MARRI LAXMAN REDDY GROUP OF INSTITUTIONS

Marri Laxman Reddy Institute of Pharmacy

(Approved by AICTE & PCI, New Delhi, JNTUH Affiliated)
Dundigal -Gandimaisamma (V)&(M)
Medchal Dt, Hyderabad
Telangana State - 500043

"Wherever the Art of Medicine is Loved, There is Also a Love of Humanity"

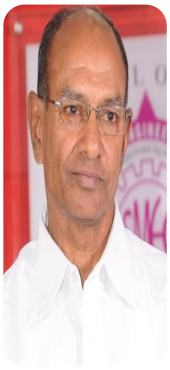
– Hippocrates.

INSIDE THIS:

PharmaScout

MLRIP's official e-mag

Vol. 5, 2022



Sri Marri Laxman Reddy

Chairman

MLR Group of Institutions

He has been in the field of education for more than three decades. He is an exemplary personality and extraordinary visionary and a constant inspiration to the younger generation. He is a veteran athlete of international repute. He emphasizes the importance of physical health for academics and overall personality development.

Sri Marri Rajshekar Reddy

Founder-Secretary

MLR Group of Institutions

He is a person of great acumen and remarkable abilities. He is a dynamic leader and strives hard to make every dream a reality. He is an initiator, innovator, and executor of novel plans for the progress of the institutions. He is the motivational and driving force of all the activities in the campus.

PRINCIPAL'S DESK

Dr. Nakka Jyothi
Professor & Principal

It is with immense pleasure that I address you all through our college newsletter, a platform that allows us to celebrate our achievements, share our experiences, and strengthen the bonds that unite us as a community.

As we reflect on the past months, it is clear that our college has continued to thrive despite the challenges we have faced. This resilience is a testament to the dedication and perseverance of each and every member of our community, and I am incredibly proud of what we have accomplished together.

To our students, I extend my heartfelt appreciation for your commitment to academic excellence and your passion for learning. Your curiosity, creativity, and willingness to embrace new ideas are the driving forces behind our college's success, and I have no doubt that you will go on to achieve great things in your future endeavors.

To our faculty, I offer my sincere gratitude for your tireless efforts in educating, inspiring, and mentoring our students. Your expertise, enthusiasm, and dedication to your craft are instrumental in shaping the minds and hearts of the next generation of leaders, innovators, and changemakers.

And to our staff, I want to express my deepest thanks for your hard work, professionalism, and unwavering support. Whether you work behind the scenes or interact directly with students, your contributions are invaluable to the smooth functioning of our college, and I am grateful for everything you do.

As we look ahead to the future, let us continue to uphold the values that define our college: integrity, excellence, inclusivity, and community. Let us embrace the opportunities that lie before us with optimism and determination, knowing that together, we can overcome any obstacle and achieve our shared goals.

VIRTUAL REALITY - ITS APPLICATION IN MEDICINE AND PHARMACEUTICAL INDUSTRY

Dr. B. Madhulatha, M. Pharm, Ph. D., Assoc. Professor, Dep. of Pharmacognosy
S. Swetha, B. Pharm II Year.

Virtual Reality (VR) is a computer-generated simulation of an environment that allows a person to interact with it as if it were real. Augmented Reality (AR) is an enhanced version created by adding digital information to the real world. These technologies are being used in healthcare for various purposes such as training, rehabilitation, surgery, and patient education. VR and AR are still emerging technologies, but there is potential for them to have a major impact on healthcare. These technologies can improve patient care and safety, reduce costs, and increase efficiency. It especially holds promise in revolutionizing the behavioural health space, with substantial research supporting its effectiveness. It was formally studied more than two decades ago, though it wasn't until the last few years that the field became prominent, with new companies moving into the space. And as technology has improved and gotten more intuitive to use, it has also become less expensive. And in 2022, the American Medical Association approved the first-ever CPT code for VR-mediated therapy.

