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CSIR-Central Drug Research Institute

# Annual Report 2023-24


csir.cdri | www.cdri.res.in | director@cdri.res.in

## CSIR-Central Drug Research Institute

Fundamental Science
Driven Innovation

# Editorial Board



# Acknowledgement

Editorial board sincerely thanks and acknowledges all those who have extended their generous support, advice and help in the preparation of the Annual Report 2023-24. We are grateful to all the Area Coordinators and Heads/ In Charge of Divisions/ Units, Administration for the timely submission of inputs and for the support.

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सीएसआईआर
CSIR
भारत का नवाचार इंजन
*The Innovation Engine of India*

# ANNUAL REPORT

# 2023-24

CSIR-Central Drug Research Institute


**CSIR-Central Drug Research Institute**

Sector 10, Jankipuram Extension, Sitapur Road, Lucknow 226031

Phone: +91-(522)-2771940 / 2772550

Fax: +91-(522)-2771941

Website: www.cdri.res.in

# Organizational Structure

**Hon'ble Prime Minister**
**President, CSIR**

**Hon'ble Minister of S & T**
**Vice President, CSIR**

**Dr. N. Kalaiselvi**
Director General, CSIR & Secretary DSIR

**Research Council** → **Dr. Radha Rangarajan**
Director, CSIR-CDRI ← **Management Council**

### State of the Art Facilities

- Common Research and Technology Development Hub
- GLP Test Facilities for Pharmaceuticals
- Knowledge Resource Centre
- Medicinal Plant Herbarium Facility
- National Laboratory Animal Facility
- Sophisticated Analytical Instrument Facility

### Knowledge Management Groups

- Academic Affairs Unit
- Business Development and Intellectual Property Unit
- Human Resource Development Group
- Scientific Directorate

### Technical Infrastructure Groups

- Computer Centre
- Centralized Utility Services
- Instrumentation
- Auditorium
- Laboratory Engineering Services

### R&D Divisions

1. **Biochemistry & Structural Biology**
2. **Cancer Biology**
3. **Endocrinology**
4. **Medicinal and Process Chemistry**
5. **Molecular Microbiology & Immunology**
6. **Neuroscience and Ageing Biology**
7. **Pharmaceutics & Pharmacokinetics**
8. **Pharmacology**
9. **Toxicology & Experimental Medicine**
10. **Virus Research & Therapeutics**

### General Administration and Facilities

- Administration
- Accounts
- Stores & Purchase
- CSIR Dispensary
- Canteen

### Field Station

- CDRI Clinical Pharmacology Unit, Seth G.S. Medical College, Mumbai
- KGMU, Lucknow
- PGIMER, Chandigarh

# Contents

## Vision

To drive discovery and development of cutting edge and affordable healthcare technologies

CSIR-INDIA
सीएसआईआर
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The Innovation Engine of India

CSIR-Central Drug Research Institute

## Mission

Discovery and development of therapeutics for nationally important diseases with global impact, understanding fundamental disease biology and training future drug researchers

## Mandate

- ✓ To discover and develop new drugs in the area of national priorities with a futuristic vision
- ✓ To systematically explore natural resources for therapeutic potential, and development of phytopharmaceuticals / botanicals
- ✓ To serve as a national nodal center for drug discovery and pre-clinical development to translate 'leads' to 'candidate drugs'
- ✓ To provide co-working platforms, process technologies and consultancy to the healthcare industry
- ✓ To conduct cutting-edge research in disease biology to identify novel druggable targets and pathways
- ✓ To develop biotherapeutics for diseases of national importance
- ✓ To develop novel disease markers and diagnostics
- ✓ To protect traditional knowledge (intellectual property) and disseminate new knowledge
- ✓ To develop globally employable human resource specializing in diverse areas of drug discovery and development

# Director's Message

It is an honour and a privilege to present the Annual Report of the CSIR-Central Drug Research Institute for the financial year 2023-24.

I take this opportunity to express my heartfelt thanks to the CSIR-CDRI Research Council 2020-23, chaired by Prof. Goverdhan Mehta, former Director, IISc, Bengaluru and former Vice Chancellor, University of Hyderabad, for guiding the research programs of CSIR-CDRI. I also take this opportunity to cordially welcome the new Research Council 2023-26 headed by Dr. T.S. Balganesh, who has several decades of biomedical research experience in industry and academia. We look forward to working closely with the new Research Council as we strive to achieve the mission of the institute.

CSIR-CDRI's basic and translational research activities span 8 therapeutic areas: Microbial Infections, Parasitic Infections, Viral Infections, Cancer, Metabolic Disorders, Musculoskeletal Health and Disorders, Neurological Disorders and Reproductive Health. An overview of the research programs is provided below.

**(i) Missions, Healthcare theme programs and Grant-in-aid projects**

During the year, we participated in 8 CSIR Mission Programs. We played a key role in the following Missions: PAN CSIR Cancer Mission focused on affordable cancer therapies (nodal laboratory), API Mission focused on indigenised, economical process technologies for life saving drugs, Antiviral Mission focused on identifying novel therapies for emerging viral infections, IND Mission and Phytopharmaceutical Mission aimed at fast tracking studies for IND filings.

The Institute completed Two projects under 'New Millennium Indian Technology Leadership Initiative' scheme. One project was aimed at IND enabling studies of an anti-stroke phytopharmaceutical and the other, in collaboration with an industry partner, focused on establishing efficacy and completing preclinical studies for a phytopharmaceutical for bone health.

Under the healthcare theme, Six Niche Creating Projects (NCP), One Fast Track Translational Project and Two CSIR-First projects progressed towards their objectives.

During the year, a total of 126 Grant-in-Aid/Collaborative projects were implemented, which included grants from 15 national and international funding agencies through 34 different schemes. During the year, 46 externally funded projects with a total approved budget of 42.77 Crore were initiated. Compared to the financial year 2022-23, total ECF secured for 2023-24 is 192 % higher. We acknowledge the sincere efforts of our scientists in achieving this

milestone.

Amongst the newly funded projects, we are privileged to receive a Grant from the Bill and Melinda Gates Foundation to validate targets for non-hormonal contraception.

We gratefully acknowledge strategically important collaborative projects from DRDO-INMAS to conduct preclinical safety and toxicology studies on compounds with radioprotective properties to enable regulatory filings.

**(ii) New research initiatives**

In order to strengthen the preclinical pipeline of the institute, a new scheme was initiated. Proposals aimed at identifying target specific compounds, validating mechanisms of action or establishing proof of concept for novel compounds were invited from teams of scientists across 2 or more divisions. A total of 35 projects were funded and those with promising data will continue to receive funding for another year, if not funded by external agencies.

**(iii) Collaborations**

In order to expand and diversify our research, we have been entering into agreements with external institutions. In the last year, we signed two Technology Transfer Agreements, One Grant Agreement, 7 Sponsored Project Agreements, One consultancy, 4 Memorandum of Cooperation Agreements, 15 Memorandum of Understanding for joint R&D, Two Collaborative Research Agreements, 31 Confidential Disclosure Agreements, 6 Clinical Trials Agreements, 5 Memorandum of Agreements with Department of Biotechnology, and 3 joint IP Agreements with different academic institutions, industries, and companies. These collaborations are poised for positive impact on the outcomes from the Institute.

**(iv) Technology transfers**

I am delighted to report that we transferred a novel ophthalmic formulation for fungal keratitis to Cipla Limited on February 12th, 2024. Globally, approximately 1.2 million cases of fungal keratitis are reported every year. Existing therapies have limitations, such as the need for prolonged and frequent use of drugs and emerging drug resistance. The CDRI formulation has demonstrated faster resolution of the infection in preclinical studies. Cipla Ltd. will scale up the product, conduct the required studies and seek regulatory approvals for commercialization.

Another technology, Phosphoramidite-based fluorescence quenchers was transferred to ESS CEE Biotech Pvt. Ltd on 17th February, 2024 for commercialization in the US and European markets. The novel quencher with a broad absorption property has been designed to match the emission characteristics of a wide range of fluorophores and can be used in PCR-based diagnostics and nucleic acid based biomedical research.

**(v) IP**

A total of 6 patents were filed in India and 10 applications filed abroad. During the year, 6 Indian patents were granted by the authority. Filed patents include a promising SMAC mimetic for cancer, genetically attenuated parasite line for malaria, PCSK-9 inhibitor for dyslipidemia, a promising anti-filarial lead series and PARP inhibitors for cancer. Institute is focussing on the further developmental studies of these leads.

**Research and development activities**

**(i) Clinical and preclinical pipeline**

I am happy to share that Cipla received IND approval for L-Ormeloxifene, the L-isoform of Centchroman. This drug was licensed to Cipla on the basis of a collaborative agreement initiated in 2019. Cipla intends to conduct a bioequivalence trial in the near future. S007-1500, an NCE licensed to Troikaa, is scheduled to start a Phase 1 study. The academic clinical trial for Centinhale, an oral dry powder inhalation product of Rifabutin + Isoniazid has been delayed due to difficulties in obtaining the API. This issue has now been overcome and the study is expected to start shortly.

Umefenovir, repurposed for Covid-19 and licensed to Medizest Pvt. Ltd., completed all Phase 3 trials and is now awaiting marketing authorization from CDSCO.

The Phase 3 trial for Picroliv, a phytopharmaceutical for Non-alcoholic fatty liver disease has been delayed but will be initiated in the new FY.

In terms of the preclinical pipeline, Regulatory toxicity studies for compounds S011-1793 for malaria, S016-1348 for colon cancer and Chebulinic acid enriched extract for benign prostatic hyperplasia (Phytopharmaceutical) are ongoing. 96/261 is on hold until further data to establish differentiation is established.

In addition, there are 4 advanced leads, all first-in-class. This includes CDRI4-105 for chemotherapy-induced neuropathic pain; S017-622 for dyslipidemia; S016-1271 for resistant infections; and GS/IICT5/6 (anti-angiogenic).

In the phytopharmaceutical pipeline, leads for stroke and fracture healing, both enriched extracts of different parts of the *Withania* plant are being characterized as per the Phytopharmaceutical Act, 2015. Regulatory toxicity studies have been initiated.

**(ii) Diagnostics**

Our scientists have shown a strong interest in developing diagnostics products. Three new diagnostic proposals, one for Triple negative breast cancer, one for cervical cancer and one for "monsoon fever" (Dengue, Chikungunya, Malaria, and Typhoid) are in the laboratory validation phase. In the coming year, based on emerging data, their suitability for prospective clinical trials will be ascertained.

**(iii) Research output**

During the year, 275 research papers were published with an average Impact Factor of 4.80, on par or exceeding our previous record. This includes 9 publications with an Impact Factor of more than 10 and 102 Publications with IF more than 5.

**(iv) Learning activities**

We introduced 2 new speaker series to give CDRI scientists, students and staff exposure to cutting edge research in India. The first series called "Innovation in Health" is aimed at bringing speakers whose research is multi-disciplinary and has a strong translational focus. The inaugural speaker was Dr Gaurav Ahuja, (Associate Professor, IIIT Delhi). The second series is focused on clinical research is intended to connect basic and clinical research. Dr Vineet Ahuja (Professor, MD, DM, MNAMS, Department of Gastroenterology, AIIMS, New Delhi) presented his work on Inflammatory bowel disease. In addition, all our faculty have the opportunity to present their work in the faculty colloquium, held twice a month.

**(v) Special facilities**

The unique facilities at CSIR-CDRI such as DSIR Common Research and Technology Development Hub (CRTDH) equipped with the R&D Scale Formulations Manufacturing Facility and a Drug Testing Lab (DTL), Bioanalytical Facility for Preclinical and Clinical Pharmacokinetics' and GLP Test Facility for Pharmaceuticals continued to provide services to academic and research institutions and companies. CRTDH has provided services to 41 pharmaceutical companies. In the GLP test facility, a total of 22 studies were conducted.

Through the Knowledge Resource Centre, a Digital Access Zone has been created to cater the needs to biomedical researchers for international journals and databases. This facility conducted 12 training programs to the researchers on use and applications of various available databases and software.

The National Laboratory Animal Facility supplied a total of 22,782 experimental animals to researchers from CSIR-CDRI and external CCSEA registered users. During the year, the breeding facility was renovated and modernized with state of the art features and IVC cages.

The Sophisticated Analytical Instrument Facility has provided service to about 75 internal and 350 external users. More than 90% of the external users comprise researchers from universities and colleges in India. The facility analysed a total of 63,180 samples during the year.

**Human Resource Development**

**(i) PhD program**

During the year 2023-24, 72 research scholars joined the Institute and 68 research scholars submitted their PhD thesis.

**(ii) Skill development programs**

Skill development courses have been designed to meet the aspirations of students, young researchers, and industry personnel. CSIR-CDRI offered training in Advanced Spectroscopic (NMR, HPLC, LC-MS, UV/IR) Techniques, Computational Approaches to Drug Design and Development, Pharmaceutical Product Development and Quality Control etc., which included theory and hands-on learning. During this period, 360 aspirants from more than 145 colleges/institutes from different parts of the country have participated.

**(iii) Scientific social responsibilities**

We continue to fulfil our scientific-social

responsibilities through outreach programs. We conducted 90 programs in different villages of Uttar Pradesh. As a part of Jigyasa and scientific social responsibility activities, more than 53 programs were conducted. These programs benefitted more than 12,000 students, 1500 faculty and 10,000 members of the general public.

**(iv) Women-centric initiatives**

Gender Advancement for Transforming Institutions (GATI) program is a major initiative of the Department of Science and Technology to promote gender equity through the removal of the structural, social, and cultural barriers that prevent stakeholders (students, faculty, and staff) from achieving professional excellence. I am delighted to report that the CSIR-CDRI has received GATI achiever recognition by DST in July 2023.

During the last year, we expanded the crèche to enable families with young children have high quality care for their children. We conducted a team building workshop to create cohesiveness and undertook a series of events to mark International Women's Day. Starting with a logo competition and ending with a panel discussion, the learning was that there is a leaky pipeline for women in science and a need to address gender bias through cultural change.

**Budget and financial resources**

We are grateful for the support from CSIR under the regular budget heads for the last financial year. In addition, the Institute generated Rs. 28 Crore of ECF and added Rs. 4.34 crores to the lab reserves.

**Future plans**

The priorities of the Institute are to develop the late preclinical stage candidates to IND filings, initiate clinical development for IND approved candidates and stimulate early translational projects to fill the R&D pipeline. This requires dedicated funding and a well-defined strategy for progression. We will make focused efforts to identify public and private funds to support these goals. Further, we will continue to support basic research activities, build capabilities in advanced technologies and broaden our collaborations to bring in complementary research expertise. However, headwinds in the form of recruitment delays and uncertain funding continue to pose major challenges.

The impact of our work can be realized only if our IP is licensed and transferred to industry. To this end, we will continue to engage with industry and seek their inputs on ongoing R&D projects. Further, we will work with industry partners to seed new ideas with joint contributions from both sides leading to product development.

