DECEMBER 2024 Volume 5 • Issue 4

PHARMA TAB

CLINICAL PHARMACY NEWSLETTER

C.L. BAID METHA COLLEGE OF PHARMACY
Affiliated to The Tamil Nadu Dr. M.G.R. Medical University & Approved by PCI
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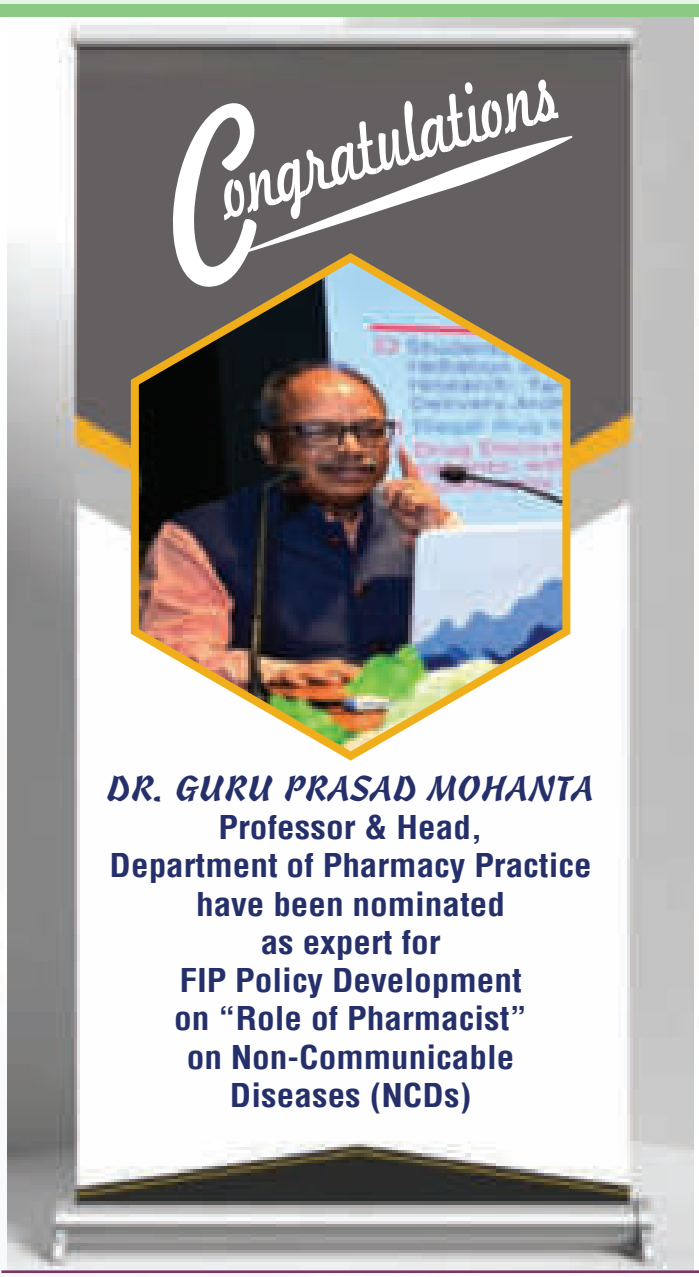
Theme: PHARMACOGENOMICS AND PERSONALIZED MEDICINE



Editor's Desk

Pharmacogenomics - A Game Changer in Personalized Medicine

Not all patients respond to medications the same way. Genetic differences can influence how drugs are metabolized, transported, or interact with the body. By understanding how genetic variations influence individual responses to drugs, pharmacogenomics is paving the way for personalized medicine.

Unlike the traditional "one-size-fits-all" approach, pharmacogenomics tailors drug selection and dosages to an individual's genetic profile, thereby it reduce adverse effects, and enhance therapeutic outcomes. They are not just scientific advancements, but the blueprint for the future of healthcare. As research and technology continue to evolve, pharmacogenomics role as a game changer in personalized medicine is undeniable. The current issue contains articles focusing more on Pharmacogenomics and personalised medicines and of course it has all our regular features. Hope you find this issue engaging and enjoyable to read

IN THIS ISSUE

Important Health Awareness Days

January - March 2025

World Leprosy Day	30January
World Cancer Day	04 February
National Tooth ache Day	09 February
World Oral health Day	20 March
National De-Worming Day	10 February
World Hearing Day	03 March
World Obesity Day	04 March
National Multiple Personality Day	05 March
Glaucoma Day	12 March
World Kidney Day	13 March
World Disabled Day	15 March
World Down Syndrome Day	21 March
World Tuberculosis Day	24 March