VIRTUAL REALITY TECHNOLOGY IN MEDICAL FIELD:

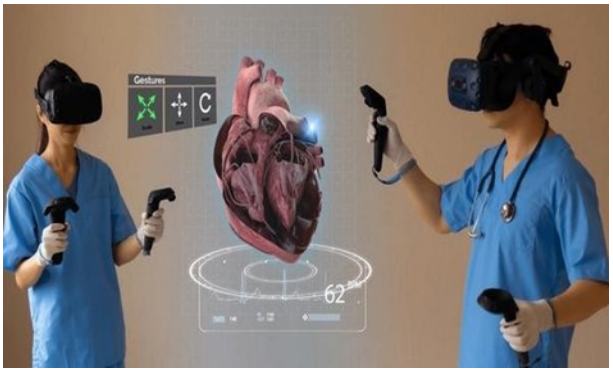
1.Pain management: Virtual reality is an effective tool for managing pain. A study published in the journal Cyberpsychology, Behaviour, and Social Networking found that VR was effective in reducing pain intensity in patients with burn injuries. **2. Rehabilitation:**. A study published in Frontiers in Psychology found that VR can help stroke patients regain movement in their affected limbs.**3. Anxiety and stress relief:** A study published in the journal PLOS ONE found that VR can help people with social anxiety disorder overcome their fear of public speaking. **4. Education and training:** A study published in Computers & Education found that VR can help medical students learn anatomy more effectively. **5. Research:** A study published in Nature found that VR can be used to study how the brain processes information about space. The study found that VR was more effective than traditional fMRI scans. **6. Improves mental health:** Several studies have shown that VR can effectively treat anxiety, post-traumatic stress disorder (PTSD), and phobias, depression. **7. Teaches Surgical Skills:** Another benefit of virtual reality in healthcare is that it can be used to teach surgical skills. **8. Reduces Costs:** A study found that VR simulations were more cost-effective than traditional animal models for teaching surgical skills. Additionally, VR simulations can be reused multiple times, reducing costs. **9.Improving Dentistry Treatments:** VR can create a 3D model of the patient's mouth, which can be used to plan treatments, assess risks and carry out procedures. VR can also provide patients with an immersive experience and understanding of the procedure. **10. Cognitive and Motor Skill Rehabilitation:** Virtual reality can be used to help patients recover from cognitive and motor impairments for patients recovering from strokes or traumaticbrain-injuries. **11. Phobia Treatment:** Virtual reality can be used to help patients overcome phobias by exposing them to virtual stimuli in a safe and controlled environment. **12. Pain distraction:** Virtual reality can be used to distract patients during medical procedures, reducing their perception of pain and discomfort.

VIRTUAL REALITY TECHNOLOGY IN THE PHARMACEUTICAL INDUSTRY:

1. Virtual reality product and device design review: Virtual reality allows you to display the 3D model of your pharmaceutical products at 1:1 scale, and interact with it in real time.

2. Virtual reality in pharmaceutical manufacturing: Pharmaceutical manufacturing requires a very high level of control from design to market. Most of the production relies on complex equipment that involves precise steps. VR enhances manufacturing processes by displaying and simulating the whole assembly process or any maintenance scenario you want to run.

3. Virtual reality for specialized technician training: It is crucial to familiarize yourself with pharmaceutical manufacturing equipment and medical devices before using it in real life. However, some of these machines are very expensive, and many scenarios can't be tested with the real equipment. With a digital twin in VR of the machine, you can train technicians in VR simulations that would have been too dangerous or too rare to be done with traditional training methods.



4. Virtual reality platform for remote pharmaceutical operations: Global pharmaceutical companies have research facilities and production plants located all over the globe. Sometimes their experts and headquarters are (again) in another location. All the stakeholders of a project can collaborate on the same CAD models, on a remote cloud-based platform. It's an ideal solution for specialists in HQ to share their perspective in real-time with operations or maintenance staff, by taking notes on the digital mock-up and record videos of their virtual sessions.

5. Virtual reality for ergonomics and operability on the floor plan of a hospital: When working on large-scale models, such as a hospital, a laboratory or a factory, you can use VR to optimize the design-to build process and improve ergonomics.