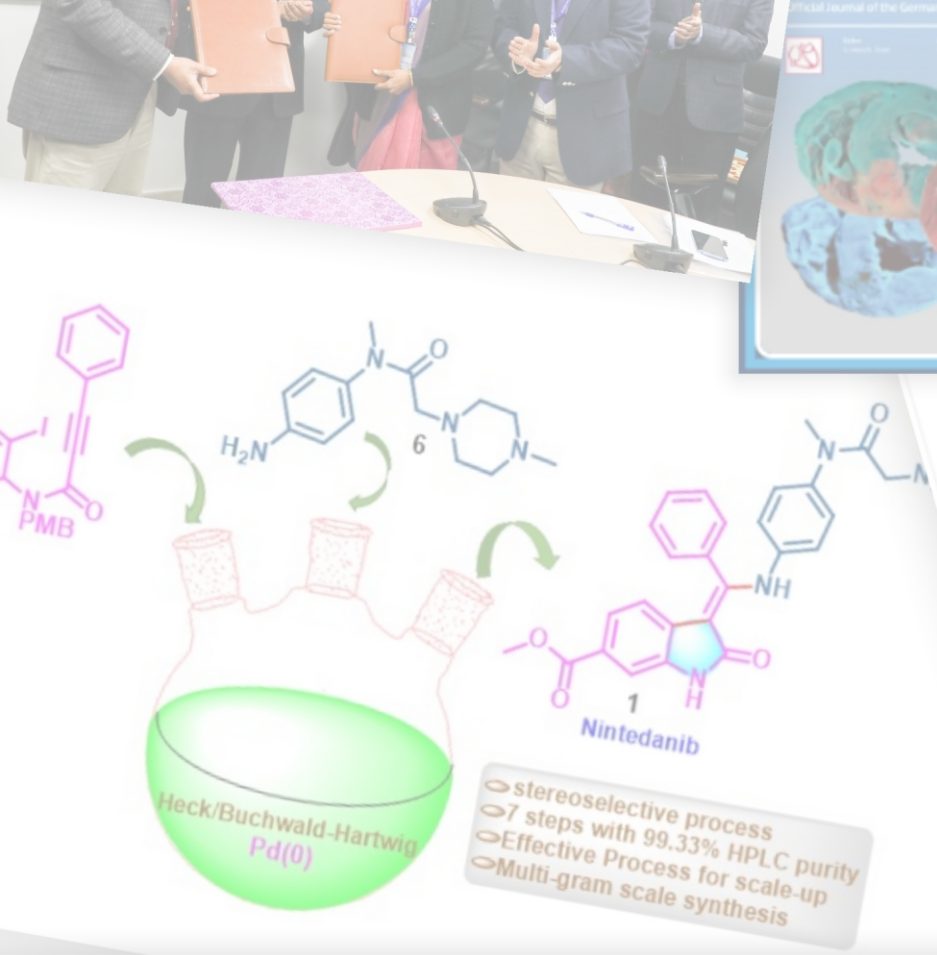
I take this opportunity to express my sincere gratitude to all members of the CDRI community for their sustained and dedicated efforts to deliver on the mandate of the Institute.

- Radha Rangarajan

# Executive Summary and R&D Highlights


Vice President CSIR,
26th December, 2023


asic Research in
Cardiology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7 steps with 99.33% HPLC purity
Effective Process for scale-up
Multi-gram scale synthesis


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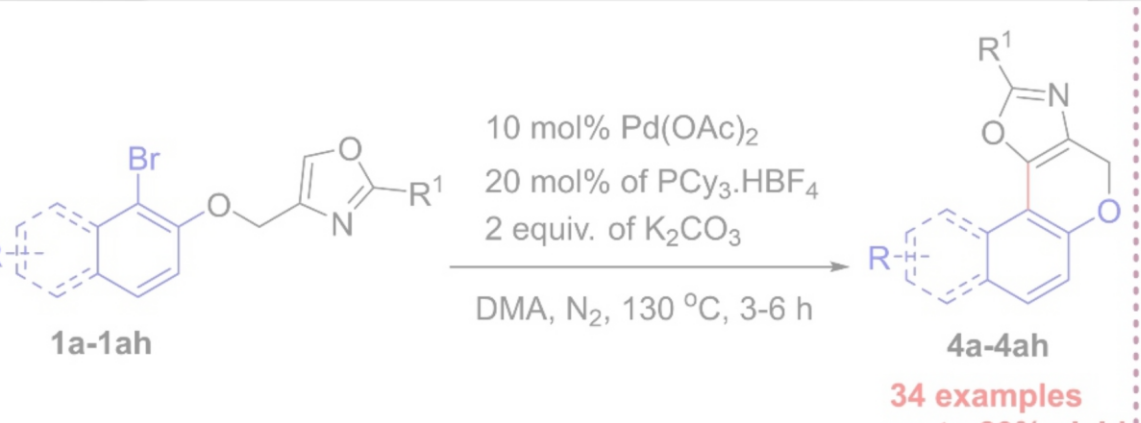
REDOX
BIOLOGY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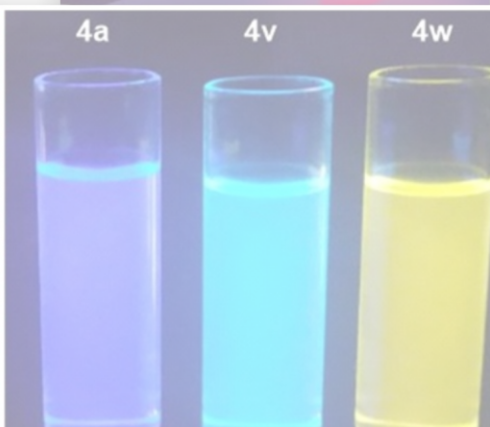
34 examples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## Highlights of Achievements 2023-24

| | | |
|---|---|---|
| **Products & Technologies** | | |
| Technology Transfer | : | • Ophthalmic Formulation of Amphotericin B transferred to CIPLA Limited, Mumbai on 12 February 2024<br>• Phosphoramidite-based Fluorescence Quenchers with flexible functional modifications for biomedical applications transferred to Esscee Biotech (India) Pvt. Ltd., Lucknow on 21 February 2024 |
| Candidate Drugs under clinical trial | : | • Umifenovir (Anti-viral) in Phase III<br>• Picroliv (Treatment of NAFLD) in Phase III<br>• S007-1500 (Fracture healing) in Phase I<br>• S007-867 (Anti-thrombotic) in Phase I<br>• Centinhale (Anti-tubercular) in Phase I (academic)<br>• L-Ormeloxifene (Contraception) in Phase I |
| **Publications in SCI Journals** | | |
| Total Number | : | 275 |
| Average Impact Factor | : | 4.80 |
| Publications with >10 Impact Factor | : | 09 |
| Publications with >5 Impact Factor | : | 102 |
| **Patents** | | |
| Filed in India | : | 06 |
| Filed Abroad | : | 10 |
| Granted in India | : | 06 |
| **Human Resource Development** | | |
| Ph.D. Thesis Submitted | : | 68 |
| Post-graduate / Skill Trainees | : | 360 |
| **New Projects** | | |
| Grant-in-Aid & Sponsored Projects Initiated | : | 46 |
| Total Approved Cost of the Grant-in-Aid & Sponsored Projects Initiated (ECF) | : | Rs. 42.77 Crore |

## Therapeutic Research Areas

- Microbial infections
- Viral infections
- Parasitic infections
- Neurological disorders
- Metabolic disorders
- Musculoskeletal health and disorders
- Cancer
- Reproductive health

## Activity Portfolio

### Discovery & Development

- Drugs
- Indigenous Process Technologies
- Diagnostics

### Fundamental Research

- Disease biology in the areas of national importance
- Chemistry

### Human Resource Development

- Doctoral and Post-Doctoral Training
- Post-graduate Training and Skill Development

### Scientific and Technical Services

- CRTDH – Drug Testing Lab
- GLP Test Facility
- Biological Screening
- Sophisticated Analytical Instruments

# Product Pipeline

## Small molecule

| Phytolead | Indication | Lead Optimization | IND Enabling studies | IND Filed | Phase I Clinical | Phase II Clinical | Phase III Clinical |
|---|---|---|---|---|---|---|---|
| **Umifenovir** (Licensed) | COVID-19 | | | | | | |
| **S-007-1500** (Licensed) | Fracture healing | | | | | | |
| **L-Ormeloxifene** (Licensed) | Female contraceptive | | | | | | |
| **S-007-867** (Licensed) | Thrombosis | | | | | | |
| **S-011-1793** | Malaria | | | | | | |
| **S-016-1348** | Cancer | | | | | | |
| **SB-CDRI4-105** | Chemotherapy induced neuropathic pain | | | | | | |
| **S-017-622** | Cardio Vascular Disorders | | | | | | |
| **GS/IICT5-6** | Antiangiogenic | | | | | | |
| **S-016-1271** | Complicated UTI | | | | | | |
| **S-019-0277** | Filariasis | | | | | | |

## Phytopharmaceuticals

| Phytolead | Indication | Lead Optimization | IND Enabling studies | IND Filed | Phase I Clinical | Phase II Clinical | Phase III Clinical |
|---|---|---|---|---|---|---|---|
| **Picroliv** | Non-alcoholic fatty liver disease | | | | | | |
| **NMITLI -118 AF1** | Stroke | | | | | | |
| **Chebulinic Acid Enriched Fraction** (Licensed) | Benign Prostatic Hyperplasia | | | | | | |
| **NMITLI -118 WFA** (Co-development with industry) | Bone health | | | | | | |
| **1703F003 4-HIL** | Polycystic Ovary Syndrome | | | | | | |

## Novel Formulations

| Formulation | API | Indication | Lead optimization | Subsequent New Drug Application | Phase I Clinical | Phase II Clinical | Phase III Clinical |
|---|---|---|---|---|---|---|---|
| **Centinhale** (Dry powder formulation) | Rifabutin and Isoniazid | MDR TB | | | | | |
| **Ophthalmic formulation** (Licensed) | Amphotericin | Fungal keratitis | | | | | |

# Breakthrough Achievement in 2023-24

## Transfer of Technology

### Technology for Corneal Targeted Ophthalmic Formulation of Amphotericin B for fungal keratitis transferred to CIPLA Limited, Mumbai on 12 February 2024

Globally, around 1.2 million cases of fungal keratitis are reported every year with tropical countries recording a higher incidence.

CSIR-CDRI has developed a prototype formulation for antifungal drug to enhance ocular bioavailability and reduce dose/dosing frequency. The prototype was designed by team of scientists Dr. Rabi Sankar Bhatta, Dr. Madhav Mugale, Dr. Sidharth Chopra and Dr. Sanjeev Shukla. In preclinical evaluation, the formulation exhibited rapid resolution of infection.

On 12 February, 2024, CSIR-CDRI and CIPLA Limited signed an agreement to jointly develop this novel ophthalmic formulation for fungal keratitis. The collaboration aims to leverage the combined expertise and resources of both the organizations to develop a safe and efficacious drug for fungal keratitis. CSIR-CDRI inventors demonstrated the technology and document was handed over to the CIPLA team during 26-28 February 2024.

**Photo:** Licensing agreement signed in presence of Dr. Y. K. Hamied, Non-Executive Chairman, CIPLA, Dr. Radha Rangarajan, Director, CSIR-CDRI and Team Members from CSIR-CDRI and CIPLA

**Photo:** Technology Transfer Document handed over to the representatives from CIPLA by the CSIR-CDRI Team after successful demonstration of technology on 28 February 2024 on the occasion of National Science Day Celebrations

# Breakthrough Achievement in 2023-24

## Transfer of Technology

**Technology for new modified Phosphoramidite-based Quenchers Transferred to M/s ESS CEE Biotech (India) Private Limited, Lucknow on 28 February 2024**

On the occasion of the National Science Day celebration at CSIR-CDRI, the technology for new modified phosphoramidite-based quenchers was transferred to M/s ESS CEE Biotech India Pvt. Ltd., Lucknow for manufacturing and commercialization of these reagents for life sciences research and biomedical applications.

Under the government initiative to develop cost-effective make-in-India chemical reagents and products, the team led by Dr. Atul Goel developed an economical route for phosphoramidite-based modified quenchers which are used as reagents for DNA/RNA research. The affordable indigenous technology will be used for manufacturing new nucleic acid reagents for biomedical research and development of cost-effective diagnostics.

Extensive applications of single- or dual-labelled phosphoramidite-based oligonucleotides in molecular biology research, and increasing demand of high quality oligonucleotide reagents in clinical therapeutics and diagnostics domain, CDRI technology may significantly catalyse economic growth and bolster India's standing in the global scientific community.

**Technology of Phosphoramidite-based modified Quenchers**

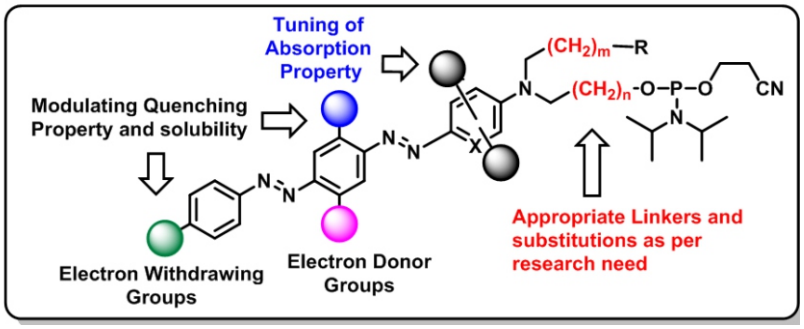



**Photo:** Technology Transfer Document handed over to Mr. Sanjay Srivastava, Assistant Director, M/s ESS CEE Biotech India Pvt. Ltd. Lucknow by Dr. Radha Rangarajan, Director, CSIR-CDRI and Dr. Atul Goel, Chief Scientist and Inventor on 28 February 2024 during National Science Day celebrations after successful demonstration of technology

# Some Important Publications - 2023

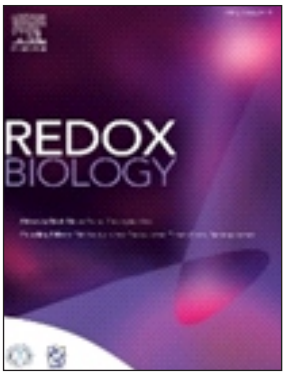
## Biological Sciences

| SN | Article Title | Author Names | Journal, Year, Volume (Issue), Page Numbers | IF |
|---|---|---|---|---|
| 1. | Loss of PERK function promotes ferroptosis by downregulating SLC7A11 (System Xc -) in colorectal cancer | Saini KK, Chaturvedi P, Sinha A, Singh MP, Khan MA, Verma A, Nengroo MA, Satrusal SR, Meena S, Singh A, Srivastava S, Sarkar J and Datta D. | **Redox Biology,** 2023, 65, 102833 | 11.4 |
| 2. | Musashi-2 causes cardiac hypertrophy and heart failure by inducing mitochondrial dysfunction through destabilizing Cluh and Smyd1 mRNA | Singh S, Gaur A, Sharma RK, Kumari R, Prakash S, Kumari S, Chaudhary AD, Prasun P, Pant P, Hunkler H, Thum T, Jagavelu K, Bharati P, Hanif K, Chitkara P, Kumar S, Mitra K and Gupta SK. | **Basic Research in Cardiology,** 2023, 118, 46 | 9.5 |
| 3. | The *Saccharomyces cerevisiae* SR protein Npl3 interacts with hyperphosphorylated CTD of RNA Polymerase II | Gupta A, Kumar A, Singh N, Sudarshan N, Studitsky VM, Zhan KYJ, Akhtar Md. S. | **International Journal of Biological Macromolecules,** 2023, 253, 127541 | 8.2 |
| 4. | TORC1 mediated regulation of mitochondrial integrity and calcium ion homeostasis by Wat1/mLst8 in *S. pombe* | Anjum S, Srivastava S, Panigrahi L, Ansari UA, Trivedi AK and Ahmed S. | **International Journal of Biological Macromolecules,** 2023, 253, 126907 | 8.2 |
| 5. | *Mycobacterium tuberculosis* Rv2324 is a multifunctional feast/famine regulatory protein involved in growth, DNA replication and damage control | Dubey S, Maurya RK, Shree S, Kumar S, Jahan F, Krishnan MY and Ramachandran R. | **International Journal of Biological Macromolecules,** 2023, 252, 126459 | 8.2 |
| 6. | Regulation of futile ligation during early steps of BER in *M. tuberculosis* is carried out by a β-clamp-XthA-LigA tri-component complex | Shukla A, Afsar M, Khanam T, Kumar N, Ali F, Kumar S, Jahan F and Ramachandran R. | **International Journal of Biological Macromolecules,** 2023, 255, 442 | 8.2 |
| 7. | Regulation of Atg8 membrane deconjugation by cysteine proteases in the malaria parasite *Plasmodium berghei* | Mishra A, Varshney A and Mishra S. | **Cellular and Molecular Life Sciences,** 2023, 80, 334 | 8.0 |
| 8. | CLUH functions as a negative regulator of inflammation in human macrophages and determines ulcerative colitis pathogenesis | Khan S, Raj D, Sahu S, Naseer A, Singh NC, Kumari S, Ishteyaque S, Sharma J, Lakra P, Mugale MN, Trivedi AK, Srivastava M, Chandra T, Bhosale V, Barthwal MK, Gupta SK, Mitra K, Nazir A, Ghoshal UC and Lahiri A. | **JCI Insight,** 2023, 8:e161096 | 8.0 |
| 9. | A glucuronated flavone TMMG spatially targets chondrocytes to alleviate cartilage degeneration through negative regulation of IL-1β | Kothari P, Dhaniya G, Sardar A, Sinha S, Girme A, Rai D, Chutani K, Hingorani L and Trivedi R. | **Biomedicine & Pharmacotherapy,** 2023, 163, 114809 | 7.5 |
| 10. | Combined immunotherapeutic effect of Leishmania-derived recombinant aldolase and Ambisome against experimental visceral leishmaniasis | Yadav K, Kumar N, Joshi S, Ratnapriya S, Sahasrabuddhe AA and Dube A. | **Journal of Microbiology Immunology and Infection,** 2023, 163-171 | 7.4 |