DRUGS APPROVED BY CDSCO

Drugs Approved by Central Drugs Standard Control Organization during the period of October to December 2024

Drug Name	Approved date	Indication
Mavacamten capsules 2.5mg, 5mg,10mg,15mg	08/10/2024	for the treatment of symptomatic (NEW York Heart Association, NYHA, class II-III) obstructive hypertrophic cardiomyopathy(oHCM) in adult patients.,
Ferumoxytol Bulk Drug & Ferumoxytol Injection 510mg Elemental Iron/17mL (30mg/mL)	08/10/2024	for the treatment of iron deficiency anemia(IDA) in adult patients who have intolerance to oral iron and who have chronic kidney disease (CKD)
Lumateperone Tosylate Bulk Drug & Lumateperone capsules 42mg	26/12/2024	for the treatment of depressive episodes associated with bipolar I or II disorder (bipolar depression) in adults
Trelagliptin Succinate Bulk & Trelagliptin Tablets 25mg, 50mg, and 100mg	26/12/2024	For treatment of Type 2 diabetes

Source: https://cdscoonline.gov.in/CDSCO/Drugs

DRUGS APPROVED BY US FDA

Drugs Approved by US Food and Drug Administration (US FDA) during the period of October to December 2024

Drug Name	Approved Date	Indication	Status in India
Inavolisib	10/10/2024	To treat locally advanced or metastatic breast cancer.	Not yet approved by CDSCO
Sulopenem, Etzadroxil, Probenecid	25/10/2024	To treat uncomplicated urinary tract infections (uUTI) uremic syndrome (aHUS)	
Revumenib	15/11/2024	To treat relapsed or refractory acute leukemia	
Zanidatamab-hrii	20/11/2024	To treat unresectable or metastatic HER2-positive (IHC 3+) biliary tract cancer	
Acoramidis	22/11/2024	To treat cardiomyopathy of wild-type or variant transthyretin-mediated amyloidosis	
Landiolol	22/11/2024	To treat supraventricular tachycardia	
Zenocutuzumab-zbco	04/12/2024	To treat non-small cell lung cancer and pancreatic adenocarcinoma	
Cosibelimab-ipdl	13/12/2024	To treat cutaneous squamous cell carcinoma	
Ensartinib	18/12/2024	To treat non-small cell lung cancer	
Olezarsen	19/12/2024	To treat familial chylomicronemia syndrome	
Vanzacaftor, Tezacaftor and Deutivacaftor	20/12/2024	To treat cystic fibrosis	

Reference: https://www.fda.gov/drugs/new-drugs-fda-cders-new-molecular-entities-and-new-therapeutic-biological-products/novel-drug-approvals-2023

GENOMIC BIOMARKERS IN PREDICTING IMMUNOTHERAPY RESPONSE IN CANCER PATIENTS

The advent of immunotherapy has revolutionized cancer treatment, offering durable responses and prolonged survival in patients with advanced malignancies. Genomic biomarkers, derived from tumor or host genomes, have emerged as valuable tools and play a critical role in predicting immunotherapy outcomes. These biomarkers not only help predict response to immunotherapy but also aid in understanding tumor-immune interactions. This article focuses on predictive factors such as, Tumor Mutational Burden (TMB), Microsatellite Instability (MSI), PD-L1 expression and other emerging genomic features.

Praveen Kumar. P
Pharm D Intern

KEY GENOMIC BIOMARKERS IN CANCER IMMUNOTHERAPY

1. Tumor Mutational Burden (TMB):

TMB refers to the number of somatic mutations per megabase of the tumor genome. A high TMB often correlates with increased neoantigen production, enhancing the likelihood of immune recognition and response to immune checkpoint inhibitors (ICIs). Studies have shown that patients with high TMB benefit more from ICIs such as pembrolizumab and Nivolumab. For instance, in non-small cell lung cancer, high TMB was associated with improved progression-free survival in patients treated with ICIs[1][2]. However, TMB is not universally predictive across all cancer types. Standardization of TMB measurement and thresholds remains a challenge.

2. Microsatellite Instability (MSI):

MSI is caused by defects in the DNA mismatch repair (MMR) system, leading to hypermutation and increased immunogenicity. MSI-high tumors, such as those in colorectal cancer, show strong responses to pembrolizumab and other ICIs[3]. MSI status is now an FDA-approved biomarker for immunotherapy in multiple cancer types. While MSI-high tumors respond well to immunotherapy, the prevalence of MSI varies, limiting its broader applicability.

