing lights when the patient needs a dose, lockable reminder devices, and a patient compliance dashboard that can display your next scheduled dose. Pharmacy technological innovations benefit both the patient and the employees by enhancing the overall experience and the coordination of every stage of the prescription procedure. As the globe develops, more and more will be done to enhance patient safety and health while also greatly streamlining and automating the provider process.

Technical Article

Immersive Technologies: Transforming Pharmacy Education with Augmented Reality and Virtual Reality

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Augmented Reality (AR) and Virtual Reality (VR) are immersive technologies that transform how users interact with digital content. VR creates a fully immersive digital environment, replacing the real world with a virtual one. Users wear VR headsets to experience a 3D-generated world, navigating and interacting as if they were physically present. VR is used in gaming, education, healthcare, and training simulations, providing engaging experiences for users. AR overlays digital content onto the real world, enhancing users' perception of reality. Users experience AR through devices like smartphones or AR glasses, which superimpose digital elements onto their physical surroundings. AR is used in gaming, retail, healthcare, and education, offering interactive and visual enhancements to real-world scenarios. In pharmacy education, AR and VR offer students immersive and engaging learning opportunities, enabling them to practice skills and simulate patient interactions.

VR and AR are paving the way for a new era in pharmacy education by offering innovative and immersive methods for training future pharmacy professionals. These technologies allow students to engage with complex real-world scenarios in a controlled and interactive setting, enhancing their learning experience and preparing them for successful careers in the field.

Practical Skills Development

VR immerses students in digital environments where they can practice and master skills such as compounding, dispensing, and patient counseling. This hands-on approach helps them gain practical experience and confidence without the risk of real-world consequences. For example, students can work with virtual medications and equipment, learning through trial and error without fear of harm.

Augmented Learning

AR overlays digital content onto the real world, allowing students to visualize and interact with educational materials in new ways. For instance, AR can enhance

anatomy lessons by displaying 3D models of human organs and systems, allowing students to better understand medication effects on the body. AR can also provide visual guides for drug administration techniques and demonstrate complex processes step by step.

Simulated Scenarios

Both VR and AR offer opportunities to simulate complex scenarios, such as emergency situations or unique patient cases. Students can practice decision-making, critical thinking, and problem-solving skills in a controlled environment. These simulations help students become more adaptable and better prepared for the challenges they may face in their professional careers.

Real-Time Feedback and Assessment

Instructors can use VR and AR technologies to provide real-time feedback and assessments during training exercises. This allows for personalized guidance and targeted support, helping students understand their strengths and areas for improvement. Real-time data can also help instructors track student progress and adjust their teaching methods accordingly.

Collaboration and Remote Learning

VR and AR enable students to collaborate and learn remotely, breaking down geographical barriers. Virtual classrooms and labs allow students from different locations to participate in group exercises and discussions, fostering a sense of community and teamwork. This flexibility also promotes inclusivity and accessibility in pharmacy education.

Future Outlook

In conclusion, VR and AR present exciting new horizons in pharmacy education, offering innovative ways for students to develop their skills and knowledge. By embracing these immersive technologies, institutions can provide students with an engaging and modern learning experience that equips them for the evolving demands of the pharmacy profession.

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Technical Article

The Enlargement of Technology in The Pharmacy Profession

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The purpose of this topic is to examine the growth of technology in the pharmacy profession, exploring strategic visions for the development of technical requirements and how these technological advances support patient care services. By focusing on the ways in which human performance can be enhanced technologically, this study aims to highlight how technology is transforming the pharmacy profession.

Technology is streamlining workflows, reducing the time spent on manual processes, and enabling pharmacists to access and update patients' records flawlessly. This allows pharmacists to spend more time on patient counseling and medication therapy management, utilizing technology to identify patterns and predict patients' needs more effectively.

The global pharmaceutical packaging market is projected to expand at a compound annual growth rate of 97%. This includes the rise of intelligent packaging technology, which represents a significant shift in how food products are monitored and managed throughout the supply chain. Embedded sensors in intelligent packaging help measure and transmit data on various parameters such as temperature, humidity, and freshness.

The manufacturing industry has seen advancements in technologies such as 3D printing, IoT, and robotics, which improve production facilities and offer a competitive edge. Implementing digital capabilities across the value chain can help protect long-term profitability and improve efficiency.

Overall, technology has undoubtedly transformed the field of pharmacy, improving patient care and safety, streamlining workflows, and expanding the role of the pharmacist. By leveraging advanced manufacturing technologies such as robotics, automation, and artificial intelligence, pharmacies can continue to evolve and provide enhanced services to their patients.

Technical Article

Revolutionizing Diagnostics: The Impact of Artificial Intelligence Technology on Healthcare

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Artificial Intelligence (AI) has revolutionized many industries, from transportation to finance. However, the healthcare industry is one where it is making notable advancements, especially in the area of diagnostics. AI-powered diagnostics may alter the way illnesses are identified and avoided, improving both individual and societal health outcomes.

- **Medical Imaging Analysis:** AI algorithms can analyze medical images such as X-rays, MRIs, CT scans, and mammograms to assist radiologists in detecting abnormalities. AI can help identify patterns and anomalies that may be difficult for the human eye to detect, improving accuracy and efficiency in diagnosis.
- **Pathology:** Pathology is a field that studies the histomorphological study of human tissue specimens, and it is crucial to the diagnostic process. For instance, previous histological confirmation of the diagnosis is necessary for the guideline-adherent care of many oncological disorders, and the number of medications needing molecular pathological identification of predictive biomarkers before to their administration is continuously rising. Genomic Analysis: AI algorithms can analyze genetic data to identify mutations or genetic markers associated with various diseases. This can help in predicting disease risk, selecting appropriate treatments, and developing personalized medicine approaches. Pathologists generate, evaluate, and integrate enormous amounts of data from several sources in their everyday work, including significant clinical data, image data from immunohistochemical and histological stainings, and molecular pathology data from sequence studies. Over the past 20 years, entire slide scanning has advanced quickly making it possible to digitally capture adequate amounts and quality of previously analog microscopic picture data. But digital transformation in pathology is still relatively new, whereas other imaging specialties have been using mostly computer-based workflows for years. Using machine learning and artificial

intelligence (AI) might be one of the most promising advancements in this regard (ML).