# Some Important Publications - 2023

## Chemical Sciences

| SN | Article Title | Author Names | Journal Year, Volume (Issue), Page Numbers | IF |
|---|---|---|---|---|
| 1. | Iridium-Catalyzed Enantioselective Allylic Substitution of Vinylcyclopropanes by Carboxylic Acids | Adhikari AS, Pandit S, Kant R and Majumdar N. | **ACS Catalysis,** 2023, 13, 6261-6267 | 12.9 |
| 2 | A scalable and eco-friendly total synthesis of poly(ADP-ribose) polymerase inhibitor Olaparib | Chatterjee I, Roy D and Panda G. | **Green Chemistry,** 2023, 25, 9097-9102 | 9.8 |
| 3 | A new class of teraryl-based AIEgen for highly selective imaging of intracellular lipid droplets and its detection in advanced-stage human cervical cancer tissues | Sharma CP, Vyas A, Pandey P, Gupta S, Vats RP, Jaiswal SP, Bhatt MLB, Sachdeva M and Goel A. | **Journal of Materials Chemistry B,** 2023, 11, 9922-9932 | 7 |
| 4 | Design and synthesis of novel halogen rich salicylanilides as potential antileishmanial agents | Lal J, Ramalingam K, Meena R, Ansari SB, Saxena D, Chopra S, Goyal N and Reddy DN | **European Journal of Medicinal Chemistry,** 2023, 246, 114996 | 6.7 |
| 5 | Design, synthesis and evaluation of novel pyrrole-hydroxybutenolide hybrids as promising antiplasmodial and anti-inflammatory agents | Pandey AR, Singh SP, Joshi P, Srivastav KS, Srivastava S, Yadav K, Chandra R, Bisen AC, Agrawal S, Sanap SN, Bhatta RS, Tripathi R, Barthwal MK and Sashidhara KV. | **European Journal of Medicinal Chemistry,** 2023, 254, 115340 | 6.7 |
| 6 | Discovery, SAR and mechanistic studies of quinazolinone-based acetamide derivatives in experimental visceral leishmaniasis | Ansari A, Seth A, Dutta M, Qamar T, Katiyar S, Jaiswal AK, Rani A, Majhi S, Kumar M, Bhatta RS, Guha R, Mitra K, Sashidhara KV and Kar S | **European Journal of Medicinal Chemistry,** 2023, 257, 115524 | 6.7 |
| 7 | Design, synthesis, and biological evaluation of quinoline-piperazine/ pyrrolidine derivatives as possible antileishmanial agents | Katiyar S, Ramalingam K, Kumar A, Ansari A, Bisen AC, Mishra G, Sanap SN, Bhatta RS, Purkait B, Goyal N and Sashidhara K. | **European Journal of Medicinal Chemistry,** 2023, 261, 115863 | 6.7 |
| 8 | Anti-adipogenic action of a novel oxazole derivative through activation of AMPK pathway | Mishra T, Gupta S, Rai P, Kh andelwal N, Chourasiya M, Kushwaha V, Singh A, Varshney S, Gaikwad AN and Narender T. | **European Journal of Medicinal Chemistry,** 2023, 262 | 6.7 |




## Research Highlights

### Loss of PERK function promotes ferroptosis by downregulating SLC7A11 (System Xc⁻) in colorectal cancer

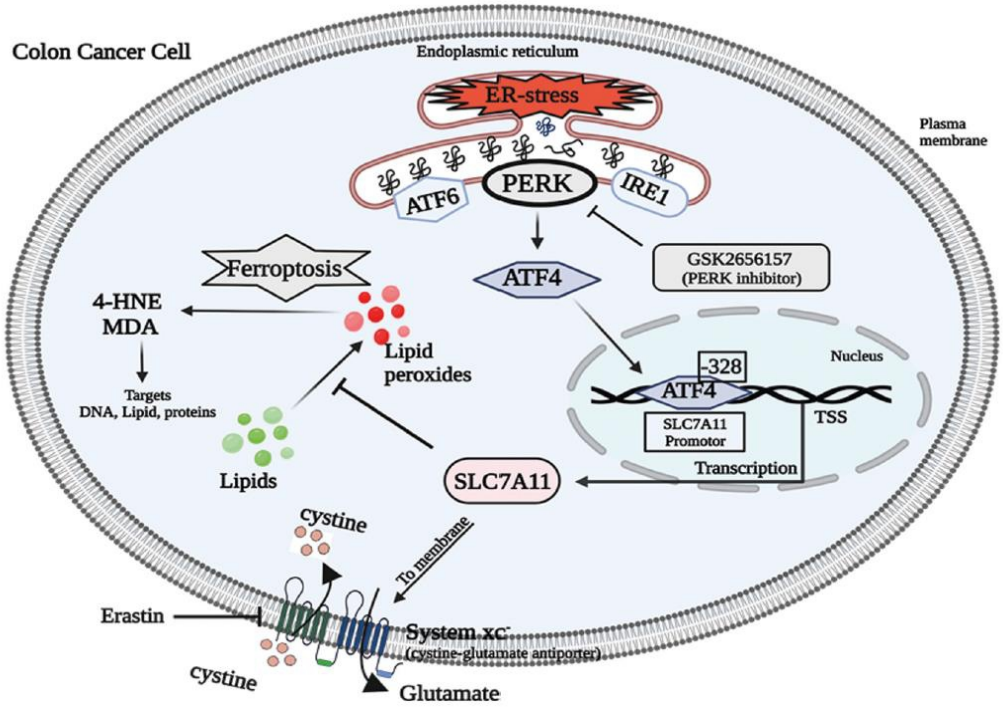
**Krishan Kumar Saini, Priyank Chaturvedi, Abhipsa Sinha, Manish Pratap Singh, Muqtada Ali Khan, Ayushi Verma, Mushtaq Ahmad Nengroo, Saumya Ranjan Satrusal, Sanjeev Meena, Akhilesh Singh, Sameer Srivastava, Jayanta Sarkar, Dipak Datta.**

**Redox Biology, 2023, 65, 102833**

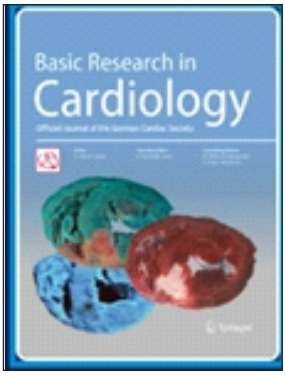
**Krishan Kumar Saini**

**Dr. Dipak Datta**

Ferroptosis, a genetically and biochemically distinct form of programmed cell death, is characterised by an iron-dependent accumulation of lipid peroxides. Therapy-resistant tumor cells display vulnerability toward ferroptosis. Endoplasmic Reticulum (ER) stress and Unfolded Protein Response (UPR) play a critical role in cancer cells to become therapy resistant. Tweaking the balance of UPR to make cancer cells susceptible to ferroptotic cell death could be an attractive therapeutic strategy. To decipher the emerging contribution of ER stress in the ferroptotic process, we observe that ferroptosis inducer RSL3 promotes UPR (PERK, ATF6, and IRE1$\alpha$), along with overexpression of cystine-glutamate transporter SLC7A11 (System Xc-). Exploring the role of a particular UPR arm in modulating SLC7A11 expression and subsequent ferroptosis, we notice that PERK is selectively critical in inducing ferroptosis in colorectal carcinoma. PERK inhibition reduces ATF4 expression and recruitment to the promoter of SLC7A11 and results in its downregulation. Loss of PERK function not only primes cancer cells for increased lipid peroxidation but also limits *in vivo* colorectal tumor growth, demonstrating active signs of ferroptotic cell death *in situ*. Further, by performing TCGA data mining and using colorectal cancer patient samples, we demonstrate that the expression of PERK and SLC7A11 is positively correlated. Overall, the experimental data indicate that PERK is a negative regulator of ferroptosis and loss of PERK function sensitizes colorectal cancer cells to ferroptosis. Therefore, small molecule PERK inhibitors hold huge promise as novel therapeutics and their potential can be harnessed against the apoptosis-resistant condition.



## Research Highlights




### Musashi-2 causes cardiac hypertrophy and heart failure by inducing mitochondrial dysfunction through destabilizing Cluh and Smyd1 mRNA

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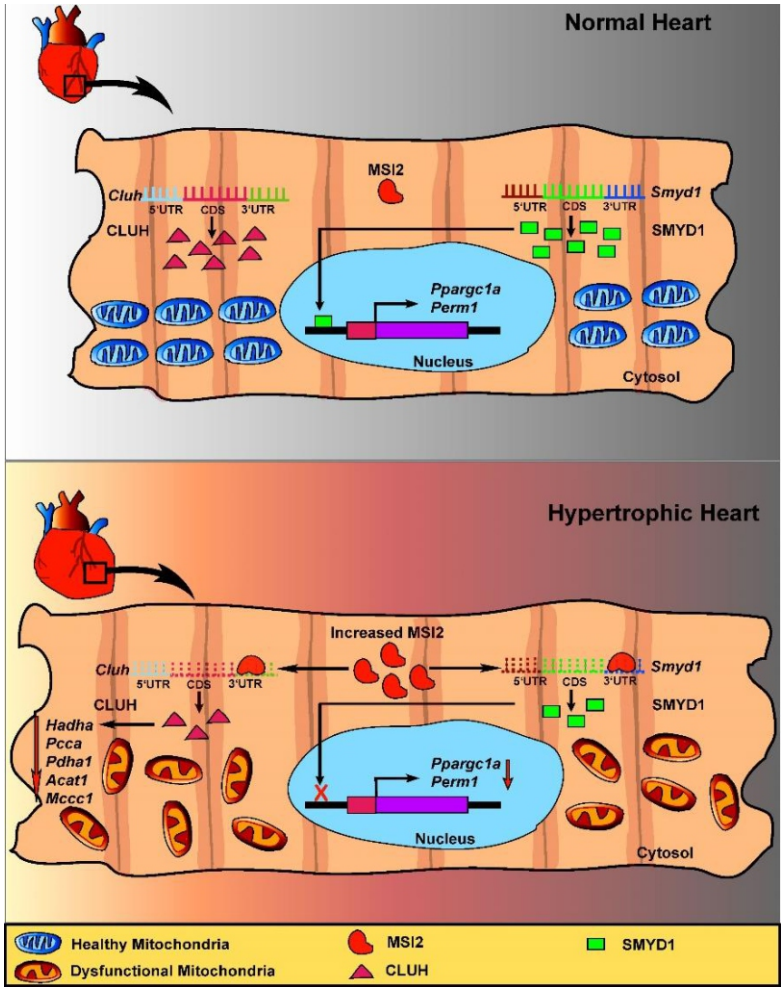
**Sandhya Singh, Aakash Gaur, Rakesh Kumar Sharma, Renu Kumari, Shakti Prakash, Sunaina Kumari, Ayushi Devendra Singh Chaudhary, Pankaj Prasun, Priyanka Pant, Hannah Hunkler, Thomas Thum, Kumaravelu Jagavelu, Pragya Bharati, Kashif Hanif, Pragya Chitkara, Shailesh Kumar, Kalyan Mitra, Shashi Kumar Gupta**

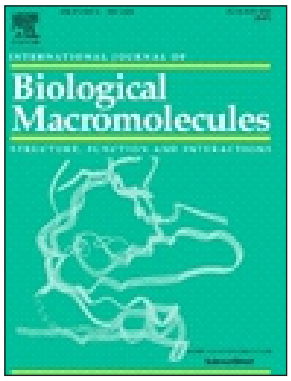
**Basic Research in Cardiology, 2023, 118, 46**

**Sandhya Singh**

**Dr. Shashi Kumar Gupta**

Regulation of RNA stability and translation by RNA-binding proteins (RBPs) is a crucial process altering gene expression. Musashi family of RBPs comprising Msi1 and Msi2 is known to control RNA stability and translation. However, despite the presence of MSI2 in the heart, its function remains largely unknown. Here, we aim to explore the cardiac functions of MSI2. We confirmed the presence of MSI2 in the adult mouse, rat heart, and neonatal rat cardiomyocytes. Furthermore, Msi2 was significantly enriched in the heart cardiomyocyte fraction. Next, using RNA-seq data and isoform-specific PCR primers, we identified Msi2 isoforms 1, 4, and 5, and two novel putative isoforms labeled as Msi2 6 and 7 to be expressed in the heart. Overexpression of Msi2 isoforms led to cardiac hypertrophy in cultured cardiomyocytes. Additionally, Msi2 exhibited a significant increase in a pressure-overload model of cardiac hypertrophy. We selected isoforms 4 and 7 to validate the hypertrophic effects due to their unique alternative splicing patterns. AAV9-mediated overexpression of Msi2 isoforms 4 and 7 in murine hearts led to cardiac hypertrophy, dilation, heart failure, and eventually early death, confirming a pathological function for Msi2. Using global proteomics, gene ontology, transmission electron microscopy, seahorse, and transmembrane potential measurement assays, increased MSI2 was found to cause mitochondrial dysfunction in the heart. Mechanistically, we identified Cluh and Smyd1 as direct downstream targets of Msi2. Overexpression of Cluh and Smyd1 inhibited Msi2-induced cardiac malfunction and mitochondrial dysfunction. Collectively, we show that Msi2 induces hypertrophy, mitochondrial dysfunction, and heart failure.