3. PD-L1 Expression:

PD-L1 expression, measured through immune histochemistry, is widely used as a biomarker for response to ICIs targeting the PD-1/PD-L1 pathway. High PD-L1 expression correlates with better responses to ICIs in NSCLC, melanoma, and urothelial carcinoma[4]. However, the predictive utility of PD-L1 is inconsistent due to tumor heterogeneity and the dynamic nature of its expression. Variations in assay platforms further complicate its application.

4. Gene Expression Profiles:

Gene expression signatures, such as the T-cell inflamed gene expression profile (GEP), have shown potential in predicting immunotherapy outcomes. GEP reflects the presence of an active immune microenvironment and has been associated with response to pembrolizumab[5].

Conclusion:

Genomic biomarkers play a pivotal role in predicting immunotherapy response, offering insights into tumor biology and immune interactions. Despite challenges, their integration into clinical practice could bring a new era of precision oncology, maximizing therapeutic benefits while minimizing risks. Continued research, standardization, and collaboration are essential to realize the full potential of genomic biomarkers in cancer immunotherapy.

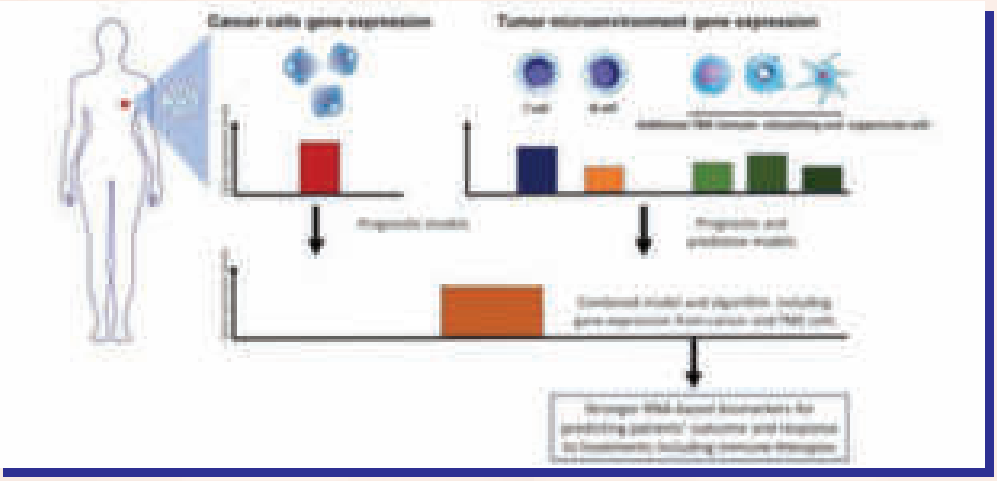


Fig 1: A combined model and algorithm that captures both cancer and TME cells
Source: Munkácsy, G et al., Biomedicines 2022, 10(2), 248.

References:

1. Rizvi NA., Hellmann MD, Snyder A, Kvistborg P, Makarov V et al., Cancer immunology. Mutational landscape determines sensitivity to PD-1 blockade in non-small cell lung cancer. Science. 2015 Apr 3;348(6230):124-8. [Cited 2024 Oct 13].

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3. Le DT Uram JN, Wang H, Bartlett BR, Kemberling H et al., PD-1 Blockade in Tumors with Mismatch-Repair Deficiency. N Engl J Med. 2015 Jun 25;372(26):2509-20. [Cited 2024 Oct 15].

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REWRITING HEART HEALTH: THE POWER OF GENE THERAPY

Cardiovascular diseases refer to a class of heart or artery-related disease of the host, such as coronary artery disease, stroke, peripheral arterial disease, cardiomyopathy, aortic aneurysm, hypertensive heart disease, rheumatic heart disease, etc. According to the WHO Global Health Estimates 2024, CVDs now account for approximately 31.5% of all global deaths, which represents about 18.6 million deaths annually. This number makes CVD the main cause of death [1].

Gene therapy refers to the use of genetic material to treat or prevent disease by modifying the expression of specific genes. In the context of cardiac diseases, gene therapy aims to repair or replace defective genes, modify gene expression, or introduce new genes that can help heal damaged heart tissue. As of 2024, gene therapy for cardiovascular diseases (CVD) is an emerging area of research in India, but it has not yet become widely available as an established treatment.[2]

AAV1/SERCA2a Gene Transfer in patients with severe heart failure:

Gene therapy targeting SERCA2a, (Sarcoplasmic/Endoplasmic Reticulum Calcium ATPase) for heart failure is a promising area of research that is being explored in both preclinical and clinical trial settings. In phase 2 placebo controlled RCT,at 12 months of follow-up, in the high-dose group versus placebo, there were improved signs and symptoms of HF, functional status, biomarker profile, and left ventricular function. A significant decrease in recurrent cardiovascular (CV) events (myocardial infarctions, hospitalizations related to HF, episodes of worsening HF) was evident in the patients who received high-dose AAV1/SERCA2a compared with those who received placebo.[3]

Gene Therapy for Ischemic Heart Disease:

Gene therapy for ischemic heart disease (IHD) has gained significant interest as a potential therapeutic approach to stimulate angiogenesis and promote myocardial tissue repair. Among the most studied approaches for ischemic heart disease are the use of angiogenic factors like Vascular Endothelial Growth Factor (VEGF) and Fibroblast Growth Factor (FGF). These growth factors are involved in promoting the growth of new blood vessels, improving blood flow, and aiding tissue repair after ischemic injury.

VEGF Gene Therapy:

VEGF is perhaps the most highly investigated growth factor that has been studied to induce angiogenesis in the ischemic heart. Isoforms of VEGF bind to specific receptors on endothelial cells and play an essential role in angiogenesis. Gene therapy with VEGF-165 has been proven successful in the Kuopio Angiogenesis Trial (KAT trial). In the KAT trial, adenovirus mediated VEGF-A165 gene therapy when administered by intracoronary injection in patients with class 2–3 angina undergoing PTCA showed improvement in coronary perfusion with no difference in the rates of vascular stenosis.

Harrini. R
Pharm D 4th year

Gene Therapy with Fibroblast Growth Factor (FGF):

FGFs stimulate endothelial cell migration, proliferation, and new blood vessel formation. FGF-2 is also involved in fibroblast proliferation, which can help in tissue regeneration. Trials using FGF-2 gene therapy in ischemic heart disease patients have also shown some improvement in heart function and blood vessel growth. However, like VEGF therapy, FGF therapy is still largely in the experimental phase and requires further study to establish its long-term safety and efficacy [4].

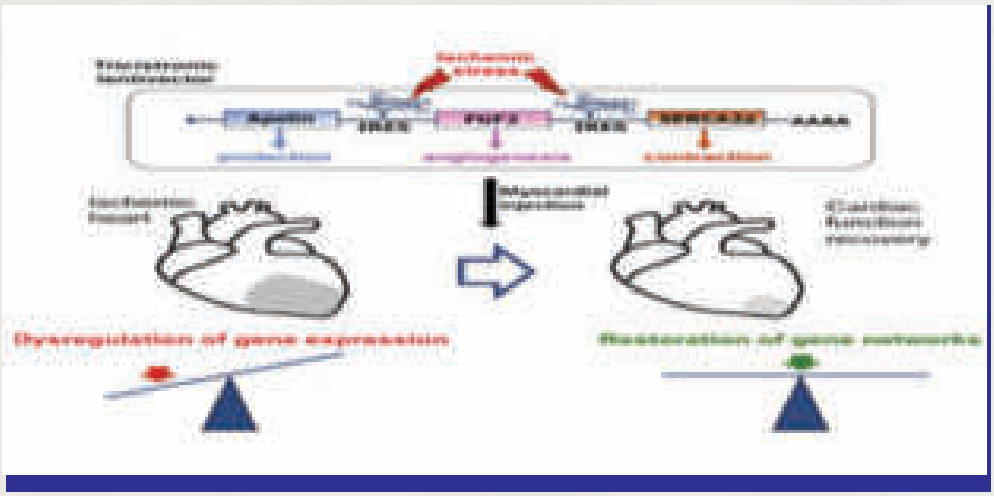

Fig 2: Therapeutic Benefit and Gene Network Regulation by Combined Gene Transfer of Apelin, FGF2, and SERCA2a into Ischemic Heart
Source: Edith Renaud et al., Molecular Therapy (2018) 26 (3) 902

Gene Editing: CRISPR-Cas9:

The advent of CRISPR-Cas9 gene editing has brought new hope for the treatment of genetic heart diseases. CRISPR allows precise edits to DNA, enabling the correction of mutations that cause inherited diseases. Researchers are investigating how CRISPR-Cas9 can be used to correct mutations in heart cells, which could potentially cure conditions like Duchenne muscular dystrophy or certain arrhythmias.