- **Diagnostic Decision Support Systems:** Diagnostic decisions are made based on experience and hypothetico-deductive reasoning. A doctor has two options when faced with diagnostic uncertainty: treat the patient or obtain further evidence (tests). With every new diagnostic test, the physician modifies the likelihood of the disease in doubt, according to Bayesian theory. The repercussions of an incorrect diagnosis determine the desired degree of confidence in major part. Diagnostic testing is often required until a treatment (or no test) threshold probability, or the threshold of adequate evidence, is reached. AI-powered diagnostic decision support systems can analyze patient data, including symptoms, medical history, and test results, to generate differential diagnoses and suggest appropriate tests or treatments for healthcare providers to consider.
- **Remote Monitoring:** Artificial intelligence (AI) is becoming more and more common in the healthcare industry. One of the popular healthcare apps, remote patient monitoring (RPM), helps physicians keep an eye on hospitalized patients, elderly individuals receiving in-home care, and patients with acute or chronic illnesses when they are in remote areas. The efficiency of staff time management, which is influenced by their workload, is critical to the dependability of manual patient monitoring systems. Invasive methods that require skin contact are used in conventional patient monitoring to track health status. This paper attempts to do a thorough analysis of RPM systems, including adopted cutting-edge technologies, the effect of AI on RPM, as well as issues and developments in AI-enabled RPM. This research examines the advantages and difficulties of implementing cloud, fog, and wearable sensor-enabled patient-centric RPM systems using Internet of Things wearables. AI-powered wearable devices and mobile apps can continuously monitor patients' vital signs, activity levels, and other health metrics. AI algorithms can analyze this data in real-time to detect any deviations from normal patterns, allowing for early intervention and improved disease management.
- **Natural Language Processing (NLP):** AI-driven NLP systems can analyze unstructured medical data such as clinical notes, research papers, and patient records to extract relevant information and insights. This can assist healthcare

providers in staying updated with the latest research findings and clinical guidelines, leading to better-informed diagnoses and treatment decisions.

- **Drug Discovery and Development:** AI algorithms can analyze large datasets to identify potential drug candidates, predict their efficacy and safety profiles, and optimize drug design. This can accelerate the drug discovery and development process, leading to the discovery of new treatments for various diseases.

Overall, AI has the potential to revolutionize disease diagnosis by improving accuracy, efficiency, and personalized treatment approaches, ultimately leading to better patient outcomes. However, it's important to ensure that AI systems are rigorously validated, ethically deployed, and integrated into clinical workflows in a responsible manner.

Technical Article

Molecular Docking: A Powerful Tool for Structure-Based Drug Discovery

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Molecular docking is a computational technique used in the field of structural biology and drug discovery. It predicts the preferred orientation and binding mode of a small molecule (ligand) within the active site or binding pocket of a larger biomolecule, typically a protein (receptor) to form a stable complex. The aim is to identify and characterize the most energetically favourable interaction between the ligand and the receptor, providing insights into molecular recognition and aiding in the design of novel therapeutics.

Here are the typical steps involved in molecular docking:

1. **Preparation of Protein and Ligand Structures:** This step involves retrieving the three-dimensional structures of the protein target and the small molecule ligand(s) from databases or generating those using computational modeling techniques. These structures need to be prepared by removing water molecules, adding hydrogen atoms, and optimizing the geometry.

2. Protein Grid Generation: A three-dimensional grid is generated around the protein binding site to define the search space for ligand docking. This grid defines the spatial and energetic constraints within which ligands are docked.

3. Ligand Conformational Sampling: Various conformations of the ligand are generated to explore its flexibility and potential binding modes. Techniques such as molecular dynamics simulations or systematic conformational search algorithms may be employed.

4. Docking Algorithm Application: Using an appropriate docking algorithm (e.g., rigid docking, flexible docking, induced-fit docking), the ligand is systematically positioned and oriented within the protein binding site to predict the most favourable binding pose(s) based on scoring functions.

5. Scoring and Ranking: Docking poses are evaluated and scored based on various factors such as shape complementarity, electrostatic interactions, van der

Waals forces, hydrogen bonding, and desolvation energies. These scores help rank the poses and identify the most likely binding mode.

6. Analysis and Visualization: The docking results are analyzed to understand the protein-ligand interactions, including hydrogen bonds, hydrophobic interactions, and other key interactions contributing to binding affinity and specificity. Visualization tools are often used to inspect the docked complexes and identify potential leads for further experimental validation or optimization.

7. Validation and Refinement: Docking results are validated against experimental data if available. Additionally, refinement techniques such as molecular dynamics simulations or energy minimization may be employed to further optimize the predicted binding poses and improve accuracy.

8. Lead Optimization and Drug Design: Promising lead compounds identified through molecular docking are subjected to further optimization through medicinal chemistry approaches to enhance their potency, selectivity, and pharmacokinetic properties, leading to the development of potential drug candidates.

There are several molecular docking software tools available, each with their own strengths, features, and user interfaces. Here are some notable ones:

1. Auto Dock Vina: Widely used for its efficiency and accuracy, Auto Dock Vina employs Sequential local search and flexible ligand docking to predict binding modes. Supporting various file formats, it offers a user-friendly interface, simplifying the docking process.