## Research Highlights

### The *Saccharomyces cerevisiae* SR protein Npl3 interacts with hyperphosphorylated CTD of RNA Polymerase II

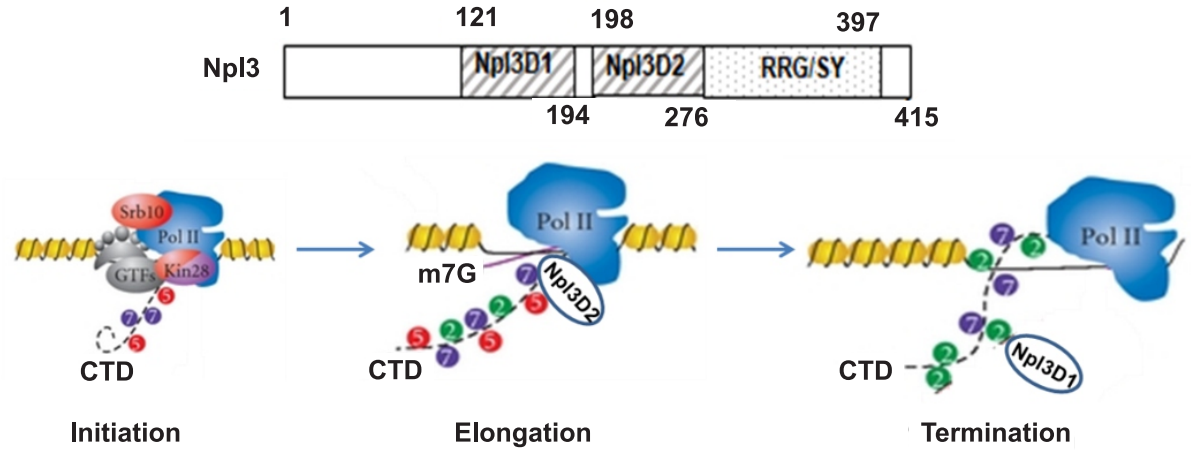
**Adity Gupta, Ashutosh Kumar, Neha Singh, Nikita Sudarshan, Vasily M. Studitsky, KamY.J. Zhang, Md. Sohail Akhtar**

**International Journal of Biological Macromolecules, 2023, 253, 127541**

The catalytic subunit of RNA Polymerase II contains a highly conserved carboxy terminal domain (CTD) composed of multiple tandem heptad sequence Tyr1Ser2Pro3Thr4Ser5Pro6Ser7. The non-proline residues in CTD undergo posttranslational modifications, with Ser5 phosphorylation (Ser5P) predominating at the start of the transcription cycle and Ser2P at the end, while other phosphorylation levels are high all throughout. The differentially phosphorylated CTD is recognized by regulatory proteins, helpful during mRNA transcription and export. One such protein Npl3 is composed of two RNA binding domains and a C-terminus RGG/SR domain. The Ser411 of Npl3 is reported to make direct contact with Ser2P of CTD for its recruitment and function, while the Npl3 lacking of C-terminal 25 amino acids (Npl3 Δ 389-414) showed no apparent defects in mRNA synthesis. Here, we report that the RNA binding domains of Npl3 are separate folding units and interact also with the CTD. The interaction between Npl3 and CTD appears to involve not just Ser2P, but also the Ser5P and Ser7P. The Arg126 of the first RNA binding domain interacts with Ser2P whereas the Arg235 of the second RNA binding domain interacts with either Ser7P or Ser5P of another heptad. The finding provides new insight of Npl3 function for mRNA transcription.

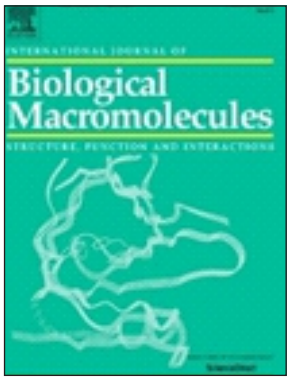
**Adity Gupta**

**Dr. Md. Sohail Akhtar**




**Npl3 interacts with CTD through both the domains and helps during the late phase of mRNA transcription**

## Research Highlights




### TORC1 mediated regulation of mitochondrial integrity and calcium ion homeostasis by Wat1/mLst8 in *S. pombe*

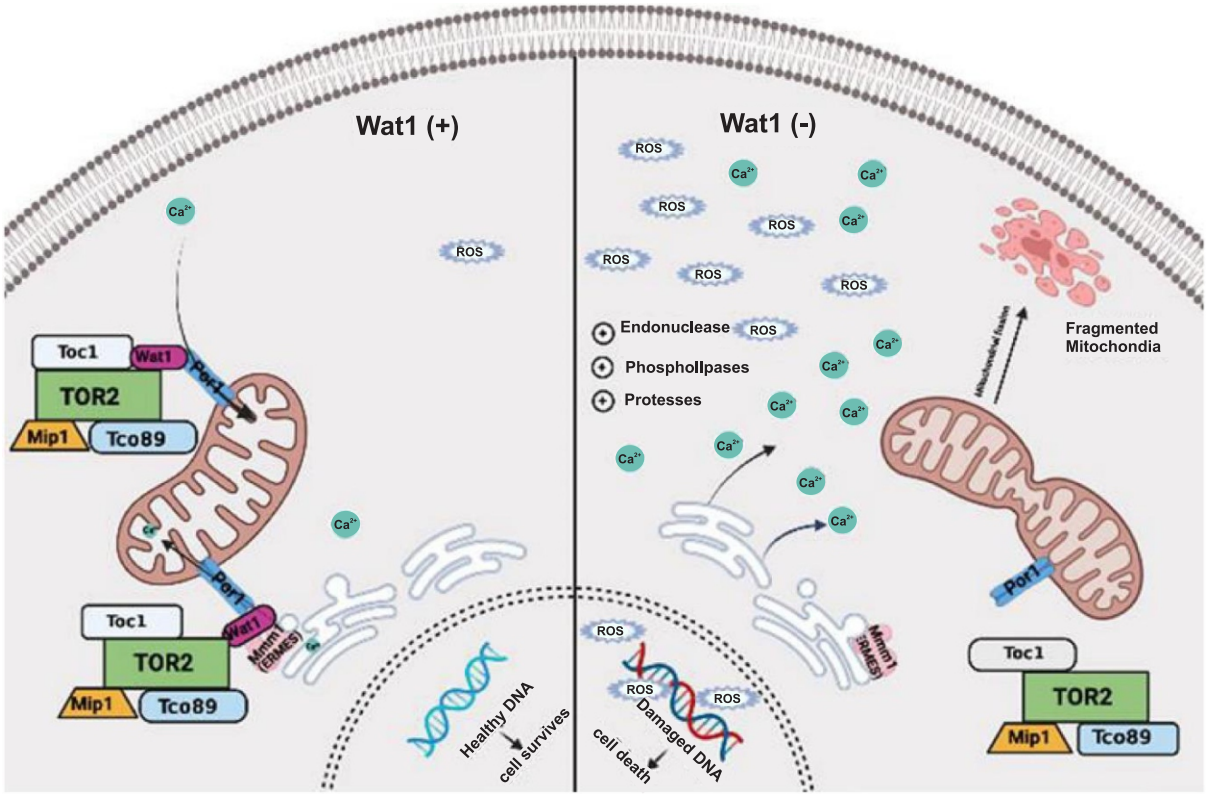
**Simmi Anjum, Swati Srivastava, Lalita Panigrahi, Uzair Ahmad Ansari, Arun Kumar Trivedi, Shakil Ahmed**

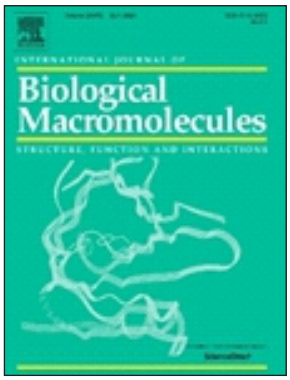
**International Journal of Biological Macromolecules, 2023, 253, 126907**

**Simmi Anjum**

**Dr. Shakil Ahmed**

The mTOR complexes play a fundamental role in mitochondrial biogenesis and cellular homeostasis. Wat1, an ortholog of mammalian Lst8 is an important component of TOR complex and is essential for the regulation of downstream signaling. Earlier we reported the role of Wat1 in oxidative stress response. Here, we have shown that the abrogation of wat1 causes respiratory defects and mitochondrial depolarization that leads to a decrease in ATP production. The confocal and electron microscopy in wat1Δ cells revealed the fragmented mitochondrial morphology implying its role in mitochondrial fission. Furthermore, we also showed its role in autophagy and the maintenance of calcium ion homeostasis. Additionally, tor2-287 mutant cells also exhibit defects in mitochondrial integrity indicating the TORC1-dependent involvement of Wat1 in the maintenance of mitochondrial homeostasis. The interaction studies of Wat1 and Tor2 with Por1 and Mmm1 proteins revealed a plausible cross-talk between mitochondria and endoplasmic reticulum through the Mitochondria-associated membranes (MAM) and endoplasmic reticulum-mitochondria encounter structure (ERMES) complex, involving TORC1. Taken together, this study demonstrates the involvement of Wat1/mLst8 in harmonizing various mitochondrial functions, redox status, and Ca2+ homeostasis.






## Research Highlights

### *Mycobacterium tuberculosis* Rv2324 is a multifunctional feast/famine regulatory protein involved in growth, DNA replication and damage control

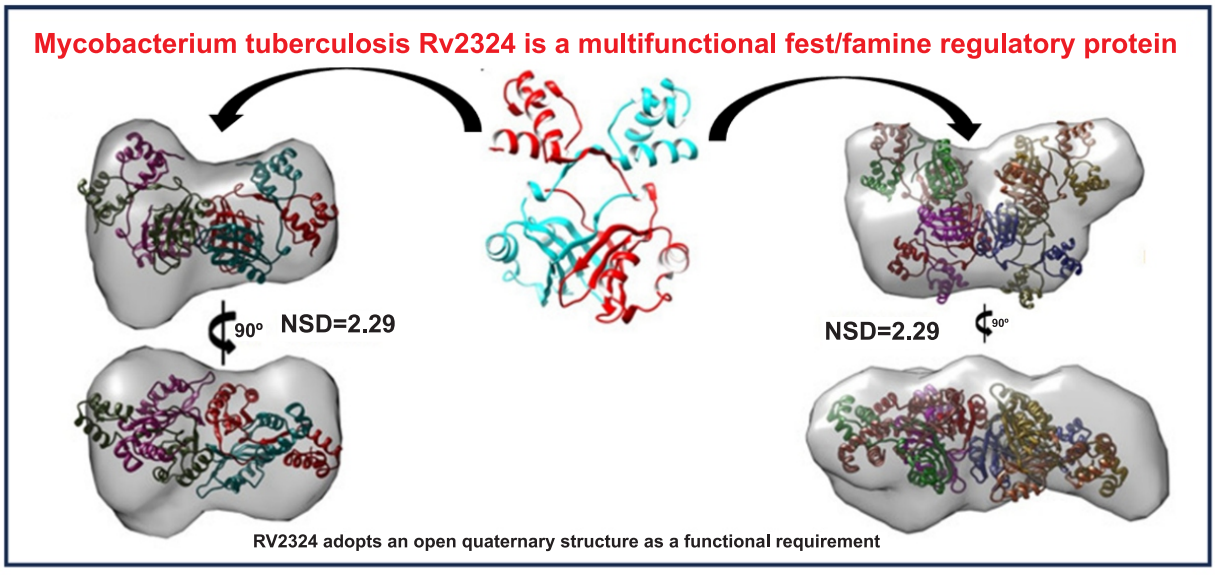
**Shikha Dubey, Rahul Kumar Maurya, Sonal Shree, Sanjay Kumar, Farheen Jahan, Manju Yasoda Krishnan, Ravishankar Ramachandran**

**International Journal of Biological Macromolecules, 2023, 252, 126459**

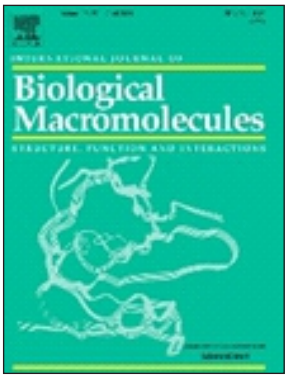
**Shikha Dubey**

**Dr. Ravishankar R**

Feast/famine regulatory proteins (FFRPs) are multifunctional regulators. We show that Mtb Rv2324 is important for growth, survival, and countering DNA damage in *Mycobacterium tuberculosis* (Mtb). DNA-relaxation activity against linear and supercoiled substrates suggest its involvement in transcription activation, while its high affinity for recombination, replication and repair substrates suggest a role there too. Small-Angle-X-ray scattering supports the adoption of an 'open' quaternary association in response to amino-acid binding. Size-exclusion-chromatography and glutaraldehyde cross-linking identify the adoption of diverse oligomers modulated by amino-acid binding, and DNA interactions. We tested G52A, G101T and D104A mutants which correspond to highly conserved residues, distal to the DNA-binding site, and are important for amino acids binding. G101T exhibits increased DNA affinity, while G52A and D104A exhibit weak DNA-binding thereby suggesting that they mediate effector-binding, and DNA binding activities. Gain and loss-of-function studies show that Rv2324 overexpression promotes growth-rate, while its knock-down leads to retarded growth. Rv2324 down-regulation lowers Mtb survival inside resting and IFN-Y-activated macrophages. Rv2324 protects the pathogen from DNA damage, as evidenced by the reduction in the knockdown strain's survival following treatment with $H_2O_2$ and UV light. Overall, we show that Rv2324 plays a crucial role in regulating survival and growth of Mtb.



## Research Highlights




### Regulation of futile ligation during early steps of BER in *M. tuberculosis* is carried out by a β-clamp-XthA-LigA tri-component complex

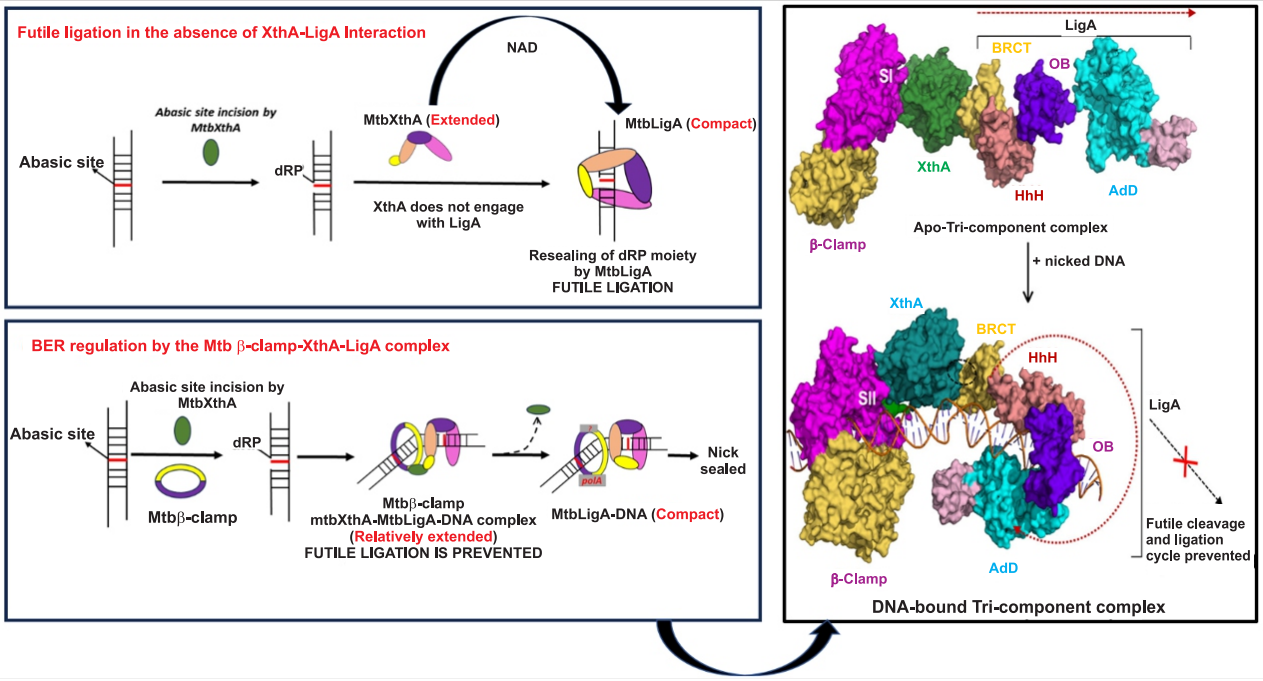
**Ankita Shukla, Mohammad Afsar, Taran Khanam, Nelam Kumar, Faiz Ali, Sanjay Kumar, Farheen Jahan, Ravishankar Ramachandran**

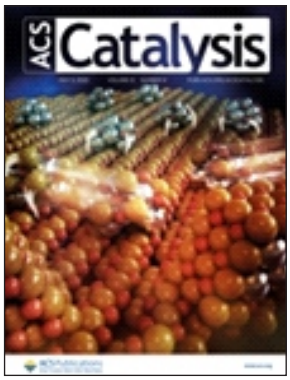
**International Journal of Biological Macromolecules, 2023, 255, 442**

**Ankita Shukla**

**Dr. Ravishankar R**

The Class-II AP-endonuclease (XthA) is a mycobacterial DNA base excision repair (BER) pathway enzyme that functions in the initial steps. It acts on DNA substrates that contain abasic sites to create nicks with 32 -hydroxyl (OH) and 52 -deoxyribose phosphate (52 -dRP) moieties. The NAD+-dependent DNA ligase (LigA) is the terminal player in mycobacterial BER and seals such nicks efficiently. Here, we demonstrate that the Mtb β-clamp-MtbXthA complex that exists in the initial steps of BER engages with MtbLigA to form a novel tri-component BER complex. Size exclusion chromatography (SEC) experiments analysis show that the three proteins interact with equimolar stoichiometry. Small angle X-ray scattering (SAXS) analysis and associated studies reveal that the apo tri-component BER-complex adopts an extended conformation where MtbXthA is sandwiched between the Mtb β-clamp and MtbLigA. The studies support that in the apo-complex MtbXthA binds subsite-I of Mtb β-clamp through 239QLRFPKK245 motif and to MtbLigA by 104DGQPSWSGKP113 motif simultaneously. However, the complex adopts a less-extended conformation in the presence of substrate DNA, where MtbXthA interactions switch from predominantly subsite-I to subsite-II of the Mtb β-clamp. Overall, the novel tri-component complex prevents futile ligation activity of MtbLigA on the product of MtbXthA and ensures forward progression of the pathway and productive mycobacterial BER interactions.