Transforming growth factor-beta (TGF-β):

Chronic conditions like heart failure often involve fibrosis (scarring) & maladaptive remodeling of the heart muscle. Gene therapy approaches that target fibrosis-related pathways can potentially reverse or halt this progression. Transforming growth factor-beta (TGF-β): TGF-β signaling is a major contributor to cardiac fibrosis. Inhibition of this pathway via gene therapy could reduce fibrosis and improve heart function [5]

Conclusion:

Gene therapy for cardiovascular diseases is an exciting and rapidly evolving field. Though gene therapy holds great promise, there are still significant challenges related to safety, efficacy and long-term effects that need to be addressed. Emerging technologies like CRISPR-Cas9 and the exploration of fibrosis-targeting therapies offer additional avenues for future breakthroughs in treating CVD.

References:

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GENOMICS AND GENE THERAPY - REVOLUTIONIZING MODERN MEDICINE

Genomics and gene therapy are at the cutting edge of medical innovation, offering new ways to understand, prevent, and treat diseases. Genomics focuses on studying the entire DNA sequence to uncover how genetic differences influence health, disease risk, and responses to treatment. This information is the foundation of precision medicine, where therapies are tailored to an individual's unique genetic profile.[1]

Genomic Tools: Genomic tools are advanced technologies and methods that provide critical insights into the genetic basis of diseases, help identify therapeutic targets, and enable the development of innovative treatments. These includes

Genome Sequencing: Determining the exact sequence of DNA in an organism.

Single nucleotide polymorphism: A single nucleotide's difference in a genetic sequence is known as a single nucleotide polymorphism (SNP). In humans, it is the most prevalent kind of genetic variation. In the 1980s, restriction enzymes were used to detect it

DNA Amplification: PCR is a cost-effective method that can amplify a single DNA exponentially. It is a rapid, highly specific, and extremely sensitive method.

Linkage and Association analysis: Genes for heritable characteristics have been mapped to their chromosomal sites via linkage studies. Sturtevant A. created the first genetic linkage map in 1911. For monogenic illnesses, the disease-causing gene is mapped using parametric linkage analysis.

Comparative genomic hybridization: Comparative genomic hybridization (CGH) was developed in 1992. CGH can detect DNA copy number changes across the entire genome of a patient sample in a single experiment. It compares the hybridization signal intensity of a test sample (for example tumor sample) against a reference sample along the chromosomes.[2]

Roshan Nawaz
Pharm D Intern

Gene Therapy

By modifying, replacing, or repairing faulty genes, genetic therapies provides a revolutionary approach to treating conditions like spinal muscular atrophy, hemophilia, and even cancer.

Key Strategies in Gene Therapy:

1. **Gene Replacement:** Replacing a faulty or missing gene with a healthy copy to restore normal function.
2. **Gene Editing:** Using tools like CRISPR-Cas9 to precisely modify faulty genes by correcting mutations.
3. **Gene Silencing:** Inactivating or "turning off" a malfunctioning gene that causes disease.
4. **Gene Addition:** Introducing new or modified genes to help fight diseases or improve cellular function.[3]

Delivery Methods:

Gene therapy uses vectors to deliver genetic material into cells:

- **Viral Vectors:** Modified viruses (e.g., adenoviruses, lentiviruses) are commonly used to carry therapeutic genes.
- **Non-viral Methods:** Direct injection of DNA or RNA, or use of nanoparticles.

Applications of Gene Therapy: By targeting the root causes of diseases at the genetic level, gene therapy provides innovative and precise solutions for conditions that previously had limited treatment options. Here are some key applications:

- **Inherited Disorders:** Treating genetic diseases like cystic fibrosis, sickle cell anemia, or hemophilia.
- **Cancer:** Modifying immune cells (e.g., CAR-T therapy) to target and destroy cancer cells.
- **Neurological Diseases:** Developing treatments for conditions like spinal muscular atrophy and Parkinson's disease.
- **Infectious Diseases:** Enhancing immune response to viruses, including HIV.

Introduction to Gene Therapy in India: India is steadily making advancements in gene therapy, leveraging its scientific talent and healthcare infrastructure to develop novel treatments. One of India's notable breakthroughs is the development of CAR-T cell therapy. India's first home grown CAR-T therapy, developed through collaboration between IIT Bombay, Tata Memorial Hospital, and the start up Immuno ACT, was launched in 2024. This innovation stands out for its affordability, being significantly cheaper than similar treatments available globally. The therapy exemplifies India's "Make in India" and "Atmanirbhar Bharat" initiatives, highlighting a successful academia-industry partnership. [4]

Challenges and considerations

1. **Safety:** Off-target effects in gene editing and immune reactions to viral vectors need mitigation.
2. **Cost:** High costs limit accessibility, especially in low-resource settings.
3. **Infrastructure and Expertise:** The need for specialized equipment and trained professionals limits the widespread implementation of gene therapy treatments.
4. **Ethical Misuse:** Technologies for gene editing could be misused for non-therapeutic purposes, such as enhancing physical traits, intelligence, or athletic ability, sparking debates on eugenics. [5]

Conclusion

Genomics and gene therapy symbolize the forefront of medical innovation, offering hope for curing previously untreatable conditions. While challenges persist, continued research and collaboration among scientists, clinicians, and policymakers will ensure these technologies achieve their full potential in transforming global health.