2. DOCK: Developed by the Kuntz group at UC San Francisco, DOCK offers rigid-body and flexible ligand docking protocols. Highly customizable with additional scoring functions. It is ideal tool for virtual screening and drug design projects.

3. AutoDock Tools (ADT): It provides a graphical interface for Auto Dock and Auto Dock Vina. ADT simplifies setup and analysis, especially for users unfamiliar with command-line interfaces.

4. Schrodinger Suite (Glide): Glide in the Schrodinger Suite is renowned for its speed and accuracy. Using a grid-based approach and various scoring functions, it facilitates high-throughput virtual screening in pharmaceutical research.

5. Fast Rigid Exhaustive Docking (FRED): FRED by Open Eye Scientific Software uses a systematic search algorithm for exhaustive exploration of ligand conformations. Designed for high-throughput docking in drug discovery projects. It implements conformational flexibility of the ligand by creating an ensemble of ligand conformers that are then rigidly docked into the binding site

6. Swiss Dock: Swiss Dock is an online service by the Swiss Institute of Bioinformatics, offers a user-friendly web interface for docking small molecules to proteins, catering to users who prefer web-based tools.

These are just a few examples of molecular docking software tools available. The choice of software depends on factors such as the specific research requirements, computational resources available and user preferences.

Technical Article

Artificial Intelligence in healthcare sector

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Now a day's most of the surgery is based on AI artificial intelligence. The healthcare sector is one of them that AI is going to play a main role to improve the treatment process more independently and with better results in terms of disease diagnosis and medical care assistance. The increasing availability of healthcare data and rapid development of big data analytic methods has made possible the recent successful applications of AI in healthcare.AI is also used in fitness tracking devices that monitor heart rates, sleeping patterns and walking activities, helping users to generate alerts and exercise accordingly. In future AI can do all major operations.

Applications of AI in Healthcare

1. Disease identification/ diagnosis.
2. Personalized treatment/Behavioral modification
3. Drug discovery/ Manufacturing
4. Robotic surgery
5. Clinical trial research
6. Doing repetitive job
7. Treatment design

Role of AI in Healthcare

1. Radiology
2. Screening
3. Dermatology
4. Drug interaction
5. Electronic health records
6. Primary care

1. Disease Identification/ Diagnosis

In this computer algorithm to detect disease easily based upon the symptoms to be answering on the chat bots but they must be developed and applied with care.

An AI computer algorithm using high quality data proved more consistent and accurate.

2. Personalized Treatment/ Behavioral Modification

Personalized medicines are more effective treatment based on individual health data paired with predictive analytics. Micro biosensors “and devices with more sophisticated health measurement and remote monitoring capabilities will provide another deluge of data that can be used to help facilitate R&D and treatment efficacy.

3. Drug Discovery/ Manufacturing

The applications of AI in healthcare are numerous with the potential to transform key aspects of the Industry such as drug discovery. The success of AI and drug discovery is largely due to deep learning. Many of the pharmaceutical companies have only relatively recent made serious efforts to apply AI to drug discovery. Abbvie is using AI in drug discovery. "IBMs" own health applications have had initiatives in drug discovery since its early days.

4. Robotic Surgery

The da Vinci robot has gotten the bulk of attention in the robotics surgery space. While robotic surgery is considered generally safe. In future we will put entire life in robots freely.

5. Clinical Trial Research

AI in helping shape and direct clinical trial research.AI can also use for remote monitoring and real time data access for increased safety. For example, monitoring biological and other signals for sign of harm or death to participants.

6. Treatment Design

- ✓ AI systems have been created to analyze data, notes and reports from a patient file, external research and clinical expertise to help select the correct individually customized treatment path.
- ✓ To assign the patients to the doctors based on the diseases and availability of the doctor.
- ✓ It can maintain all the records of the patients and conditions.

Conclusion

“In the health care sector, Artificial Intelligence helps to decrease medication cost with a more accurate diagnosis, better prediction and treatment of diseases." The researchers are also working on an AI project that can be a boon for humus in the upcoming years. The brain- computer interface can help patients who are physically disabled or suffering spinal cord injury as well. Hence, the healthcare industry fully ripe for some major changes. From chronic disease and cancer to radiology and risk assessment, it can be deployed with new AI- based technologies with more precise, efficient and cost- efficient inventions. The health care industry treated as a complicated science bound by legal, ethical, economic and social constraints and can be implemented with AI by making parallel changes in the environment.

Technical Article

Sustainability in Pharmacy: Reducing Waste with Tech Solutions

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Sustainability in pharmacy practice has become increasingly important as the industry faces challenges such as medication waste and environmental impact. Technology offers innovative solutions to minimize waste and enhance sustainability within pharmacies. By leveraging technology, pharmacies can streamline processes, improve efficiency, and contribute to a healthier planet.

Reducing Medication Waste

One-way technology reduces medication waste is through efficient inventory management. Real-time tracking software allows pharmacies to maintain optimal stock levels, preventing overstocking and the risk of medication expiration. Advanced analytics and forecasting guide purchasing decisions, aligning inventory with actual demand and minimizing waste. Automated dispensing systems further enhance dispensing accuracy, using robotics and artificial intelligence to precisely measure and dispense medications. E-prescribing also improves dispensing precision and reduces the potential for waste by minimizing transcription errors.

Recycling and Disposal

In addition to medication waste, technology aids in safe disposal and recycling practices. Tech-based take-back programs and kiosks provide patients with convenient options for disposing of unused or expired medications safely. Pharmacies can also use technology to educate patients about proper disposal practices, helping to prevent environmental pollution. Moreover, technology supports recycling initiatives by providing information on proper recycling procedures for medication packaging. Encouraging the use of biodegradable or recyclable materials for medication containers further contributes to reduced waste.