6. Virtual reality presentations for immersive pharmaceutical sales pitches: A huge obstacle for successful sales in the drug industry is competing for a professional's time and attention. Which is why a VR presentation is a great tool to communicate accurately, efficiently and have a lasting effect, compared to a traditional sales pitch.

7. Virtual reality in pharmaceutical research and drug discovery: Virtual reality enables researchers to be fully immersed in their 3D models, and visualize complex three-dimensional data from within. It helps them understand and analyze how everything connects and interact particularly during clinical trials.

As we navigate the landscape of 2024, the convergence of technology, heightened personalization and a growing awareness of holistic health will redefine patient experiences, drive innovation in treatment modalities and reshape the counters of health care and pharmaceuticals. The collaborative efforts of healthcare professionals, innovators and pharmaceutical entities are set to usher in a new era of health care that is more accessible, personalized and technologically advanced than ever before.

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SEIZURES IN CHILDREN - FIRST AID MEASURES

Dr. B. Raja Rajeshwari, Pharm. D, Asst. Professor, Dep. of Pharmacy Practice

Keeping risks to a minimum:

- Because there is some risk of another seizure, it makes sense to think about safety.

Here are some examples:

- Encourage your child to shower rather than bathe. If your child does have a bath don't leave them unattended and never lock the door.
- While you child has a shower, consider having someone with them or just outside the door, checking that they're safe.
- If your child swims without you then ensure they tell the lifeguard or a responsible adult that they've had a seizure in the past.
- If your child rides a bike or scooter, ensure they wear a helmet. Use cycle lanes where possible.
- If you have free-standing heaters at home, try to place them out of the way so your child is less likely to bump into them if they fall over or trip during a seizure.
- Don't place their bed right up against a wall or next to a radiator. This should reduce the risk of your child banging or burning themselves if they experience jerking of their limbs during a seizure.

FIRST AID FOR AN EPILEPTIC PATIENT:

DO'S

MAKE THE PERSON COMFORTABLE BY PLACING A PILLOW UNDER HEAD.

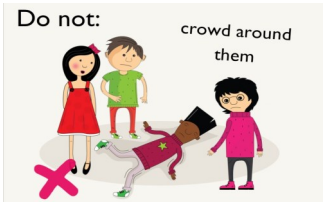
MOVE THE PATIENT TO HIS SIDE AFTER SEIZURES STOP TO PROMOTE BREATHING.

LOOSEN THE CLOTHES AND CUT DOWN THE TEMPERATURE BY SPONGING.

STAY WITH THE PERSON AND MAKE SURE HE/SHE IS FINE UNTIL THE HELP ARRIVES.

THINGS YOU SHOULDN'T DO DURING AN EPILEPSY

DONT'S

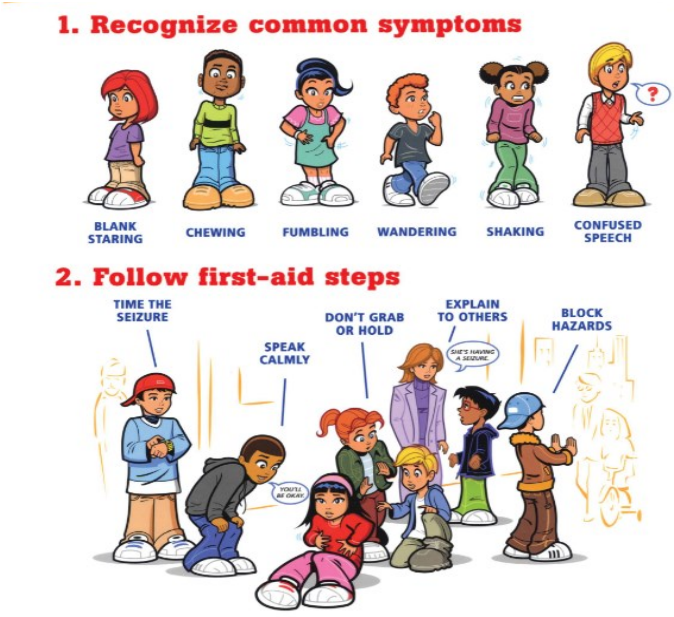


NEVER CROWD AROUND THE PATIENT.