## Research Highlights

### Iridium-catalyzed enantioselective allylic substitution of vinylcyclopropanes by carboxylic acids

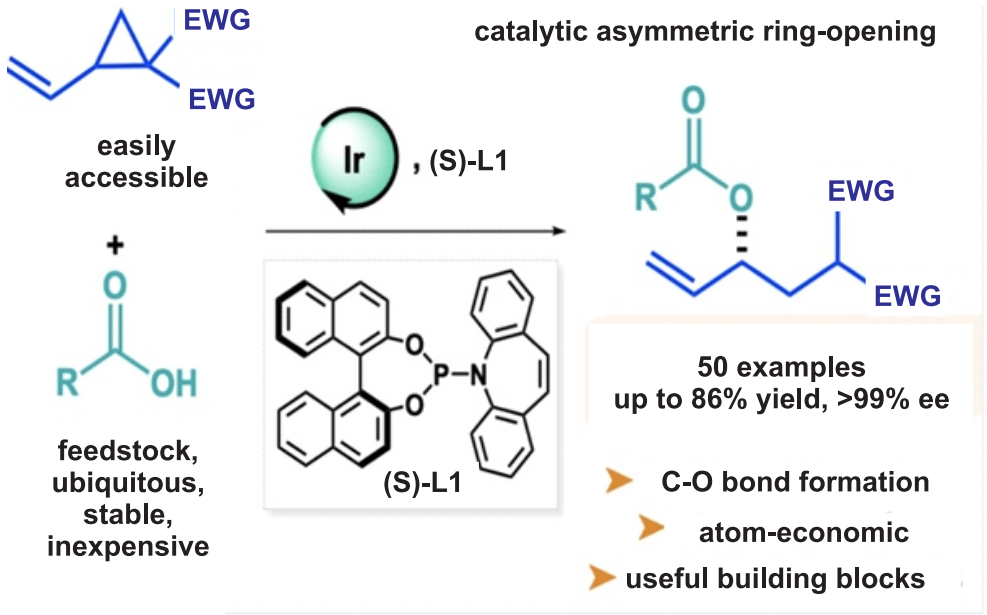
**Amit Singh Adhikari, Soumen Pandit, Ruchir Kant, Nilanjana Majumdar**

**ACS Catalysis, 2023, 13, 6261-6267**

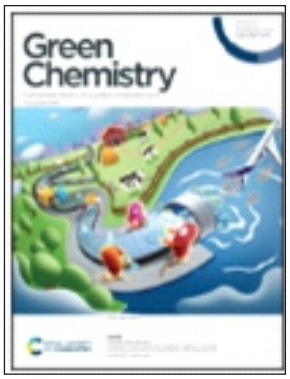
An efficient method for a highly regio- and enantioselective allylic substitution of vinylcyclopropanes using carboxylic acids as oxygen nucleophile via iridium catalysis has been developed. This represents a highly atom-economic approach for the synthesis of synthetically useful chiral building blocks in high yields. The practical utility of this method is demonstrated by the application of the products in useful transformations.

**Amit Singh Adhikari**

**Dr. Nilanjana Majumdar**



## Research Highlights




### A scalable and eco-friendly total synthesis of poly (ADP-ribose) polymerase inhibitor Olaparib

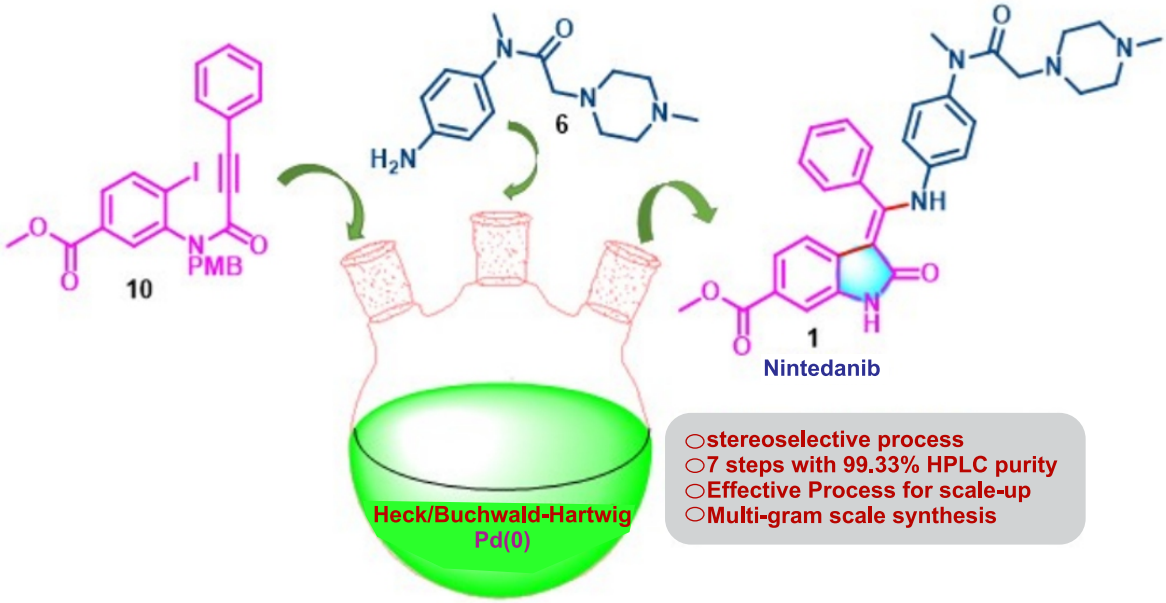
**Indranil Chatterjee, Deblina Roy, Gautam Panda**

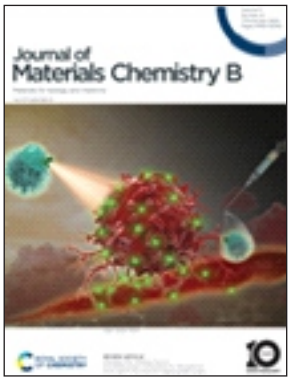
**Green Chemistry, 2023, 25, 9097-9102**

**Indranil Chatterjee**

**Dr. Gautam Panda**

A scalable total synthesis of a potent poly(ADP-ribose) polymerase (PARP) enzyme inhibitor, Olaparib (Lynparza), approved by U.S. FDA and EMA for ovarian cancer, is disclosed. The process is operationally simple, highly atom economical and environmentally benign as compared to the existing literature route of Olaparib. Herein, we report an eco-friendly synthesis of Olaparib using commercially available inexpensive starting materials, in only four steps with 51% overall yield. This synthesis comprises the key steps of generation of conjugated enolate from 2-acetylbenzoic acid to produce $\alpha$-arylated product under transition metal-free conditions followed by ring construction of the final phthalazinone scaffold affording Olaparib. An alternative synthesis of another PARP inhibitor, AZD2461, using the same protocol is also reported. Highlighting this work is the phosphonate-free synthesis, as opposed to the Horner-Wadsworth-Emmons olefination reaction utilized previously which requires the synthesis of a phosphonate precursor.






## Research Highlights

### A new class of teraryl-based AIEgen for highly selective imaging of intracellular lipid droplets and its detection in advanced-stage human cervical cancer tissues

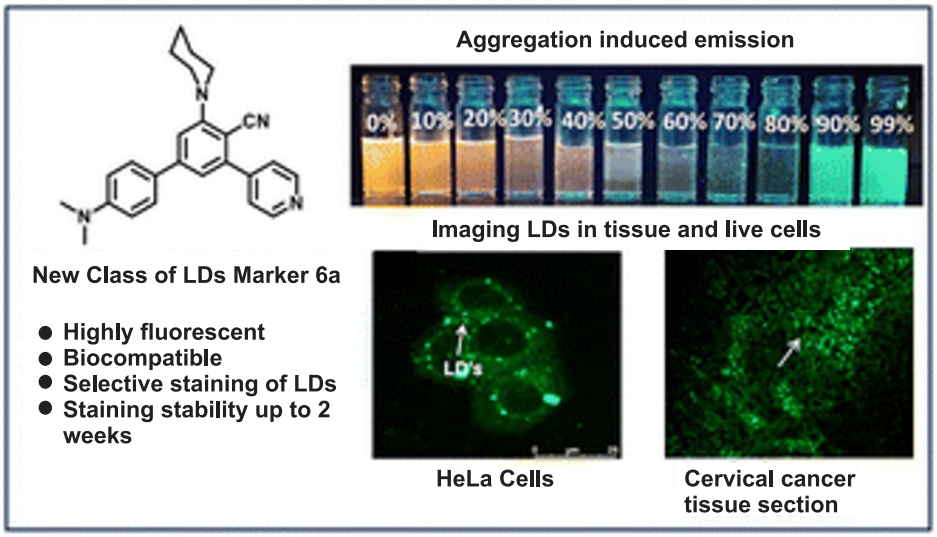
**Chandra Prakash Sharma, Akanksha Vyas, Priyanka Pandey, Shashwat Gupta, Ravi Prakash Vats, Sakshi Priya Jaiswal, Madan Lal Brahma Bhatt, Monika Sachdeva, Atul Goel**

**Journal of Materials Chemistry B, 2023,11, 9922-9932**

**Chandra Prakash Sharma**

**Dr. Atul Goel**

. Lipid droplets (LDs) have drawn much attention in recent years. They serve as the energy reservoir of cells and also play an important role in numerous physiological processes. Furthermore, LDs are found to be associated with several pathological conditions, including cancer and diabetes mellitus. Herein, we report a new class of teraryl-based donor–acceptor-appended aggregation-induced emission luminogen (AIEgen), 6a, for selective staining of intracellular LDs in *in vitro* live 3T3-L1 preadipocytes and the HeLa cancer cell line. In addition, AIEgen 6a was found to be capable of staining and quantifying the LD accumulation in the tissue sections of advanced-stage human cervical cancer patients. Unlike commercial LD staining dyes Nile Red, BODIPY and LipidTOX, AIEgen 6a showed a high Stokes shift (195 nm), a good fluorescence lifetime decay of 12.7 ns, and LD staining persisting for nearly two weeks.



## Research Highlights


### Design and synthesis of novel halogen rich salicylanilides as potential antileishmanial agents

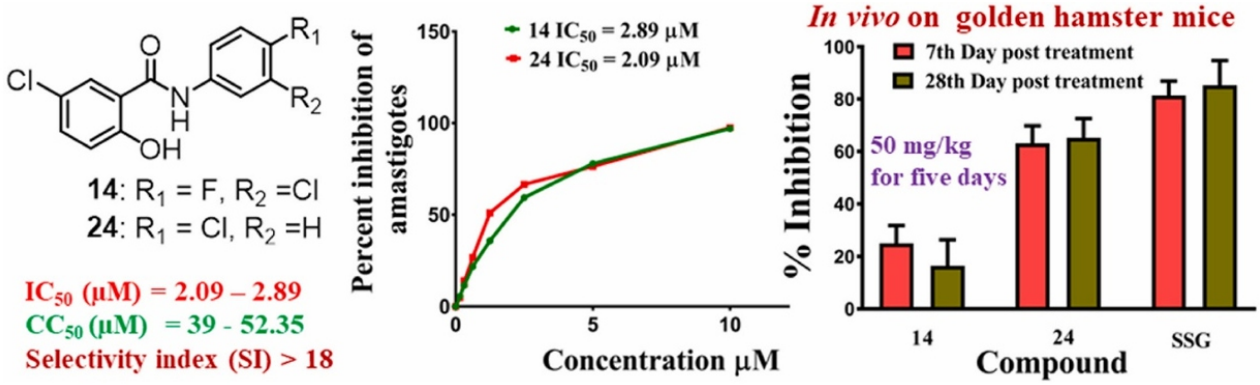
**Jhajan Lal, Karthik Ramalingam, Rachana Meena, Shabina B. Ansari, Deepanshi Saxena, Sidharth Chopra, Neena Goyal, Damodara N. Reddy**

**European Journal of Medicinal Chemistry, 09 Dec 2022, 246:114996**

**Jhajan Lal**

**Dr. Damodar N Reddy**

The available therapeutic treatment for leishmaniasis is inadequate and toxic due to side effects, expensive and emergence of drug resistance. Affordable and safe antileishmanial agents are urgently needed and toward this objective, we synthesized a series of 32 novel halogen rich salicylanilides including niclosamide and oxyclozanide and investigated their antileishmanial activity against amastigotes of *Leishmania donovani*. *In vitro* data showed fifteen compounds inhibited intracellular amastigotes with an $IC_{50}$ of below 5 μM and selectivity index above 10. Among 15 active compounds, 14 and 24 demonstrated better activity with an $IC_{50}$ of 2.89 μM and 2.09 μM respectively and selectivity index is 18. Compound 24 exhibited significant *in vivo* antileishmanial efficacy and reduced 65% of the splenic parasite load on day 28th post-treatment in the experimental visceral leishmaniasis golden hamster model. The data suggest that 24 can be a promising lead candidate possessing potential to be developed into a leishmanial drug candidate.