Digital Transformation

Digital transformation in pharmacy practice has a significant impact on sustainability. Telepharmacy reduces the need for physical visits, minimizing carbon

emissions associated with transportation. Remote counseling and patient education through telepharmacy can also improve adherence and reduce medication waste. Additionally, e-prescriptions eliminate paper use, enhance efficiency, and lower waste by enabling precise and accurate dispensing. Digital patient records streamline processes and reduce the need for physical storage, further contributing to sustainability.

Green Pharmacy Initiatives

Green pharmacy initiatives, such as adopting renewable energy sources like solar or wind power, can help pharmacies reduce their carbon footprint. Investing in energy-efficient appliances and lighting also decreases energy consumption, promoting sustainable operations. Smart energy management systems can optimize energy use and identify areas for improvement.

Sustainable Practices in Pharmacy Operations

Pharmacies can incorporate sustainable practices in various aspects of their operations. For instance, optimizing the supply chain through technology can reduce emissions and waste associated with transportation and packaging. Additionally, pharmacies can adopt digital platforms for order processing and delivery, reducing the need for physical paperwork and conserving resources.

Pharmacies can also engage with suppliers who prioritize eco-friendly practices and sustainable sourcing, contributing to a more holistic approach to sustainability. By choosing environmentally responsible partners, pharmacies can support a larger network of sustainability in the healthcare industry.

Furthermore, investing in continuous training for staff on sustainability practices can foster a culture of eco-consciousness within the pharmacy. Educating employees on waste reduction, energy conservation, and environmentally friendly practices can lead to more sustainable operations.

In conclusion, embracing technology in pharmacy practice is essential for achieving sustainability. By implementing tech solutions in various aspects of operations, pharmacies can reduce waste, improve efficiency, and contribute to environmental conservation. Pharmacies should assess their current practices and explore opportunities to adopt sustainable technologies for an eco-friendly future.

Additionally, engaging patients and the community in these initiatives can help raise awareness and foster a culture of sustainability in pharmacy practice.

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Technical Article

3D Printing Technology in Pharma: Navigating Customized Compounding

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Computer-aided designs and printing parameters are used in three-dimensional (3D) printing technology, a technique for developing pharmaceutical formulations and drugs that adds flexibility to the drugs which are printed later. Meanwhile, the method of combining, mixing, or modifying materials to make drugs in response to particular patient circumstances requiring for certain dosage forms, drug strengths, or excipients is known as classical pharmaceutical compounding. The present formulation and medicine creation procedures, which provide limited customization options, will be greatly enhanced by the integration of 3D printing technology into pharmaceutical compounding. In our effort to challenge the "one size fits all" paradigm that now governs medicine, 3D printing technology has enormous promise to transform the customized medicine field. Personalized medicine's primary objective is to customize drugs to each patient's unique needs while accounting for variations in genetic profiles, age, race, gender, epigenetics, and environmental variables. We believe that enhancing patient care and moving forward will depend on the prompt incorporation of 3D printing technology into pharmacy operations.

Benefits of 3D Printing Technology in Pharmacy Practice

1. Personalized precision medications, which allow for customization of dosage, shape, taste, and release profile, may be produced with the use of 3D printing technology.
2. The ability to customize medicine contents and release profiles for individual patients is enhanced by the use of 3D printing in compounding.
3. Pharmacies can save money and minimize the number of pharmaceutical ingredients required for on-demand medication printing by using 3D printing technology, which also makes medications safer for patients in specific population groups.
4. It is feasible to consistently achieve good accuracy, precision, and medication consistency across dosage forms with 3D printing technology.

Challenges of 3D Printing

1. Concerns about contamination arise when edible goods are 3D printed. Every 3D drug printer that comes into touch with edible printed goods or their ingredients needs to be readily cleaned.
2. Reusing medication formulation components from one task to another in 3D printing raises additional issues about contamination due to the possibility of exposure to ink or processing conditions from prior uses.
3. Printer components can also be a source of contamination. For instance, medical applications require stainless steel nozzles, which are now common on FDM printers but contain lead by default.
4. In many research with thermoplastic polymer demanding printers, like FDM, nonpharmaceutical grade polymers are employed since most polymers used in regular pharmaceutical compounding do not print effectively.
5. In order to comply with USP 795, it is necessary to determine the training requirements for pharmacists and technicians who will use 3D printers or provide patient advice on pharmaceuticals created by 3D printers.
6. The size as well as drug concentration of the intended printed drug items are directly impacted by the quality of the 3D printer that is selected. The tolerance ranges between different printer machines can affect the precision with which a pharmaceutical product is printed.

Reference

Melnyk LA, Oyewumi MO. Integration of 3D printing technology in pharmaceutical compounding: Progress, prospects, and challenges. Annals of 3D Printed Medicine. 2021; 4:100035.

Technical Article

Artificial Intelligence in Pharmacy Profession

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Artificial intelligence (AI) has immense potential to revolutionize pharmacy operations by simplifying procedures, improving efficiency, and expediting pharmaceutical research. Nevertheless, obstacles such as steep expenses, absence of faith in AI, worries about unemployment, threats to privacy, and the incapacity to substitute human decision-making have impeded acceptance. This text discusses the future of AI in the field of pharmacy, obstacles that are preventing its usage, and methods to make its integration easier.

The expansion of large data in healthcare offers chances for AI to obtain understanding, but examining and implementing information still presents difficulties. Significant obstacles such as costly implementation, safety concerns, restrictions on data exchange by regulations, and absence of interpersonal interaction need to be resolved.