DO NOT PUT ANYTHING IN MOUTH AND MAKE SURE AIR FLOW IS PROPER AND NOT OBSTRUCTED.

DO NOT HOLD THE PATIENT DURING THE ATTACK.

DO NOT SHOUT AS THE PATIENT GETS PANIC.



FATHER OF PHARMACY IN INDIA: MAHADEVA LAL

Dr. Amreen Sultana, Pharm. D, Associate Professor, Dep. of Pharmacy Practice

Prof. Mahadeva Lal Schroff was born in the Bihar city of Darbhanga on March 6, 1902. He finished his education at Bhagalpur (Bihar) and passed his intermediate test in 1920. Following that, he enrolled in the Engineering College at Banaras Hindu University (BHU) in Varanasi, India. Prof. Schroff was ordered to leave the institution in 1921 after speaking out against the then-principal, Charles A. King. Prof. Schroff left India after graduating from engineering school and spent time in China, Japan, and America. He earned his UG degree in arts with honors in chemistry in 1925 and his PG degree in chemistry and microbiology from the Massachusetts Institute of Technology (MIT) in 1927.

FATHER OF PHARMACY WORK LIFE:

He experienced several hurdles during his career and schooling, but he overcame them all to make significant contributions and nurture the pharmacy area. When he returned to India in 1929, he got a job with Birla Brothers Ltd. Then, on the recommendation of J. L. Bajaj, he was introduced to the then Vice Chancellor of BHU, Pt. Madan Mohan Malviya, and was invited to join BHU as an honorary staff member. In 1932, Prof. Schroff established pharmaceutical chemistry as the main subject in the B.Sc. program at BHU. From 1934, an integrated 2-year B.Sc. Course including the topics of chemistry, pharmacy, and pharmacognosy was launched, which was eventually transformed into a full-fledged three-year B Pharm course at BHU for the first time in India beginning in 1937. Prof. M. L. Schroff's first and greatest creation earned him the title of pioneer.

FATHER OF PHARMACY LATER LIFE:

Soon after, in December 1935, Prof. Shroff founded the United Provinces Pharma Association, which quickly expanded beyond the limits of UP in 1939 to become the Indian Pharmaceutical Association, with chapters all throughout the nation. He was the editor of the Indian Journal of Pharmacy, which was started in January 1939.

Prof. Schroff was called back to the educational area in 1964, this time at Jadhavpur University, where he was appointed Head of Department at the newly created Pharmacy Department. He resigned as professor and head of Pharmacy Department at Jadhavpur University after nearly forty years of service (1932 to 1968), including the last four years at Jadhavpur (July 1964 to January 1968). He founded the Indian Journal of Pharmaceutical Education, which he edited from 1965 to 1971, until his death in 1971.

FATHER OF PHARMACY FOUNDATIONS:

The following are some of the things which are founded by Prof. Mahadeva Lal Schroff-

- Indian Pharma Association (1935 as the U.P. Pharma Association and 1939 as the Indian Pharmacy Association).
- Indian Journal of Pharmacists (1945).
- Bhaishaj Patrika in Hindi (1980).
- Bheshjayan (1968).
- Indian Pharmaceutical Congress (1968).
- President of various State Pharmacist Associations (Bengal, Bihar).
- President of the Pharmacy Council of India (1954-1959).

His work, "The History of Indian Pharmacy," is a classic treatise that unfolds the numerous features of pharmacy practice in ancient and medieval India, which have roots and significance even in current pharmacy in our nation.

Prof. Mahadeva Lal Schroff, properly referred to as the Father of Pharmacy Education in India, passed away on August 25, 1971, and he surely remains an inspiration to all pharmacists working in this nation, regardless of their branches or responsibilities. Prof. Schroff, who was not qualified as a pharmacist, guided not just pharmaceutical education but also the Indian industry with his aptitude, comprehension, talent, and broad vision.

REMDESIVIR

Dr. Gabriela Keerthana Gondhi, Pharm. D, Asst. Professor, Dep. of Pharmacy Practice
B. Keerthi, B. Pharm II Year

BRAND NAME: VEKLURY®

GENERIC NAME: Remdesivir

MANUFACTURER: Gilead Sciences, Inc.