References

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3. Sheikh Shahnawaz Quadir, Devendra Choudhary, Supriya Singh, Deepak Choudhary, Min-Hua Chen, Garima Joshi,Genetic frontiers: Exploring the latest strategies in gene delivery, Journal of Drug Delivery Science and Technology,Volume 101, Part B, 2024, [Cited 2024 Nov 2]

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Alert

Centre Urges Snakebites as Notifiable Disease

Notifiable Disease - Snakebite Envenomation

The Centre has urged all states to make snakebite cases and deaths a "notifiable disease" under relevant provisions of the State Public Health Act or other applicable legislation making it mandatory for all government and private health facilities (including medical colleges) to report all suspected, probable snakebite cases and deaths.

This decision is part of a broader effort to address snakebite cases are treated with the urgency they require, ultimately improving outcomes for affected individuals. A Government Order (G.O) was issued in this regard by the Health and Family Welfare Department on November 4.

On 6th November Government of Tamil Nadu has also declared "Snake Bite" as a notifiable disease in the State of Tamil Nadu under the Tamil Nadu Public Health Act 1939, after the government order was issued by the Health and Family Welfare Department.

Source: https://cms.tn.gov.in/cms_migrated/document/press_release/pr081124_e_1884.pdf

63rd NATIONAL PHARMACY WEEK CELEBRATION

The 63rd National Pharmacy Week was celebrated with great enthusiasm and grandeur by C.L. Baid Metha College of Pharmacy on 22nd November 2024. The event was graced by the esteemed presence of **Chief Guest Dr. Kanimozhi NVN Somu,** Member of Parliament, and **Dr. Ezhilan Naganathan,** Member of Legislative Assembly.

One of the most significant moments of the celebration was the presentation of the "Excellence in Supply Chain Management" award to **Shri S.S. Vanangamudi, Chairman and Managing Director of Apex Laboratories Ltd.** This recognition highlighted his outstanding contributions to the field of pharmaceutical supply chain management.


Chief Guest Dr. Kanimozhi NVN Somu, Member of Parliament &
Dr. Ezhilan Naganathan, MLA. at National Pharmacy Week Celebration on 22nd November 2024.

Mr. S.S. Vanangamudi Chairman and Managing Director of Apex Laboratories Ltd, received Excellence in Supply Chain Management" award from **Dr. Kanimozhi NVN Somu,** Member of Parliament. .


Welcome dance and skit performance by Pharm D students at
National pharmacy Week celebration on 22nd November 2024.

Nafithromycin- India's First Indigenous Antibiotic to Combat AMR

KNOW ABOUT THE DRUG

In a ground breaking step for India's biotechnology sector, Union Minister Dr. Jitendra Singh formally launched the first indigenous antibiotic "Nafithromycin" for resistant infections on 20th November 2024.

The antibiotic "Nafithromycin" has been developed with the support of "Biotechnology Industry Research Assistance Council" (BIRAC), a unit of the Department of Biotechnology and expected to bring to market under the trade name "Miqnaf" by pharma company "Wockhardt". It is the country's first indigenously developed antibiotic aimed at tackling Antimicrobial Resistance (AMR).

Source: http://www.uniindia.com/~/nafithromycin-india-s-first-indigenous-antibiotic-to-combat-amr/Business%20Economy/news/3340205.htm

WEBSITE OF INTRESTS

https://cpicpgx.org/

The Clinical Pharmacogenetics Implementation Consortium (CPIC) is an essential resource for Pharm D professionals in clinical pharmacy. It provides freely accessible, evidence-based guidelines that translate genetic test results into actionable prescribing decisions. CPIC promotes implementation of pharmacogenomics through peer-reviewed, standardized recommendations, supporting personalized medicine in patient care.

https://www.pharmgkb.org/about

PharmGKB is a comprehensive pharmacogenomics resource that curates data on gene-drug interactions, genetic variants, and drug pathways. It provides annotated guidelines, FDA drug labels, and dosing recommendations, enabling the integration of genetic insights into drug response understanding. This platform supports personalized medicine and advances pharmacogenomics research and implementation.