Methods to facilitate acceptance involve upgrading medical instruction to center around AI, involving interested parties, allocating resources for research and development, creating safeguarded machine learning methods, and carefully incorporating AI to enhance, rather than replace, pharmacy personnel. Although additional effort is required to establish confidence in AI and address genuine worries, specific actions can tap into AI's capacity to enhance effectiveness, lower expenses, expedite drug exploration, and improve healthcare for patients.

Responsible and moral adoption requires tackling obstacles through cooperation among interested parties and gradual incorporation centered on enhancing human workforce, rather than substituting them.

Technical Article

The Future of Personalized Medicine: Challenges and Opportunities

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Precision, or personalized, medicine is a fast expanding profession that modifies medical care to a patient's specific genetic composition and other unique characteristics. Through bettering patient outcomes, lowering expenses, and expanding our knowledge of the basic root causes of disease, this strategy has the opportunity to completely transform the healthcare industry. Personalized medicine is becoming more generally accepted and accessible due to advances in technology and the growing availability of genomic data. The advantages, difficulties, and prospects of customized medicine will all be discussed in this article, along with how it might affect healthcare in the future.

The Advantages of Customized Healthcare

1. Improved patient satisfaction and outcomes.
2. Cheaper medical expenses and better treatment.
3. Enhanced medication efficacy and safety.
4. A greater awareness of environmental and genetic variables.
5. Challenges to Customize Treatment.
6. Concerns about data management and privacy.
7. Problems with accessibility and cost.
8. Regulatory obstacles and a lack of uniformity.
9. Restricted access to test results and data exchange.

Opportunities for Advancement

1) Development of new tools and technology for data analysis and management

There remain great prospects for customized medicine development in spite of these obstacles. The ongoing development of new technology and tools for data management and analysis facilitates the easier and more efficient collection, storing, and processing of huge amounts of data.

2) Enhanced cooperation between medical professionals and researchers

Personalized medicine can advance through increased collaboration between researchers and healthcare practitioners. They can develop novel therapies and diagnostics and make sure patients can access and benefit from them by collaborating. The underlying environmental and genetic variables that contribute to disease may also be better understood as a result of this collaboration.

3) Improvements in genetic sequencing and testing

Personalized medicine is progressing due in part to technological advancements in sequencing and genetic testing. With the increasing affordability and accessibility of these technologies, more people will be able to take advantage of personalized medicine's benefits. Additionally, researchers and healthcare professionals will be able to recognize patterns and associations that were previously hard or impossible to find due to the development of new tools for the study and interpretation of genomic data.

4) Integration of machine learning and artificial intelligence

Another interesting prospect for customized medicine is the combination of machine learning (ML) and artificial intelligence (AI). It would be challenging or impossible for people to find patterns and links in huge datasets, but these tools can assist academics and healthcare professionals to do so. In addition, by taking into account each patient's particular traits; they can assist medical professionals in developing more effective treatment programs and more accurate diagnoses.

The Future of Personalized Medicine

As long as technology continues to progress and personalized medicine techniques become more widely used and standardized, the field has a bright future. In the future, healthcare professionals and researchers will be able to evaluate and understand massive databases of genomic and clinical data more precisely and efficiently due to the integration of AI and ML, which is expected to play a big role. Future difficulties, such as ethical issues and legislative changes, could also provide difficulties. As the use of personalized medicine spreads, worries around data ownership and privacy as well as the possibility of prejudice based on genetic data may arise.

Technical Article

Robotics in Pharmacy

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Robotics is the branch of technology that deals with the design, construction, operation, and application of robots as well as computer systems for their control sensory feedback and information processing. Robots in laboratory, Life Science and Pharmaceutical applications perform task at rates beyond human capability. These robots function in potentially hazardous settings in proximity to biological danger the threat of radioactive contamination and toxic chemotherapy compounds.

Robotic Pharmacies

Due to potential hazards and high volumes some hospitals and larger Health care clinics utilize Robotics to dispense medication. Robotic pharmacies are expanding rapidly within the hospitals and clinics. Several companies are servicing that market and interest level will only increase on the retail level. Robotic in local pharmacies will be a challenge. The technology is available but regulation will pace the growth of robotic pharmacies more than the technology.

As the UCSF Medical Centre in California such a system in already in place and it is working wonders in terms of increasing efficiencies all around. Possibly the greatest benefit is the elimination of wrong dosage, wrong medication and other errors largely contingent on human mistakes. Hospital pharmacies used to be centralized, but the model is increasingly opening up. Larger hospitals have hundreds of beds and numerous division's and all the complexity basically means it can be difficult to keep track of medications flow from pharmacy to patient.

Advantages of Industrial Robots

Design Benefit: slim, quick and flexible robots are well suited for the pick and place assembly work in a Pharmaceutical environment. Vision Technology allows industrial robots to put together customised order and does things like assemble blood sugar kits.

Safety Advantage: Robots protect the integrity of Pharmaceutical products and the health of employees and patients. With industrial robots toxic chemicals can be

mixed a safely. These particular robot models are designed to work in clean room settings. Sealed arm construction and decontamination with hydrogen peroxide vapour (HPV) keep these models from ever contaminating product.

Increase Efficiency: Robotics can increase efficiency which means the price of the drug itself will become more competitive. When it comes to Pharmaceutical production, people are not as efficient as robots, especially when they are wearing a protective suit. People in protective suits also require more room to work in.

Tiredlessness: A robot can perform on 96 man- hour project in 10 hours with more consistency and higher quality results.

Accuracy: Robotic systems are more accurate and consistent than their human counterparts.

Reliability: Robots can work 24 hours a day, 7 days a week without stopping or tiring.