DRUG CLASS: Antiviral agent

USES:

Labeled: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in adults and pediatric patients (12 years of age and older and weighing at least 40 kg) requiring hospitalization

MECHANISM OF ACTION: Remdesivir is an inhibitor of the SARS-CoV-2 RNA- dependent RNA polymerase (RdRp), which is essential for viral replication.

METABOLISM: Remdesivir is a phosphoramidate prodrug that must be metabolized within host cells to its triphosphate metabolite to be therapeutically active. It is a CYP3A4 substrate, and a possible CYP2D6, CYP2C8, OAT1b1, and P-gp substrate

ELIMINATION: Remdesivir is 10% eliminated in the urine and has undetectable elimination in the feces.

CONTRAINDICATIONS:

Hypersensitivity reactions: Contraindicated in patients with a history of clinically significant hypersensitivity reactions to VEKLURY or any components of the product.

Renal failure/dialysis: Study protocols contraindicate the use of remdesivir in patients with severe renal impairment (eGFR less than 30 mL/minute), renal failure, and in patients receiving dialysis or continuous renal replacement therapy.

PRECAUTIONS:

Pregnancy: Data regarding the use of remdesivir during pregnancy are insufficient to determine the drug-associated risk for major birth defects, miscarriages, or adverse maternal or fetal outcomes.

Lactation: There are no data regarding the presence of remdesivir in human milk, the effects on the breast-fed infant, or the effects on milk production.

Pediatric Use: Safety and efficacy of remdesivir have not been established in neonates, infants, or children younger than 12 years of age or weighing less than 40 kg.

Renal Impairment: Use not recommended in patients with an eGFR < 30mL/min

Hepatic Impairment: Transaminase elevations have been reported, including serious cases; monitoring recommended and discontinuation may be necessary.

Concomitant use: Not recommended in combination with chloroquine phosphate or hydroxychloroquine sulfate as it may result in reduced antiviral activity of remdesivir.

Hypersensitivity including infusion-related and anaphylactic reactions: Hypersensitivity reactions, including infusion-related and anaphylactic reactions, have been reported during and following remdesivir administration. Signs/symptoms may include angioedema, bradycardia, diaphoresis, dyspnea, hypotension, hypertension, hypoxia, fever, nausea, rash, shivering, tachycardia, and wheezing; slowing infusion rate (maximum infusion time: 120 minutes) may be considered to potentially prevent these reactions.

ADVERSE EFFECTS:

Occurring >10% of patients: Hematologic: Anemia (15%)

Occurring >1% to <10% of patients: Endocrine & metabolic:

Hyperglycemia (1.8%) Increased serum glucose (2.2%)

Hepatic:

Acute hepatic failure

Increased serum alanine aminotransferase (1.5%) Increased serum aspartate aminotransferase (2.8%)

Renal:

Acute renal failure (2.8%) Decreased eGFR (3.7%) Increased serum creatinine (1.5%)

Miscellaneous:

Fever (5%), Nausea (5%), Occurring in <1% of patients: Renal: Decreased creatinine clearance (0.6%).