## Research Highlights

# Design, synthesis and evaluation of novel pyrrole-hydroxybutenolide hybrids as promising antiplasmodial and anti-inflammatory agents

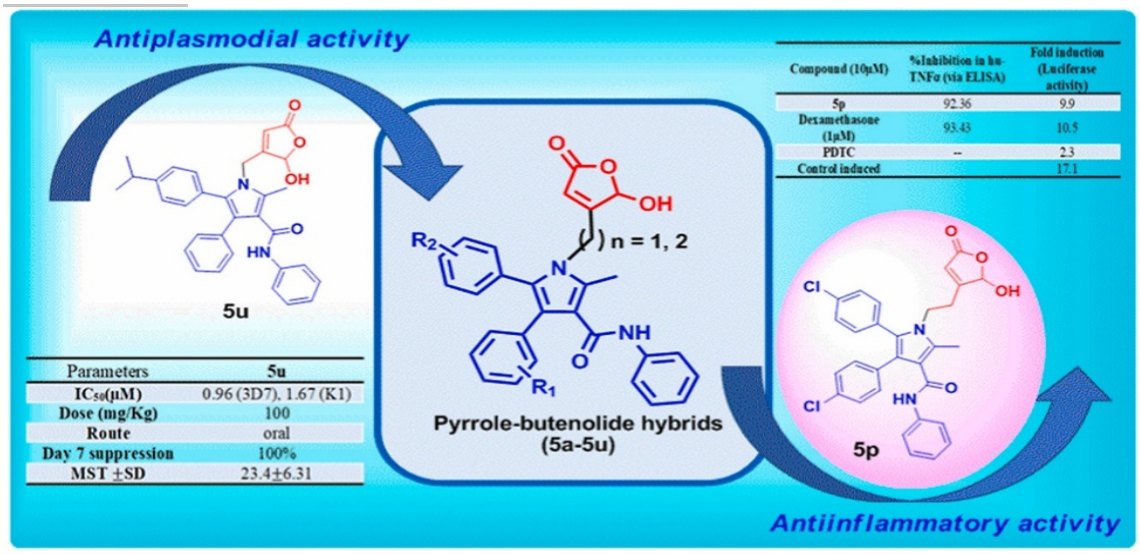
**Alka Raj Pandey, Suriya Pratap Singh, Prince Joshi, Kunwar Satyadeep Srivastav, Smriti Srivastava, Kanchan Yadav, Ramesh Chandra, Amol Chhatrapati Bisen, Sristi Agrawal, Sachin Nashik Sanap, Rabi Sankar Bhatta, Renu Tripathi, Manoj Kumar Barthwal, Koneni V Sashidhara**

**European Journal of Medicinal Chemistry, 254, 5 June 2023, 115340**

**Alka Raj Pandey**

**Dr. K.V. Sashidhara**

In the pursuance of novel scaffolds with promising antiplasmodial and anti-inflammatory activity, a series of twenty-one compounds embraced with most promising penta-substituted pyrrole and biodynamic hydroxybutenolide in single skeleton was designed and synthesized. These pyrrole-hydroxybutenolide hybrids were evaluated against *Plasmodium falciparum* parasite. Four hybrids 5b, 5d, 5t and 5u exhibited good activity with $IC_{50}$ of 0.60, 0.88, 0.97 and 0.96 μM for chloroquine sensitive (Pf3D7) strain and 3.92, 4.31, 4.21 and 1.67 μM for chloroquine resistant (PfK1) strain, respectively. *In vivo* efficacy of 5b, 5d, 5t and 5u was studied against the *P. yoelii nigeriensis* N67 (a chloroquine-resistant) parasite in Swiss mice at a dose of 100 mg/kg/day for 4 days via oral route. 5u was found to show maximum 100% parasite inhibition with considerably increased mean survival time. Simultaneously, the series of compounds was screened for anti-inflammatory potential. In preliminary assays, nine compounds showed more than 85% inhibition in hu-TNF $\alpha$ cytokine levels in LPS stimulated THP-1 monocytes and seven compounds showed more than 40% decrease in fold induction in reporter gene activity analyzed via Luciferase assay. 5p and 5t were found to be most promising amongst the series, thus were taken up for further *in vivo* studies. Wherein, mice pre-treated with them showed a dose dependent inhibition in carrageenan induced paw swelling. Moreover, the results of *in vitro* and *in vivo* pharmacokinetic parameters indicated that the synthesized pyrrole-hydroxybutenolide conjugates abide by the required criteria for the development of orally active drug and thus this scaffold can be used as pharmacologically active framework that should be considered for the development of potential antiplasmodial and anti-inflammatory agents.



## Research Highlights


### Discovery, SAR and mechanistic studies of quinazolinone-based acetamide derivatives in experimental visceral leishmaniasis

**Alisha Ansari, Anuradha Seth, Mukul Dutta, Tooba Qamar, Sarita Katiyar, Arvind K Jaiswal, Ankita Rani, Swetapadma Majhi, Mukesh Kumar, Rabi S Bhatta, Rajdeep Guha, Kalyan Mitra, Koneni V Sashidhara, Susanta Kar**

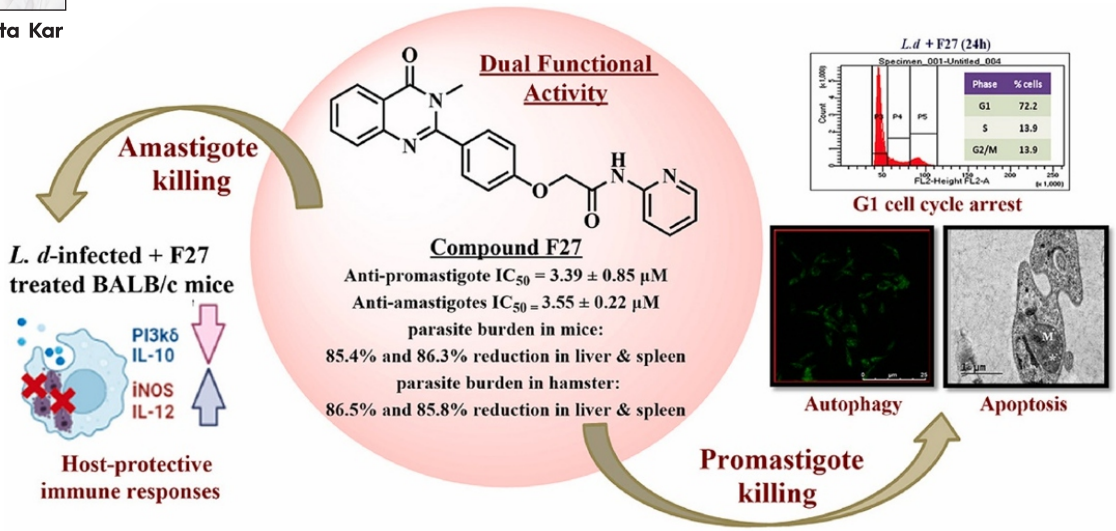
**European Journal of Medicinal Chemistry, 257, 115524**

**Alisha Ansari**

**Dr. KV Sashidhara**

**Dr. Susanta Kar**

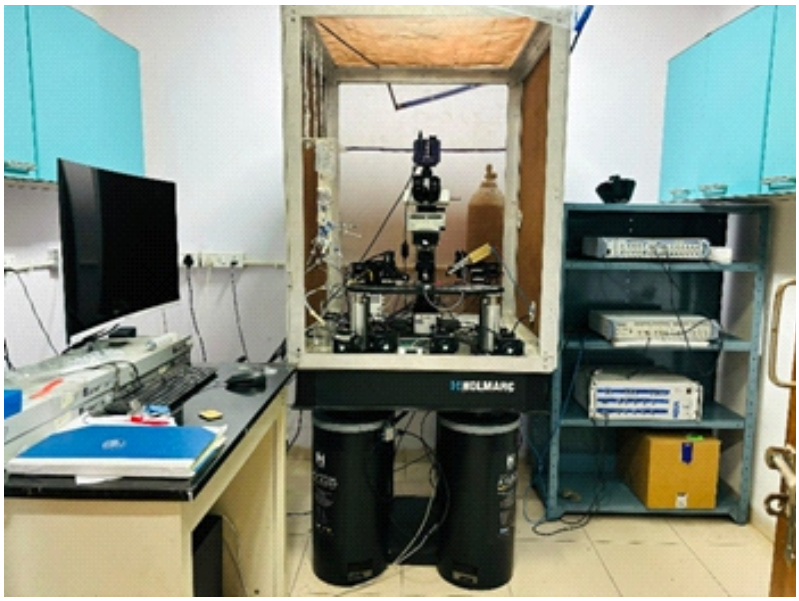
Towards identification of novel therapeutic candidates, a series of quinazolinone-based acetamide derivatives were synthesized and assessed for their anti-leishmanial efficacy. Amongst synthesized derivatives, compounds F12, F27 and F30 demonstrated remarkable activity towards intracellular *L. donovani* amastigotes *in vitro*, with $IC_{50}$ values of 5.76 ± 0.84 µM, 3.39 ± 0.85 µM and 8.26 ± 1.23 µM against promastigotes, and 6.02 µM ± 0.52, 3.55 ± 0.22 µM and 6.23 ± 0.13 µM against amastigotes, respectively. Oral administration of compounds F12 and F27 entailed >85% reduction in organ parasite burden in *L. donovani*-infected BALB/c mice and hamsters, by promoting host-protective Th1 cytokine response. In host J774 macrophages, mechanistic studies revealed inhibition of PI3K/Akt/CREB axis, resulting in a decrease of IL-10 versus IL-12 release upon F27 treatment. *In silico* docking studies conducted with lead compound, F27 demonstrated plausible inhibition of Leishmania prolyl-tRNA synthetase, which was validated via detection of decreased proline levels in parasites and induction of amino acid starvation, leading to G1 cell cycle arrest and autophagy-mediated programmed cell death of *L. donovani* promastigotes. Structure-activity analysis and study of pharmacokinetic and physicochemical parameters suggest oral availability and underscore F27 as a promising lead for anti-leishmanial drug development.



## Facility Upgradation

### hERG Screening Facility using Patch Clamp Electrophysiology

Identification of risk for hERG channel inhibition is an important prerequisite in the discovery and development of novel drugs. Manual whole cell patch clamp electrophysiology is unequivocally the gold standard for hERG testing since it allows a direct assessment of the effect of a compound on a functional hERG channel current. A state-of-the-art hERG screening service has already been established in the institute with the funding support of CSIR. It will provide quick and reliable information regarding the potential cardiac toxicity of the compounds. This facility is comprised of computer-controlled amplifier, low-noise digitizer, microscope with fluorescence illumination system, motorized micromanipulators, gravity-fed perfusion system, anti-vibration table with faraday cage, micropipette puller, fire polisher and industry leading data acquisition and analysis programs. All the internal and external users (both academic and industry) will get benefited from this facility.



# Facility Upgradation

## Rodent Breeding Facility

The facility was renovated during the year to enhance the breeding conditions for the rodents. A new Heating, Ventilation, and Air Conditioning (HVAC) system was installed as part of the modernization. This system is crucial in maintaining a stable environment within the facility, ensuring the temperature and humidity stay within a specific range. The HVAC system also includes a power backup, ensuring that the system continues functioning even during power outages.

Compliance with CCSEA Guidelines: The temperature and humidity ranges maintained by the HVAC system comply with the guidelines set by the CCSEA. This indicates that the facility adheres to nationally recognized standards for animal care in scientific research.

Individually Ventilated Caging System: The facility introduced an individually ventilated caging system (IVC) with changing stations. This system provides each cage with its own supply of filtered air, which can help reduce the spread of airborne pathogens among the rodents. The changing stations are areas where the cages can be cleaned, and the bedding can be changed, which is crucial for maintaining the health and well-being of the rodents.

Breeding SPF-Quality Rodents: The ultimate goal of these upgrades is to breed Specific Pathogen Free (SPF) rodents. SPF rodents are free from certain pathogens, making them ideal for use in scientific research. In this case, the rodents are necessary for the institute's drug discovery program.

In summary, the modernization of the rodent breeding facility at CSIR-CDRI's old campus involved significant upgrades to the infrastructure and systems to improve the breeding conditions for the rodents, ensuring they meet the necessary standards for scientific research.

# Facility Creation

## Digital Access Zone

On the occasion of celebration of CSIR Foundation Day 2024, on 4 October 2023, Dr. Radha Rangarajan, Director, CSIR-CDRI inaugurated the newly established Digital Access Zone in Knowledge Resource Centre of CSIR-CDRI. This facility is equipped with desktops providing access to various e-journals in the area of biomedical research, Databases like Orbit intelligence, Web of Science, iThenticate, and tools / programs like EndNote, Biorender, GraphPad Prism and SnapGene. The facility is being used by the students and faculty of CSIR-CDRI.


# New Initiatives

## Translational Lecture Series

During the year, CSIR-CDRI initiated a new series of lectures entitled "Translational Research Lecture Series". Under this series, leading clinicians in the various disease areas are invited to interact with CSIR-CDRI researchers and deliver a lecture. The objective of this series is to bring the academia and clinicians together and have a clinical perspective on the disease area. Institute looks forward to evolve collaborative research programs that have high translational value. The academia can learn the recent developments in the clinic and become aware of the patient unmet needs and the cutting edge research being carried out. This activity will give further impetus to the institutes drug discovery program and translational research. Lectures will be held on quarterly basis.

First lecture in the series was organized on the occasion of National Science Day celebrations 2024. Dr. Vineet Ahuja, Professor, MD, DM, MNAMS, AIIMS, New Delhi delivered lecture on "Microbiome manipulation therapies in inflammatory bowel disease" on 28-02-2024.

## CDRI Innohealth (Innovation in Health) Oration Series

This year, Institute initiated a new lecture series entitled CDRI Innohealth (Innovation in Health) Oration Series. This series aims to bring scientists/researchers from across India who have done cutting edge research in therapeutic areas of interest to CSIR-CDRI. Oratotrs may be engaged in basic or applied research, spanning the gamut of disciplines from biology to chemistry to computer science. Their work should focus on disease pathogenesis, detection, diagnostics or therapeutics. Orations will be organized on quarterly basis.

The first orator in the series, Dr Debarka Sengupta, Associate Professor of Computational Biology and Computer Science, IIIT-Delhi delivered the Oration on "Role of AI in accelerating healthcare innovations". Dr. Sengupta is the winner of 2023 Merck Young Scientist Award for his work on blood-based cancer detection and personalized treatment.

## Scientific Social Responsibility (SSR) Activities

As a part of Scientific Social Responsibility, the CSIR-CDRI has organized more than 90 programs to connect science with society in the reporting period towards fulfilling its Scientific Social responsibilities which mainly include, the Student-Scientist Connect Program for the students of various schools and colleges, Health awareness and Health Check-up Camps, Swasthya Chaupal, Rural Science Education Training Utility Program, Faculty Development Program for School Teachers, Vigilance awareness program, Mental Health Promotion Program, IPR Awareness Program, AI Awareness Program, Janjatiya Gaurav Divas Celebrations and besides that about 20 small societal projects for addressing various grass root problems were conducted. In the reporting period, through these programs about 12,000 students, 1,500 faculties and more than 10,000 common people were connected with the Institute.

## Gulmohar: A state of the art child care crèche

CSIR-CDRI Lucknow inaugurated "Gulmohar" a state of the art child care crèche on 8 December 2023 : A Milestone for Work-Life Balance for young couples. This visionary project aims to support working parents, especially women researchers, by providing a safe and enriching environment for their children. The Director of CSIR-CDRI, Dr. Radha Rangarajan, expressed her enthusiasm during the inauguration ceremony, highlighting the importance of such facilities in empowering women and ensuring a healthy work-life balance.

The crèche is staffed with qualified, dedicated, and professional individuals committed to providing the best care and education. Crèche offers a variety of activities customized for different age groups, including physical activities, quiet time (sleeping time), daily storybook sessions, group and individual activities and rest periods. Notably, activities are tailored to accommodate the needs of children with special requirements.

## Gender Advancement for Transforming Institutions (GATI)

### (Pilot program, initiated by DST)

सत्यमेव जयते

डॉ. एस. चंद्रशेखर
Dr. S. Chandrasekhar

G20 भारत 2023 INDIA
वसुधैव कुटुम्बकम्
ONE EARTH • ONE FAMILY • ONE FUTURE

आज़ादी का अमृत महोत्सव

सचिव
भारत सरकार
विज्ञान एवं प्रौद्योगिकी मंत्रालय
विज्ञान एवं प्रौद्योगिकी विभाग
**Secretary**
**Government Of India**
Ministry of Science and Technology
**Department of Science and Technolog**

D.O. No.DST/KIRAN/GE-1/2019-Part(5)/RI/2 03rd July, 2023

**Letter of Recognition under the DST-GATI Program- reg.**

Dear Dr. Rangarajan,

As you are aware, DST had conceptualized the Gender Advancement for Transforming Institutions (GATI) program in the year 2019, which was launched by the Hon'ble President of India on the occasion of National Science Day in the year 2020. It has an objective of acceleration in participation of women in STEMM. The Women in Science and Engineering (WISE) - KIRAN Division, DST has been playing an instrumental role in implementing the program.

I am happy to share that India is among seven countries to make such kind of framework which is inspired by Athena SWAN UK, but developed in Indian context for Indian institutions to achieve Gender Equality in Science. DST has worked in partnership with British Council and a mechanism to evaluate Science and Technology institutions on the basis of Gender Equality in STEMM has been worked out. The GATI Achiever recognition developed during the pilot program is to appreciate efforts and transformative contributions made by institution in the field of women in science and technology. Your institution's exemplary work showcased its commitment to driving next step by making action plans to ensure enhanced participation of women scientists at all levels.

I am delighted to inform you that CDRI Lucknow has been recognized as a "**GATI Achiever**" by the Department of Science and Technology (DST), Govt. of India, among the identified pilot institutions. This is prestigious and the first of its kind of recognition of institutions for their remarkable work done for women in STEMM through GATI program. The recognition would be valid for next five years from the date of this letter.