Affordability: with the advancement in technology and affordable Robotics becoming available at less cost, more pick and place robotic cells are being installed for automation applications.

Quality: Robots have the capacity to dramatically improve product quality. Applications are performed with precision and high repeatability every time. This level of consistency can be hard to achieve any other way.

Production: with robot's throughput speed increase, which directly impacts production, because robots have the ability to work at a constant speed without pausing for breaks, sleep, vacations they have the potential to produce more than human worker.

Safety: Robots increase workplace safety. Workers are moved to supervisory roles, so they no longer have to perform dangerous applications in hazardous settings.

Speed: Robots work efficiently without wasting movement or time. Without brakes or hesitation; robots are able to alter productivity by increasing throughout.

Disadvantages of Industrial Robots

Dangers and fears: Although current robots are not believed to have developed to the stage where they pose any treat or danger to society, fears and concerns about robots have been repeatedly expressed in a wide range of books and films. The

principle theme is the robots Intelligence and ability to act could exceed that of humans, that they could develop a conscience and motivation to take over or destroy the human race.

Expense: The initial investment of robots is significant especially when business owners are limiting their purchases to new robotic equipment the cost of automation should be calculated in light of a business greater financial budget. Regular maintenance needs can have a financial tall as well.

Return on investment (ROI): Incorporating industrial robots doesn't guarantee results. Without planning companies can have difficulty achieving their goals.

Expertise: Employees will require training in programming and interacting with the new robotic equipment this normally take time and financial output.

Safety: Robots may protect workers from some hazards, but in the meantime their very presence can create other safety problems. These new danger must be taken into consideration.

Technical Article

The Need for AI and Robotics in Transformed Health Ecosystems

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"Artificial intelligence (AI) is the term used to describe the use of computers and technology to simulate intelligent behavior and critical thinking comparable to a human being". Machine learning enables AI applications to automatically (i.e., without being explicitly programmed for) improving their algorithms through experiences gained by cognitive inputs or by the use of data. AI solutions provide data and knowledge to be used by humans or other technologies. The possibility of machines behaving in such a way was originally raised by Alan Turing and further explored starting in the 1950s.

Medical expert systems such as MYCIN, designed in the 1970s for medical consultations, were internationally recognized a revolution supporting the development of AI in medicine. However, the clinical acceptance was not very high. Similar disappointments across multiple domains led to the so-called "AI winter," in part because rule-based systems do not allow the discovery of unknown relationships and in part because of the limitations in computing power at the time. Since then, computational power has increased enormously.

Over the centuries, we have improved our knowledge about structure and function of the human body, starting with the organs, tissues, cells sub-cell components etc. Meanwhile, we could advance it up to the molecular and sub-molecular level, including protein coding genes, DNA sequences, non-coding RNA etc. and their effects and behavior in the human body.

This has resulted in a continuously improving understanding of the biology of diseases and disease progressions. Nowadays, biomedical research and clinical practice are struggling with the size and complexity of the data produced by sequencing technologies, and how to derive from it new diagnoses and treatments. Experiment results, often hidden in clinical data warehouses, must be aggregated, analyzed, and exploited to derive our new, detailed and data-driven knowledge of diseases and enable better decision making.

New tools based on AI have been developed to predict disease recurrence and progression or response to treatment; and robotics, often categorized as a branch of AI, plays an increasing role in patient care. In a medical context, AI means for example imitating the decision-making processes of health professionals. In contrast to AI that generates data; robotics provides touchable outcomes or realizes physical tasks. AI and robotics use knowledge and patient data for various tasks such as: diagnosis; planning of surgeries; monitoring of patient physical and mental wellness; basic physical interventions to improve patient independence during physical or mental deterioration.

Technical Article

Pharmacy in the Digital Age: Transformative Impact of Technology on the Profession

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Rapid technological advancements have reshaped various aspects of our world, prompting discussions on the value of human connection, particularly in patient care within the field of pharmacy. It's interesting to note that a lot of technical advancements in pharmacy preserve and even improve the pharmacist's human connection with patients, which cultivates compassion and is essential for good health results. The ability of pharmacists to directly care for patients has greatly increased as a result of these developments.

AI and Automation

Artificial intelligence (AI) is a valuable tool for healthcare professionals as it can effectively manage repetitive chores that are essential for providing quality patient care. For instance, a large healthcare institution uses AI-generated lists to find patients who don't follow through when getting prescription refills. It would be impractical to manually manage the system because it has thousands of patients. Artificial intelligence (AI) streamlines the procedure by automating the delivery of text or email reminders and the updating of electronic medical records. This increases patient medication compliance and frees up pharmacists to handle other tasks. Retail pharmacy will gain a great deal from the increasing use of automation. Many procedures can now be automated, including non-clinical tasks that professional pharmacists shouldn't have to perform themselves. But applying experience clinical knowledge based on evidence, and tact while interacting with patients is what really makes a pharmacist's job so important. To ensure that patients are using their medications correctly, this involves obtaining information, recommending medications, and providing compassionate counseling to the patients. Technology in pharmacies simplifies processes so that pharmacists can spend more time interacting with patients.

New Medical Device Technology

The underserved areas known as health care deserts, where access to quality care is severely constrained by socioeconomic and other circumstances and the limited availability of high-quality care are among the more urgent concerns facing the health care profession today. Devices that use virtual reality (VR) and augmented reality (AR) can bring medical professionals to patients wherever they are. Patients can use these gadgets to send them to pharmacists, who can use them to see sores, rashes, or wounds. The gadget can identify whether an infection is present, allowing patients to obtain treatment from the comfort of their own home. It also shows the injury, eliminating the need for the patient to make an effort to precisely explain it.