Prepared by, Dr. Keren Ann George, Assistant Professor

Monthly Drug Safety Alert

The analysis of Adverse Drug Reactions (ADRs) from the PvPI database revealed the following;

File No./ Dated	Suspected Drugs	Indications	Adverse Drug Reaction
File No. P.17019/03/2024-DSA Dated; December 26, 2024	Beta-blockers (Metoprolol, Propranolol, Atenolol)	**Metoprolol:** For the treatment of essential hypertension in adults, functional heart disorders, migraine prophylaxis, cardiac arrhythmias, prevention of cardiac death and reinfarction after the acute phase of myocardial infarction, stable symptomatic CHF and angina pectoris. **Propranolol:** For the treatment of cardiac arrhythmias; tachycardia; hypertrophic obstructive cardiac myopathy; pheochromocytoma; thrombosis; management of angina; essential and renal hypertension; prophylaxis of migraine. **Atenolol:** For the treatment of hypertension, angina pectoris, cardiac arrhythmias	Hypokalaemia
File No. P.17019/03/2024-DSA Dated: November 28, 2024	Amphotericin B	1. Treatment of Febrile Neutropenia in cancer patients. 2. Treatment for invasive fungal infection in patients, who are refractory to or intolerant of conventional Amphotericin B therapy. 3. Indicated for the treatment of Visceral Leishmaniasis.	Hyperkalaemia
	Carbimazole	Indicated for the treatment of thyrotoxicosis including thyrotoxicosis crisis.	Agranulocytosis

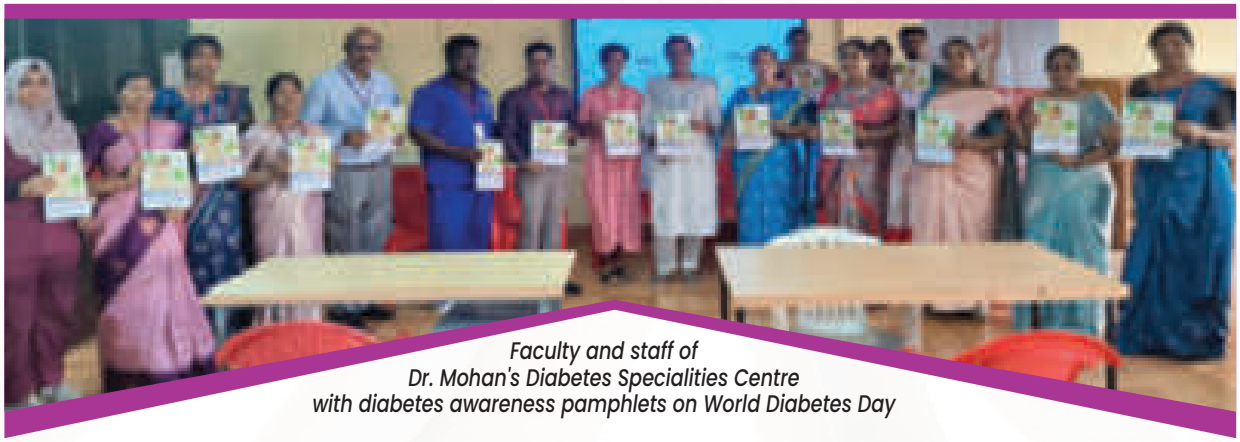
Source: http://www.ipc.gov.in

DEPARTMENTAL ACTIVITIES

World Diabetes Day 2024

In observance of World Diabetes Day 2024,
C.L. Baid Metha College of Pharmacy organized a free medical camp on 18th November 2024.
This event was conducted in collaboration with Dr. Mohan's Diabetes Specialities Centre,
highlighting the importance of proactive healthcare and diabetes management.
The camp received an overwhelming response, with 100 participants
actively availed the free services and gained valuable insights into their health.

Principal **Dr C N Nalini**, *Vice Principal* **Dr N Ramalakshmi**, *and faculty checking blood glucose level in the free medical camp conducted on world diabetes Day on 18th November 2024*



Faculty and staff of
Dr. Mohan's Diabetes Specialities Centre
with diabetes awareness pamphlets on World Diabetes Day

Congratulations

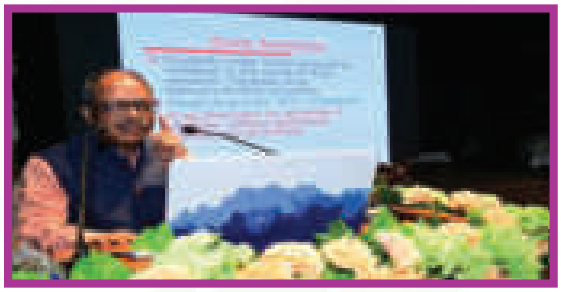
Pharm D Interns
M. Jasper Victoria, R. Sriram R & V. Vaishnavi
secured First place in the Quiz competition conducted on theme "Antibiotics" at SRM Medical college" on 14 November 2024