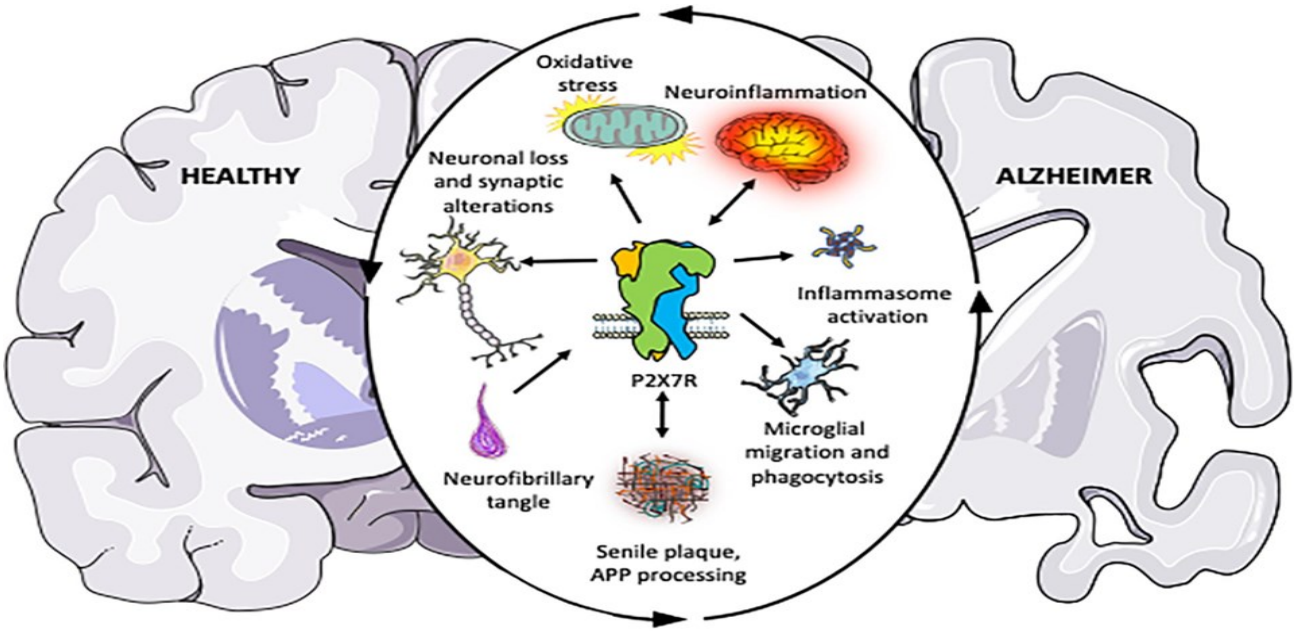
Student's corner

IMMUNE GENE ALTERATIONS IN ALZHEIMER'S DISEASE: UNRAVELLING CONNECTIONS BETWEEN THE BRAIN AND THE PERIPHERAL IMMUNE SYSTEM

Gargi Mondal, Pharm. D Intern, MLRIP

INTRODUCTION:

Alzheimer's disease (AD) stands as a formidable challenge in the realm of neuroscience and healthcare, with its relentless progression and impact on cognitive functions. It is a complex neurodegenerative disorder that not only affects cognitive functions but also exhibits intricate connections with the immune system. Recent research has shed light on immune gene alterations playing a pivotal role in the progression of Alzheimer's disease, revealing a previously underestimated interplay between the brain and the peripheral immune system. This article delves into the evolving understanding of how immune system dysregulation contributes to Alzheimer's disease and explores the potential implications for novel therapeutic interventions.



The Brain-Immune Axis in Alzheimer's Disease: AD viewed as a disorder primarily affecting neurons, Alzheimer's disease is now recognized as having profound interactions with the immune system. The concept of the brain-immune axis emphasizes bidirectional communication between the central nervous system (CNS) and peripheral immune cells. Evidence suggests that dysregulation of this axis contributes significantly to the neuroinflammation observed in AD.

Beyond the Brain: The Immune System's Role in AD

Traditionally, AD research focused solely on the central nervous system. However, growing evidence suggests the peripheral immune system, our body's defense network outside the brain, plays a crucial role. Alterations in immune gene expression and function are increasingly linked to AD pathology.

Immune Gene Alterations: Key Players in AD Pathogenesis:

Key Players:

- Altered genes like TREM2 and CD33 affect microglia, brain's clean-up crew, hindering plaque removal.
- Chronic inflammation, fueled by immune dysregulation, becomes collateral damage.

Contd….

- Gut microbiome may hold secrets, influencing communication between brain and immune system.

Studies have identified specific immune gene alterations associated with Alzheimer's disease, implicating both innate and adaptive immune responses. Microglial cells, the resident immune cells of the brain, undergo phenotypic changes in AD, transitioning to a pro-inflammatory state. Additionally, alterations in peripheral immune cells, such as T cells and monocytes, have been observed, further underscoring the systemic nature of immune dysregulation in AD.