Education, Research and Development

New developments in software have enormous possibilities for pharmaceutical research and education. As remote learning grows more extensive and dynamic, AR and VR technologies are becoming more and more beneficial in the classroom. One example of how this has improved accessibility and involvement for students is that professors can now teach pharmaceutical compounding labs remotely. Virtual 3D models for building molecules and proteins have replaced conventional techniques in molecular modeling, thanks to programs like Nanome. This program is really helpful to me as an academic because it can mimic therapeutic treatment. When explaining, for example, how beta blockers work, Students will be able to observe how atenolol blocks beta-adrenergic receptors by watching me demonstrate how the medicine interacts with these receptors. Beyond the classroom, research and development can gain a great deal from such software, which opens up new avenues for the development of medications.

Growing Pains

Maintaining secure cyber-security systems to protect patients' private health information (PHI) is critical as technology continues to revolutionize the pharmaceutical sector. With the high stakes associated with patient privacy, safeguarding PHI from unscrupulous parties becomes essential with the growing usage of cloud-based data storage.

Research/ Review Articles Published in Indexed Journal
Academic Year 2023-24

Sr. No.	Name of Authors	Title	Journal	Year; Volume (Issue): Page Number	Impact Factor
1.	Rutuja Chougale, Kiran Patil, John Disouza, **Ashok Hajare**, Namdeo Jadhav, Popat Kumbhar	Development of docetaxel-loaded (Soluplus®–PF108) mixed micelles vacuum foam-dried product for improved stability and melanoma treatment by QbD approach	Future Journal of Pharmaceutical Sciences	2024;10(1):1-16	2.7
2.	Adesh Kurane, Rutuja Chougale, Vibhuti Thakur, Kiran Patil, Shalaka Patki, John D'souza, **Ashok Hajare**	Design, development, and characterization of lyophilized posaconazole-loaded mixed micelles for improved fungal treatment and stability	Fabad Journal of Pharmaceutical Sciences	2024;49(1):143-162	0.346
3.	John Disouza, Digambar Sawwashe, Rutuja Chougale, Gitesh Gavande, Kiran Patil, Shalaka Patki, **Ashok Hajare**	Design, development, and characterization of posaconazole ethosomal in situ gel	The Thai Journal of Pharmaceutical Sciences	2024;47(4):1-11	0.15
4.	Supriya C. Patil, Suresh G. Killedar, **Ashok A. Hajare**, A. S. Manjappa, Harinath N. More	In silico exploration of phytoconstituents and identification of hits against α-amylase for antidiabetic potential	Research Journal of Pharmacy and Technology	2024;17(1):419-426	0.27
5.	Dipika S. Gaikwad, Rutuja D. Chougale, Kiran S. Patil, John I. Disouza, **Ashok A. Hajare**	Design, development, and evaluation of docetaxel-loaded niosomes for the treatment of breast cancer	Future Journal of Pharmaceutical Sciences	2023;9(1):1-13	2.7

6.	**Ashok A. Hajare**, Girija A. Ghatge, Kiran S. Patil	Development and validation of RP-HPLC method for quantification of sertraline in nanofiber formulation	Research Journal of Pharmacy and Technology	2023;16(8): 3743-3748	0.27
7.	Varsha Mane, Suresh Killedar, Harinath More, **Sameer Nadaf**, Sachin Salunkhe, Harshal Tare	Novel phytosomal formulation of *emblica officinalis* extracts with its in vivo nootropic potential in rats: optimization and development by box-behnken design	Hindawi Journal of Chemistry	2024; 2024:1-19	3
8.	Dheeraj S. Randive, Kiran P. Shejawal, Somnath D. Bhinge, Mangesh A. Bhutkar, Namdeo R. Jadhav, Sandeep B. Patil, **Sameer J. Nadaf**	Efficient in vitro oxaliplatin delivery with functionalized single-walled carbon nanotube for enhanced colon cancer treatment	Future Journal of Pharmaceutical Sciences	2023;9(1):1-15	2.7
9.	Girish Gawas, Muniappan Ayyanar, Nilambari Gurav, Dinesh Hase, Vaishali Murade, **Sameer Nadaf**, Mohd Shahnawaz Khan, Rupesh Chikhale, Mohan Kalaskar, Shailendra Gurav	Process optimization for the bioinspired synthesis of gold nanoparticles using cordyceps militaris, its characterization, and assessment of enhanced therapeutic efficacy	Pharmaceuticals	2023;16(9):1-16	4.6
10	Frazer Andrade, Christopher Jenipher, Nilambari Gurav, **Sameer Nadaf**, Mohd Shahnawaz Khan, Nilesh Mahajan, Durgacharan Bhagwat, Mohan Kalaskar, Rupesh Chikhale, Ritesh Bhole, Sulabha Lalsare, Akshay Baheti, Muniappan Ayyanar, Shailendra Gurav	Endophytic fungi-assisted biomass synthesis of eco-friendly formulated silver nanoparticles for enhanced antibacterial, antioxidant, and antidiabetic activities	Journal of Drug Delivery Science and Technology	2024;97:105749	5