We acknowledge the tireless efforts made by your GATI Self-Assessment Team and Dr. Niti Kumar, nodal scientist at CDRI Lucknow, who were consistent in their work under GATI. We look forward of effective implementation of action plans by your institute in future. With this, your institute has become a role model for other institutions who are willing to participate in this initiative.

We wish you continued success in all your future endeavors. We all are committed to fostering collaboration and driving impactful change together for promoting more participation of women and girls in science.

Once again, we convey our heartfelt congratulations on this well-deserved recognition.

With best wishes,

Yours sincerely,

(S. Chandrasekhar)

Dr. Radha Rangarajan
Director
CSIR Central Drug Research Institute (CDRI)
Lucknow-226031, Lucknow.

**Technology Bhavan, New Mehrauli Road, New Delhi - 110016**
**Tel: 0091 11 26511439 / 26510068 | Fax: 00 91 11 26863847 | e-mail: dstsec@nic.in | website: www.dst.gov.in**

## Industry-Academia Collaborations


**Photo:** CSIR-CDRI signed MoU with Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow in gracious presence of Dr. Jitendra Singh, hon'ble Minister for Science & Technology, Government of India during his visit to Lucknow on 26-12-2023


**Photo:** Recognition of CSIR-CDRI's collaboration with Dr. Reddy's Laboratories Limited, Hyderabad in the gracious presence of Dr. Jitendra Singh, hon'ble Minister for Science & Technology, Government of India during his visit to Lucknow on 26-12-2023

**Photo:** CSIR-CDRI signed Institutional MoU with Indian Institute of Science Education and Research (IISER), Kolkata on 17-02-2024 for joint research & academic programs

**Photo:** CSIR-CDRI sighed Institutional MoU with Birla Institute of Technology and Science (BITS), Pilani on 17-02-2024 for joint research & academic programs

**Photo:** Grant Agreement signed with Bill and Melinda Gates Foundation (BMGF), USA on 30-10-2023 for research on Non-Hormonal Contraception

**Photo:** Sponsored Project Agreement signed with Dr. Reddy's Laboratories Ltd., Hyderabad on 14-08-2023 for a project on Synthesis of API and Process Optimization

# Research Council

(01-09-2020 – 31-08-2023)

**Prof. Goverdhan Mehta**
University Distinguished Professor
University of Hyderabad
Hyderabad

**Chairperson**

**Members**

**Prof. Shinjini Bhatnagar**
Professor of Eminence
Translational Health Science and Technology Institute
Faridabad

**Prof. Prasad V. Bharatam**
Professor and Head
Department of Medicinal Chemistry
National Institute of Pharmaceutical Education and Research, Mohali

**Prof. Manjari Tripathi**
Professor of Neurology
All India Institute of Medical Sciences
New Delhi

**Dr. Vijay Chauthaiwale**
Former Vice President
Torrent Pharmaceuticals
Ahmedabad

**Shri N. Govindarajan**
Managing Director
Aurobindo Pharma Limited
Hyderabad

**Dr. V. G. Somani**
Drugs Controller General of India (DCGI)
New Delhi

**Dr. T.S. Balganesh**
President and CEO
GI (Interim)
President and Member Board of Directors GBPL, Bengaluru

**Dr. G. Narahari Sastry**
Director
CSIR-North East Institute of Science and Technology
Jorhat

**Dr. Radha Rangarajan**
Director,
CSIR-Central Drug Research Institute
Lucknow

**Dr. Geetha Vani Rayasam**
Head, Human Resource Development Group
CSIR, New Delhi

*Secretary*
**Dr. Aamir Nazir**
Sr. Principal Scientist,
CSIR-Central Drug Research Institute
Lucknow

# Research Council

(01-09-2023 - 31-08-2026)

**Dr. T. S. Balganesh,**
President,
GangaGen Biotechnologies Pvt.Ltd.
Bengaluru

**Chairperson**

**Members**

**Dr. C. S. Pramesh**
Director,
Tata Memorial Hospital,
Mumbai

**Dr. Priya Abraham**
Professor,
Department of Clinical Virology
Christian Medical College, Vellore

**Dr. Vikram Ramanathan**
Senior Vice President, Translational Development,
Sun Pharma Advanced Research Company Ltd, Vadodara

**Dr. Ullas Kolthur Seetharam**
Director,
Centre for DNA Fingerprinting and Diagnostics,
Hyderabad

**Dr. Rajeev Singh Raghuvanshi**
Drugs Controller General (India),
Central Drugs Standard Control Organization (HQ), New Delhi

**Dr. D. Srinivasa Reddy**
Director,
CSIR- Indian Institute of Chemical Technology, Hyderabad

**Dr. Radha Rangarajan**
Director,
CSIR-Central Drug Research Institute
Lucknow

**Dr. (Mrs.) Viswajanani J Sattigeri**
Head,
Traditional Knowledge Digital Library (TKDL), New Delhi

*Secretary*
**Dr. Prem Prakash Yadav**
Sr. Principal Scientist,
CSIR-Central Drug Research Institute
Lucknow

# Management Council

(01-01-2022 – 31-12-2023)

**Dr. Radha Rangarajan**
Director,
CSIR-CDRI, Lucknow

**Chairperson**

**Members**

**Dr. Prabodh Kumar Trivedi**
Director,
CSIR-CIMAP, Lucknow

**Dr. S K Rath**
Chief Scientist
Toxicology & Experimental Medicine
CSIR-CDRI, Lucknow

**Dr. Ritu Trivedi**
Senior Principal Scientist
Endocrinology
CSIR-CDRI, Lucknow

**Dr. Ajay Srivastava**
Principal Scientist
Medicinal and Process Chemistry
CSIR-CDRI, Lucknow

**Dr. Sonia Verma**
Scientist
Neuroscience & Ageing Biology
CSIR-CDRI, Lucknow

**Dr. Anand P Kulkarni**
Senior Principal Scientist &
Head PME
CSIR-CDRI, Lucknow

**Dr. P K Agnihotri**
Principal Technical Officer
Toxicology & Experimental Medicine
CSIR-CDRI, Lucknow

**Mr. Sanjeev Shekhar**
Controller of Finance & Accounts
CSIR-CDRI, Lucknow

*Member Secretary*
**Mr. Bhaskar Jyoti Deuri**
Senior Controller of Administration
CSIR-CDRI, Lucknow

# Management Council

(01-01-2024 – 31-12-2025)

**Dr. Radha Rangarajan**
Director,
CSIR-CDRI, Lucknow

**Chairperson**

**Members**

**Dr. Bhaskar Narayan**
Director,
CSIR-IITR, Lucknow

**Dr. T Narender**
Chief Scientist
Medicinal and Process Chemistry
CSIR-CDRI, Lucknow

**Dr. KV Sashidhara**
Senior Principal Scientist
Medicinal and Process Chemistry
CSIR-CDRI, Lucknow

**Dr. Chetan Meshram**
Senior Scientist
Virus Research and Therapeutics
CSIR-CDRI, Lucknow

**Dr. Shashi Kumar Gupta**
Scientist
Pharmacology
CSIR-CDRI, Lucknow

**Dr. Anand P Kulkarni**
Senior Principal Scientist &
Head PME
CSIR-CDRI, Lucknow

**Ms. Sarita Tripathi**
Principal Technical Officer
Toxicology & Experimental Medicine
CSIR-CDRI, Lucknow

**Mr. Sanjeev Shekhar**
Controller of Finance & Accounts
CSIR-CDRI, Lucknow

*Member Secretary*
**Mr. Bhaskar Jyoti Deuri**
Senior Controller of Administration
CSIR-CDRI, Lucknow

## Budget

Rs. in lakh

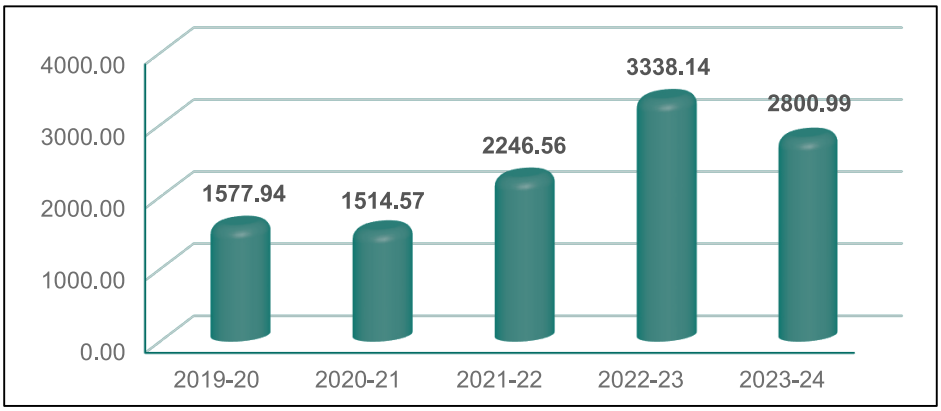
| Budget Heads | | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|---|
| (A) | **Recurring** | | | | | |
| 1 | Pay and Allowances | 5946.572 | 5637.060 | 5676.520 | 6109.337 | 6725.660 |
| 2 | Contingencies | 1328.010 | 1175.000 | 1214.832 | 1728.599 | 1397.561 |
| 3 | Maintenance (Lab and Staff Quarters) | 1155.410 | 833.300 | 1125.607 | 1210.275 | 1295.176 |
| 4 | Chemical and Consumables | 1054.491 | 546.140 | 1109.000 | 1794.994 | 1398.665 |
| | **Sub-Total** | **9484.483** | **8191.500** | **9125.959** | **10843.205** | **10817.062** |
| (B) | **Capital** | | | | | |
| 1 | Works and Services / Electrical Installation | 71.429 | 53.982 | 70.617 | 166.300 | 150.00 |
| 2 | Apparatus and Equipment/ Computer Equipment | 235.321 | 568.290 | 559.436 | 739.000 | 853.271 |
| 3 | Furniture and Fittings | 5.426 | - | 2.250 | 20.000 | 29.880 |
| 4 | Library Books and Journals | 336.680 | 166.422 | 451.127 | 178.000 | 0.00 |
| | **Sub-Total** | **648.856** | **788.694** | **1083.430** | **1103.300** | **1033.151** |
| | **Total (A+B)** | **10133.339** | **8980.194** | **10209.389** | **11946.505** | **11850.213** |
| (C) | **Special Projects HCP/ NCP / FTT / FBR / CSIR First / NMITLI** | **944.118** | **379.020** | **1259.054** | **2290.671** | **1447.410** |
| (D) | **Pension and other Retirement Benefits** | **5293.000** | **6529.000** | **6148.094** | **6478.878** | **7057.158** |
| | **Grant Total (A+B+C+D)** | **16370.457** | **15888.214** | **17616.537** | **20716.054** | **20354.781** |

***Data as on 01-04-2024**

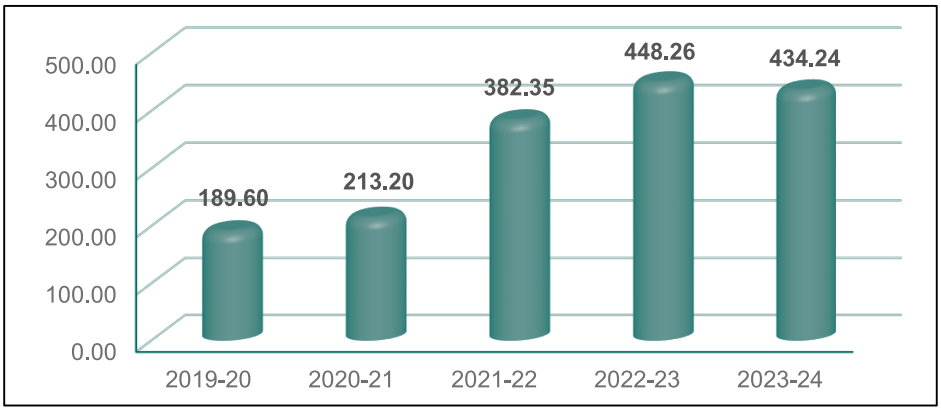
## External Budgetary Resources

Rs. in lakh

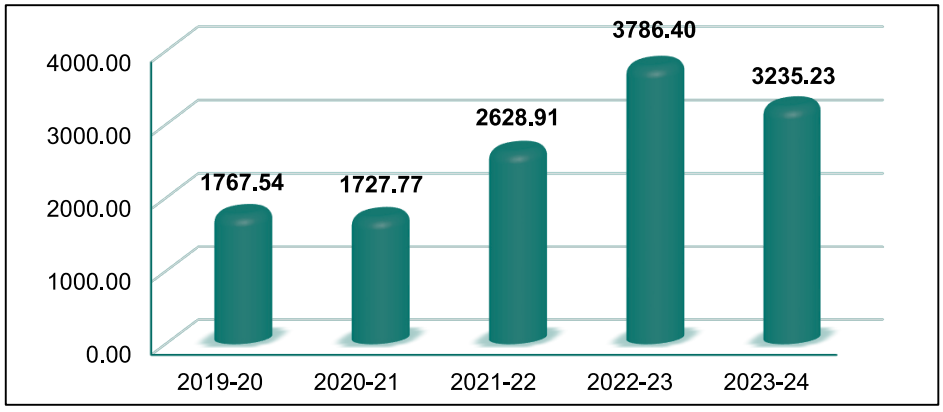
### External Cash Flow from Government Agencies & Industries




### Lab Reserve Fund Generated



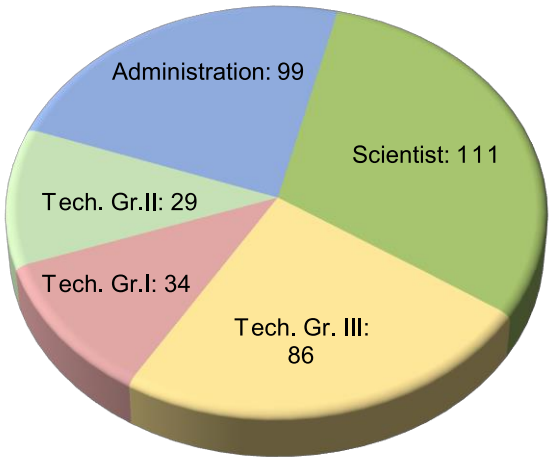

### Total External Budgetary Resources (ECF + LRF)



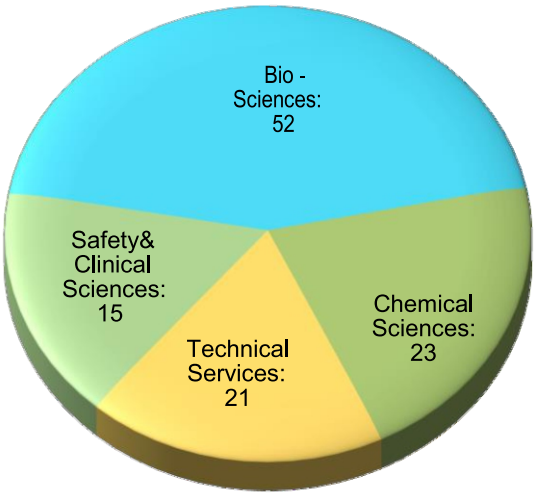

***Data as on 01-04-2024**

## Human Resource

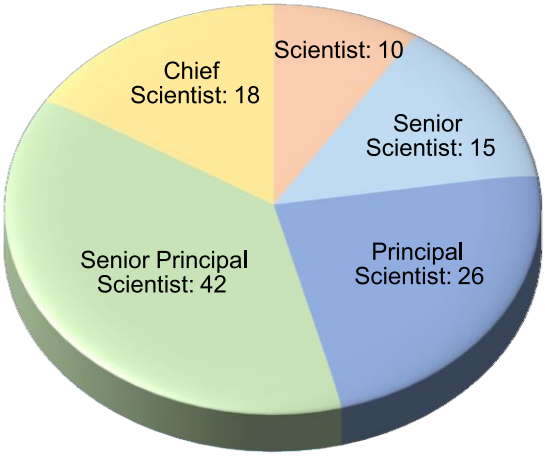
### Total Staff (359)