DEPARTMENTAL ACTIVITIES

PHARM D INDUCTION 2024

Chairman **Mr. Srinivasan R,** *Prinicipal* **Dr. C N Nalini**, *and Chief Guest* **Mr M Radha krishnan,** *Vice President (retd) Apex Laboratory Pvt Ltd at the Pharm D Induction Program conducted on 4th December 2024*

Faculty, Pharm D first Year students & Parents attended Pharm D Induction Program on 4th December 2024



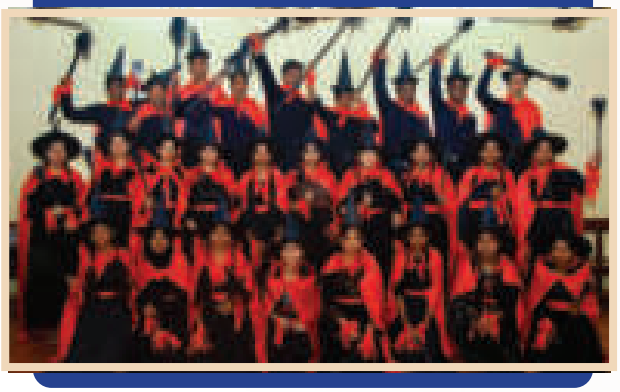
As a speaker, **Dr Guru Prasad Mohanta** *Professor & Head, Department of Pharmacy Practice delivered lecture on" Ethical and Legal Issues in Clinical Trials" at the 2nd International Conference, "**Modern Tools and Approaches in the Emerging Field of Pharmaceutical and Biomedical Research**" organised by Department of Pharmaceutical Technology, JIS University, Kolkata, held during November 20-22, 2024.*

Dr. Guru Prasad Mohanta, *delivered a lecture on Career Opportunities for Pharmacy Graduates to freshers B. Pharm. students at Institute of Pharmacy & Technology, Salipur, Odisha, on 26th November 2024.*

CELEBRATIONS

A grand fresher's program & farewell day was celebrated on 12th December 2024, where "Tesoro'22 " -the Pharm D 4th year students organised a perfect welcome to the freshers' and a memorable farewell to the outgoing batch (mixpah)

FRESHERS' DAY



MEMORABLE FAREWELL TO MIXPAH

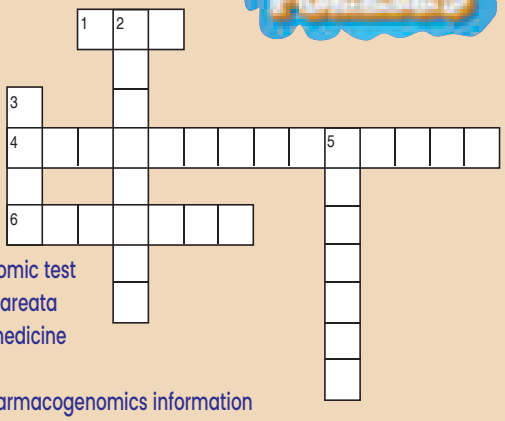
STUDENTS CORNER

- Prepared by, **Dr. Dhivya K, Assistant Professor**

CROSSWORD PUZZLES

Send your answers to pharmatabclbaid@gmail.com

First five winners name will be displayed in the next issue



Across
1. The most comprehensive pharmacogenomic test
4. For treating adults with severe alopecia areata
6. The first FDA-approved CRISPR-based medicine

Down
2. The central knowledge repository for pharmacogenomics information
3. a resource to understand the molecular features influencing drug response in cancer cells
5. a personalized medicine for treating adults with metastatic synovial sarcoma

Winners

of Previous Issue
(September - Volume 5 issue 3)

Congratulations

1. **K. Bhavadharini**
   Pharm D Intern
2. **Pratibha N**
   Pharm D Intern
3. **Shivaani M S**
   Pharm D 3rd Year
4. **Vinod Kumar**
   Pharm D 3rd Year
5. **Nandhini**
   Pharm D 2nd Year

Answer for the Word Puzzle previous issue (September 2024, Volume 5, Issue 03)

Across	*Down*
4. Nociplastic	1. MR Rajagopal
5. Nalmefene	2. United kingdom
6. Tapentadol	3. Dexmedetomidine

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