11.	Pravin Patil, Manju Choudhary, **Poournima Sankpal**, Sachinkumar Patil, Anand Gadad	Development and characterization of imatinib mesylate liposome: for in-vitro anti-cancer activity	Nanoscience & Nanotechnology-Asia	2024;14	0.953
12.	Rajesh Jagtap, Shrinivas Mohite, Sneha Jagtap, **Pournima Sankpal**, Sandeep Chavan, Vikram Shinde	Acrylic co-polymer and organic acid-based press coated pulsatile tablet of nifedipine using 3^2 factorial design: use of novel solubilizer for solubility enhancement	Polymer Bulletin	2024	3.2
13.	Pravin Patil, Priyanka Bhagwat, **Pournima Sankpal,** Sachinkumar Patil and Shashikant Dhawale	Formulation and Evaluation of Transdermal Niosomal Gel for Antihyperlipidemic Agent	Nanoscience & Nanotechnology-Asia	2024	0.953
14.	**Nilesh M. Jangade**, Manoj S. Charde	In-silico ADMET, molecular docking and anti-tubercular study of N-substituted quinoline 3-carbaldehyde hydrazone derivative	International Journal of Chemical and Biochemical Sciences	2024;25(14): 474-483	0.11
15.	**Sudhir S. Patil**, Kiran A. Wadkar	In vitro anti-cancer activity of *Epipremnum aureum*	Bangladesh Journal of Pharmacology	2024;19(1):23-28	1.6
16	V. H. Karambelkar, Neha Shankar Sheety, Ganesh Throat, Madhuranjan Vatsa, Shiju Sebastian, **Sudhir Patil**	Clinical study macular oedema	Research Journal of Pharmacy and Technology	2024;17(3):986-990	0.27
17	Shivaji Avate, Kiran L. Gaonkar, Madhuranjan Vatsa, Kumari Lipi, **Sudhir Patil**	Functional outcome of inter-trochanteric and sub-trochanteric fracture femur treated with proximal femur nail antirotation-II	Research Journal of Pharmacy and Technology	2023;16(12): 5884-5888	0.27

Books Published
Academic Year 2023-24

Sr.No.	Name of Authors	Title of Book	Publisher	Edition	Year
1.	Ashok A. Hajare	Modern Pharmaceutics	Nirali Prakashan Pune	First	2023
2.	Ashok A. Hajare	Industrial Pharmacy II	Nirali Prakashan Pune	Third	2024
3.	Ashok A. Hajare	Physical Pharmaceutics -I	Nirali Prakashan Pune	Tenth	2024
4.	Rameshwar M. Ardad, Shashikant S. Dhawale, Gajanan S. Patil, **Nilesh M. Jangade**	Essential of Pharmaceutical Organic Chemistry -I	Career Publication Nashik	First	2024

Book Chapters Published
Academic Year 2023-24

Sr. No.	Name of Authors	Book Title	Chapter	Publisher	Year	Page No.
1.	Komal Patekar, **Poournima Patil-Sankpal**, Sandeep Bandgar, Sachinkumar Patil, Babaso Udugade, Vipul Patil, Komal Mohite, **Ashok Hajare, Sudhir Patil, Sameer Nadaf**	Emerging applications of chitosan-based nanomaterials	Chitosan-based hybrid nanomaterials	Elsevier	2024	125-136
2.	Ankita Patil, **Poournima Patil-Sankpal, Ashok Hajare, Aamir Tamboli,** Sayali	Chitosan-based nanomaterials in the decontamination of hydrocarbons	Chitosan-based hybrid nanomaterials	Elsevier	2024	137-151

	Jawahire, Prafulla Choudhari, Sanket Rathod					
3.	Sayali Jawahire, **Poournima Patil-Sankpal**, Ankita Patil, Prafulla Choudhari, Sanket Rathod	Chitosan-based nanomaterials in decontamination of phenols and biphenyls	Chitosan-based hybrid nanomaterials	Elsevier	2024	247-259
4.	Manju Choudhary, **Poournima Patil-Sankpal**, Pravin Patil, **Akshay Nalawade, Shubham Yadav**	Chitosan-based nanomaterials in decontamination of detergents	Chitosan-based hybrid nanomaterials	Elsevier	2024	261-268
5.	Shreyasi Kadam, **Poournima Patil-Sankpal**, **Ashok Hajare, Nilesh Jangade,** Sachinkumar Patil, Pravin Patil, Komal Mohite, Sarika Suryawanshi, Pranali Patil	Safety, regulations, and economic impact of chitosan nanostructures	Chitosan-based hybrid nanomaterials	Elsevier	2024	333-338
6.	**Sameer Nadaf**, Popat Kumbhar, Durgacharan Bhagwat, Shailendra Gurav	Nanostrategies for Infectious Pulmonary Diseases: Current Progress and Future Prospects	Smart nanomaterials for infectious diseases	Royal Society of Chemistry	2024	25-52
7.	**Sameer Nadaf**, Durgacharan Bhagwat, Shailendra Gurav	Bioengineered Nanomaterials: Recent Trends and Bottlenecks in the Management of Infectious Diseases	Smart nanomaterials for infectious diseases	Royal Society of Chemistry	2024	240-257

Patents Published
Academic Year 2023-24

Sr. No.	Name of The Inventor(s)	Title of the Patent/Design	Patent Type	Application Number	Year	Status
1.	**Dr. Pournima Sachin Sankpal**, Mr. Mahesh Jaywant Patil, Dr. Sachin Kishore Chandavarkar, Dr. Sunil Ganpatrao Shingade, Mr. Jivan Rajaram Patil, Mrs. Soniya Vijaysarathy Phadte, Mr. Pankaj Sadashiv Gajare, Mrs. Prachita Pramod Gauns-Desai, Mr. Sandesh Narayan Somnache, Dr. Mangirish Narendra Deshpande, Mr. Amol Ramchandra Tangade	Ear dosage form applicator	Indian Patent	389940-001	2023	Published
2.	Dr. Preeti Salve, **Dr. Pournima Sachin Sankpal**, Mr. Harshwardhan Patil, Ms. Aishwarya S. Pattanshetty, Mr. Shivaprasad G. D., Mr. Vishesh Rodrigues	Portable mass spectrophotometer for analysis of chemical compounds	Indian Patent	392864-001	2023	Published

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