Peripheral Immune Cells and Systemic Dysregulation:

Beyond the confines of the CNS, alterations in peripheral immune cells further underscore the systemic immune dysregulation in Alzheimer's disease. T cells, monocytes, and other immune effectors traverse the blood-brain barrier, contributing to the neuroinflammatory milieu. Immune gene alterations in the periphery mirror those within the CNS, emphasizing the interconnected nature of the immune response in AD. Understanding the crosstalk between central and peripheral immune alterations is essential for comprehending the full scope of AD pathogenesis.

Implications for Therapeutic Intervention:

Understanding the intricacies of inflammatory signaling pathways provides potential targets for therapeutic intervention in Alzheimer's disease. Anti-inflammatory drugs, immunomodulatory agents, and interventions aimed at disrupting specific signaling cascades are under investigation. Targeting key nodes, such as the NLRP3 inflammasome or specific cytokines, holds promise for mitigating neuroinflammation and altering the disease trajectory.

Challenges and Future Directions:

While the exploration of the Brain-Immune Axis in Alzheimer's disease is promising, challenges persist. Unraveling the temporal dynamics, understanding the triggers that initiate immune alterations, and addressing the heterogeneity of immune responses among AD patients are critical for the development of effective and targeted therapeutic strategies. Continued research in this field is essential to refine our understanding of the Brain-Immune Axis and translate these insights into tangible clinical benefits for individuals affected by Alzheimer's disease.

Future Directions:

Precision Medicine Initiatives: Implementing large-scale precision medicine initiatives can accelerate the understanding of individual immune profiles in AD. Integrating genetic, molecular, and clinical data may uncover novel subtypes of the disease, allowing for more targeted and personalized therapeutic strategies.

Advanced Neuroimaging Technologies: Continued advancements in neuroimaging technologies, such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), can provide deeper insights into the dynamics of immune responses in the brain. This may aid in identifying early markers of immune dysregulation and monitoring treatment responses.

International Collaborations: Collaborative efforts on a global scale can facilitate the pooling of diverse datasets, enabling researchers to uncover patterns, identify commonalities, and validate findings across different populations. International collaboration fosters a shared understanding of AD heterogeneity and accelerates the development of effective therapies.

Research in this field is still young, and numerous challenges remain. Understanding the complex interplay between immune gene alterations, inflammation, and neurodegeneration requires further investigation.

Student's corner

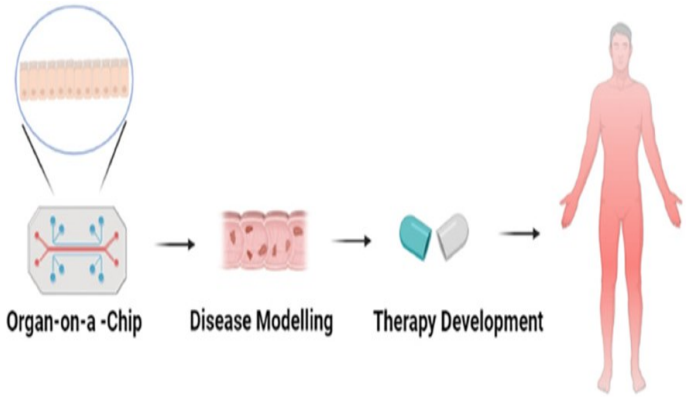
UNLEASHING THE POTENTIAL: ORGAN-ON-CHIP TECHNOLOGY IN ADVANCING HEALTHCARE

U. Sowmya, Pharm. D III Year

INTRODUCTION :

Organ on chip is a microfluidic device that imitates human organ form and function, enabling more precise drug testing, disease modelling, and the creation of customized medicine. While in-vivo tests on humans and animals are frequently used to research the physiology of the body, in the past 20 years, a number of other methods have also been investigated, such as computational approaches and 2D and 3D in-vitro models. After its introduction in 2006, induced pluripotent stem cell technology (iPSC) has emerged as a popular and efficient source of human cells for several organs, including the brain, heart, spinal cord, kidney, and so on.

Since the 1900s, 2D cell cultures have served as the foundation for research on human physiology, stem cell culture, illness research, cell-cell interaction, tissue imaging, drug discovery, toxicity, and drug metabolism. Three-dimensional cell culture technology underwent a boom in development in the late 20th century. Improved accuracy was attained in a number of drug development and cancer research using 3D cell culture. Yet, 3D cultures have drawbacks, such as the inability to easily separate 3D cultures from their scaffolds or matrices due to the possibility of undesired virus or hormone components generated from human tissue.



MODELS OF ORGANS ON A CHIP:

In recent years, researchers have constructed many models for different organs on a chip, such as the kidney, lung, heart, skin, pancreas, brain, and blood-brain barrier.

KIDNEY ON CHIP:

The initial design of Kidney on a chip had two compartments, the first compartment represented urinary lumen and has a fluid flow and the other chamber mimics interstitial space. The device utilized rat tubular cells. The model effectively demonstrated the number of primary cilia, expression of sodium-potassium ATPase and aquaporin 1, albumin uptake, and glucose reabsorption. Drug-induced nephrotoxicity investigations were effectively done utilizing microchips.

LUNG ON CHIP:

Pulmonary diseases are reported to be the fifth most common cause of death globally. The system was used to conduct nano-toxicological study in which production of intracellular reactive oxygen species (ROS) in response to alveolar exposure to nanoparticles . Cigarette smoking is the major cause for clinical exacerbations with patients with asthma and chronic obstructive pulmonary disease (COPD) .

HEART ON CHIP:

Cardiovascular diseases (CVD) are leading cause of death in several countries. Cardiovascular related failures were around 17%, highest amongst all other organs analyzed. Main challenges in developing heart on chip are-

- CVD animal models are poor predictors of human responses
- adverse effects are organism dependent
- Lengthy and costly process

Beating heart on a chip was developed with highly functional micro-engineered cardiac tissues which can be used to predict hypertrophic changes in cardiac cells.

SKIN ON CHIP:

Skin on a chip models have been used for dermal diffusion testing, toxicology studies, efficacy testing, wound healing, inflammation, repair, ageing and shear stress studies . The source of skin cell lines are induced pluripotent stem cells or commercially available reconstructed skin tissues.

About MLRIP

VISION To be an educational institute of par excellence and produce competent pharmacy professionals to serve the community through research and the ever-increasing needs of Industry.

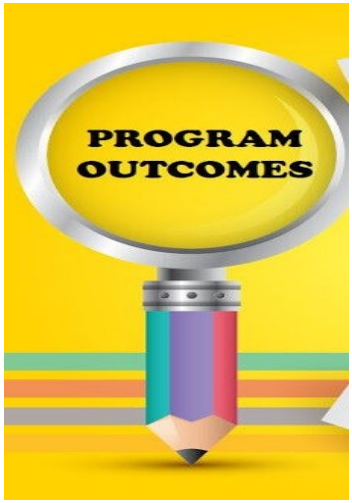
MISSION

1. Imparting quality education and innovative research for various career opportunities.
2. Creating conducive academic environment to produce competent pharmacy professionals.
3. Indoctrination of students adorned with high human values and make them aware of their responsibility as health care professionals.

Program Educational Objectives (PEO)

PEO 1: To produce graduates with sound theoretical knowledge and technical skills required for their career opportunities in various domains.
PEO 2: To incite the students towards research and to address the challenges with their innovative contributions for the benefit of the mankind.
PEO 3: To instill the essence of professionalism, ethical commitment to become a health care professional with sound integrity and adherence to the core human values in the service of the society.

1. **Pharmacy Knowledge:** Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.



2. **Planning Abilities:** Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

3. **Problem analysis:** Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

4. **Modern tool usage:** Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

5. **Leadership skills:** Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.

6. Professional Identity: Understand, analyze and communicate the value of their professional roles in society (e.g., health care professionals, promoters of health, educators, managers, employers, employees).

7. **Pharmaceutical Ethics:** Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

8. **Communication:** Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

9. **The Pharmacist and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

10. **Environment and sustainability:** Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

11. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.