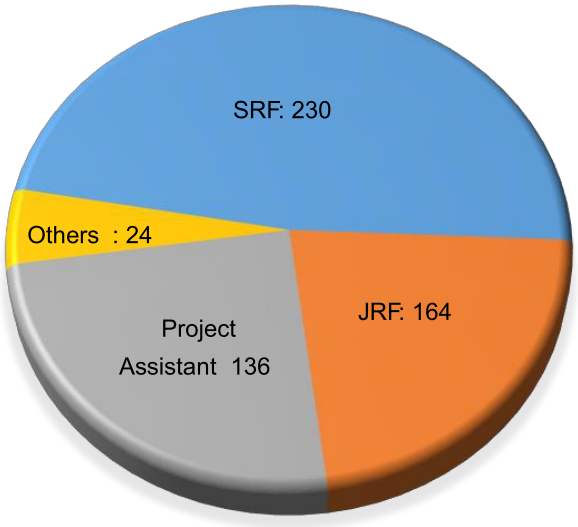

### Area-wise strength of Scientists




### Designation-wise strength of Scientists

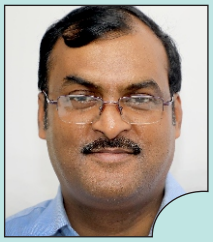



### Research Fellows & Project Staff Strength




*Data as on 31-03-2024

## Welcome to the newly Recruited staff



**Dr Arun Kumar Haldar**
Principal Scientist
Biochemistry and Structural Bilogy

**Dr Ashish Awasthi**
Senior Scientist
Toxicology & Experimental Medicine

**Dr Suresh Kumar Kalangi**
Scientist
Molecular Microbiology & Immunology

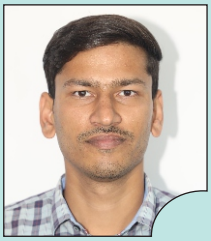
**Dr Kaushik Bhattacharjee**
Scientist
Business Development & IP Unit

**Dr Hijas KM**
Scientist
Academic Affairs Unit

**Dr Pradeep Singh**
Senior Technical Officer
(Medical Officer) Dispensary

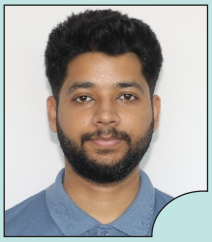
**Mr Saurav Singh KC**
Senior Technical Officer
(Medical Officer) Dispensary

**Mr Sachin Mishra**
Hindi Officer
Raj Bhasha Vibhag

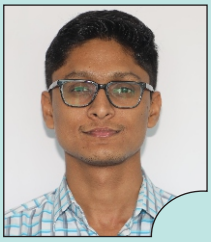


**Mr Bihari Kumar**
Hindi Translator
Raj Bhasha Vibhag

**Ms Ambica Bhavani Vaka**
Junior Secretariat Assistant
Store & Purchase



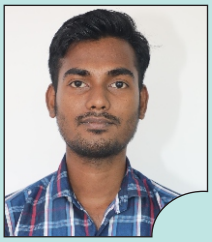
**Mr Satyam Tewari**
Junior Secretariat Assistant
Finance & Accounts



**Mr Harshit Mishra**
Junior Secretariat Assistant
Finance & Accounts

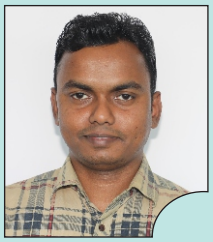
## Welcome to the newly Recruited staff

**Mr Satyam Rathour**
Junior Secretariat Assistant
Store & Purchase

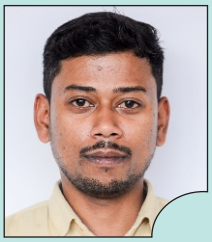


**Mr Abhishek Kashyap**
Junior Secretariat Assistant
Establishment - I

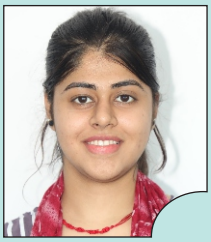
**Mr Bhupendra Kumar**
Junior Secretariat Assistant
General Section



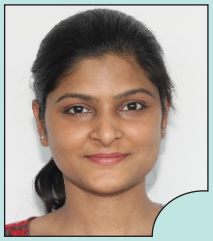
**Mr Naveen**
Junior Secretariat Assistant
Stores & Purchase



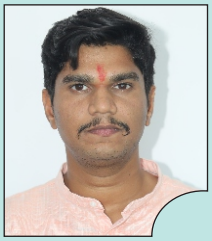
**Mr Raman Kumar**
Junior Secretariat Assistant
Finance & Accounts



**Ms Shailja Bahal**
Junior Secretariat Assistant
Establishment - I



**Ms Harshita Maheshwari**
Junior Secretariat Assistant
Bills Section

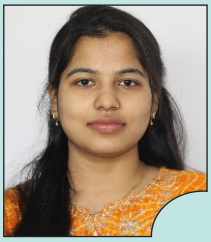


**Mr Ashutosh Chaudhary**
Junior Secretariat Assistant
General Section

**Mr Aman Soni**
Junior Stenographer
Establishment-I

**Mr Dileep Tiwari**
Junior Secretariat Assistant
Stores & Purchase

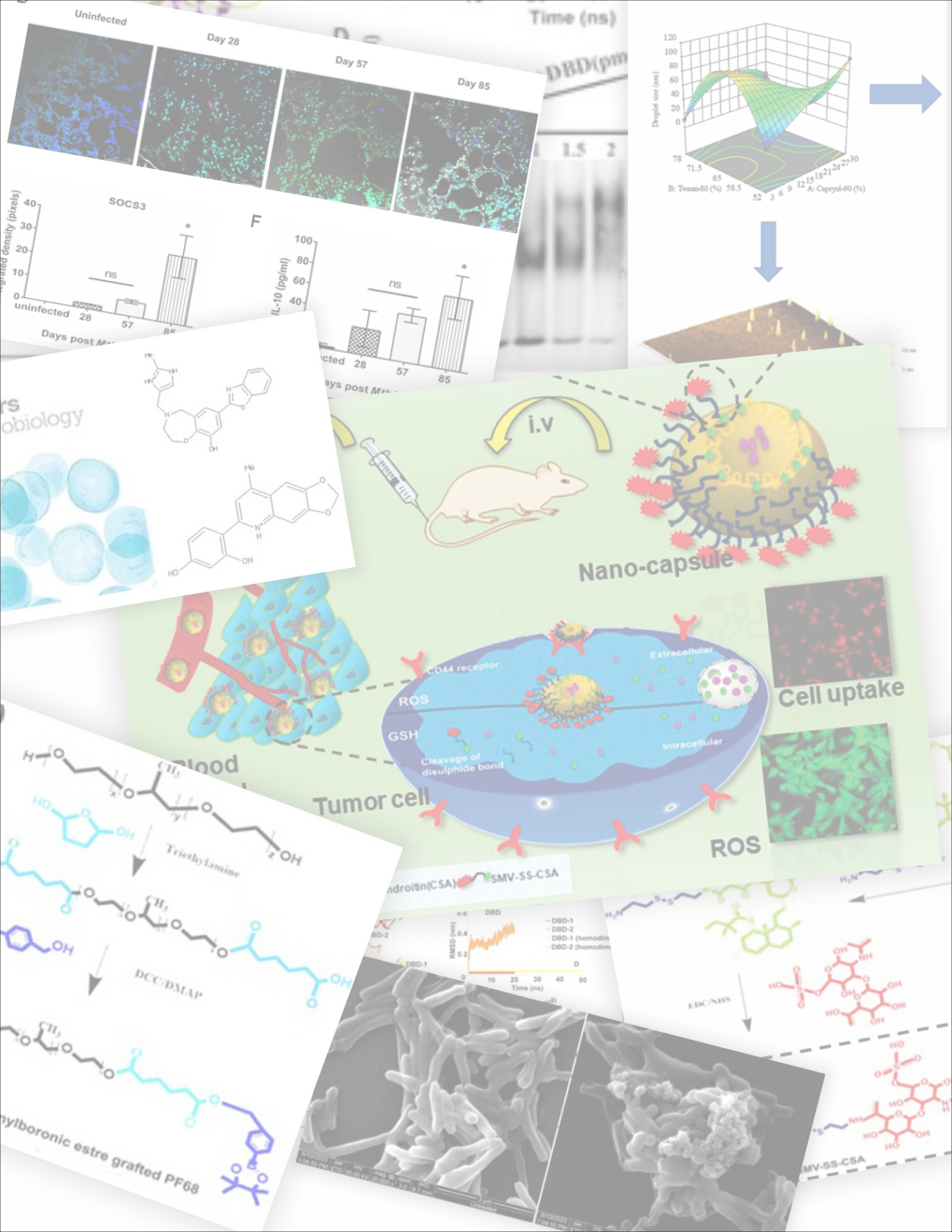
**Mr Shivam Verma**
Junior Stenographer
Establishment-II



**Ms Aastha**
Junior Secretariat Assistant
Vigilance Section

Section
I

# Progress in Thrust Areas of Research


Uninfected
Day 28
Day 57
Day 85
SOCS3
Integrated density (pixels)
uninfected
28
57
85
Days post
IL-10 (pg/ml)
ns
*
Droplet size (nm)
B: Tween-80 (%)
A: Capryol-90 (%)
i.v
Nano-capsule
CD44 receptor
ROS
GSH
Cleavage of disulphide bond
Extracellular
Intracellular
Cell uptake
Tumor cell
blood
ROS
Triethylamine
DCC/DMAP
ylboronic estre grafted PF68
EDC/NHS
SMV-SS-CSA
DBD-1
DBD-2
RMSD (nm)
Time (ns)

# 1 Regulatory Studies and Translational Research

## Vision :

To deliver high quality and reliable preclinical regulatory data and pioneer advancements that accelerate the translation of scientific discoveries

## Goals :

- To establish a cGMP facility for pilot-scale production of pharmaceutical formulations and National Clinical Trial Batch Production Facility under CRTDH program
- To extend the scope of GLP certified test facility for preclinical studies in animals required for pharmaceuticals
- Set up a center wherein activities related to a Drug Testing Lab (DTL) and bioanalytical center for analysis of samples for studying pre-clinical and clinical pharmacokinetics (PK)
- Formulations of CSIR-CDRI new drug candidates and novel drug delivery systems in the thrust areas of CSIR-CDRI
- Generate IND-enabling data for CSIR-CDRI leads as per regulatory requirements
- Development of platform for immuno toxicology assessment for biologics, phyto-pharmaceuticals including *in silico* platform for toxicity studies
- Reducing/ refining and replacement of the use of animals for regulatory purposes (use of 3R) and the development of the *in vitro* tools and techniques for risk assessment
- Clinical Trials and BA/BE studies: Strengthening the linkages with Clinical Trial Centers (KGMU Lucknow, KEM Hospital Mumbai, PGI Chandigarh) especially Clinical Trial Unit for conduct of Phase I Clinical Trials and BA/BE studies at KGMU, Lucknow

**First Row (L to R):** Dr. Virendrakumar Prajapathi, Dr. Aamir Nazir, Dr. Sharad Sharma (Coordinator), Dr. SK Rath (Coordinator), Dr. Baisakhi Moharana, Dr. Radha Rangarajan (Chairperson), Dr. Smrati Bhadauria, Dr. Prabhat Ranjan Mishra (Coordinator), Dr. Kashif Hanif, Dr. Manoj Barthwal (Coordinator), Dr. PN Yadav, Dr. Vivek Bhosale

**Second Row (L to R):** Dr. Sachin Kumar, Dr. Jiaur R Gayen, Dr. Madhav Mugale, Dr. Sarika Singh, Dr. Shubha Shukla, Dr. Namrata Singh, Dr. Anil Gaikwad, Dr. Rabi S Bhatta, Dr. Kumaravelu J, Dr. Sripathi Rao Kulkarni

*The Translational Research Group (TRG) plays a key role in building and advancing the preclinical pipeline. Compounds entering the TRG review are carefully monitored so that an adequate data package, in line with Regulatory requirements, is put together. Ultimately it is the TRG's responsibility to ensure that the right compounds progress to the clinic.*

***- Dr. Radha Rangarajan***
*Director &*
*Chairperson, Translational Research Group*

## 1.1 Formulations and Pharmaceutics

### 1.1.1 Centinhale- Inhalable Particles Containing Anti-Tuberculosis Agents

Institutional Ethics Committee approval for a Phase 1b/2a Academic Clinical trial on the safety, pharmcokinetics and early bactericidal activity of Centinhale has been received from the institute as well as the clinical trial site—King George's Medical University, Lucknow. GMP manufacture of Centinhale will be undertaken after Form CT-10 is submitted to the CDSCO and permission received. Recruitment will commence shortly thereafter.

### 1.1.2 Enhanced Anticancer Activity of siRNA and Drug co-delivered by Anionic Biopolymer: Overcoming Electrostatic Repulsion

A negatively charged cell membrane repels negatively charged siRNA, so positively charged (cationic) polymers are used to mask siRNA for crossing the cancer cell membrane. However, cationic polymers are usually toxic to the body and show several adverse effects. Negatively charged polymers are safe alternatives for delivering siRNA into cancer cells, but the main challenge lies in the repulsive interaction between siRNA and negatively charged polymers. We have designed and synthesized modified anionic polymer [6-O-(3-hexadecyloxy-2-hydroxypropyl)-hyaluronic acid] for successful co-delivery of siRNA and an anticancer drug into cancer cells. A 69% knockdown of the target gene was observed, and Western blot showed 5.7-fold downregulation of the target protein. The repulsive forces between siRNA and 6-O-(3-hexadecyloxy-2-hydroxypropyl)-hyaluronic acid were overcome by hydrogen bonding and hydrophobic interactions (molecular docking study). ***Nanomedicine (Lond). 2023 11:855-874.***

### 1.1.3 Inhaled Mycobacteriophages for Phage Therapy of Tuberculosis

Dry Powder Inhalation (DPI) formulations of mycobacteriophages D29 and TM4 were tested for efficacy against *Mycobacterium tuberculosis* infection in mice. Colony forming units (CFU) in the lungs fell significantly from about one million bacterias per gram of lung tissue to 10 thousand if infected animals were treated with four standard anti-tuberculosis therapy drugs (ATT) drugs for four weeks. Regardless of dose, the reduction in CFU achieved by phage DPI alone was about 1 order of magnitude, which was not statistically significant. However, the difference between bacterial burden in animals receiving ATT alone was also not significantly different from that in animals receiving either the low dose or the high dose DPI. Addition of DPI to oral ATT achieved statistically significant reduction in CFU to about 1000/g. We inferred that bacterial and phage populations reach a

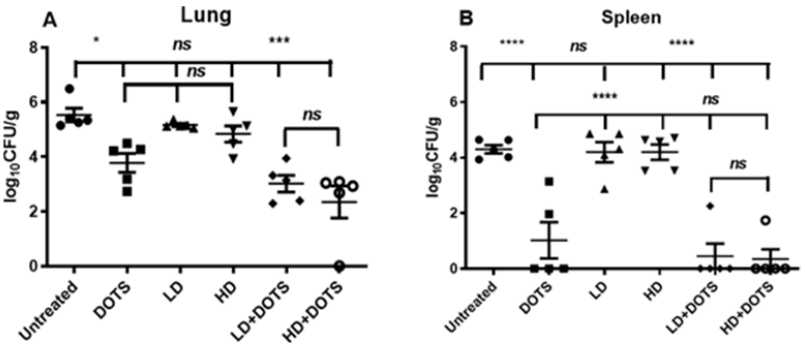



**Fig 1.** Inhaled phages do not reduce the number of bacteria in the lungs or spleen, unless oral drugs are also given

stable equilibrium in four weeks, at which point, the number of bacteria reduce by one order of magnitude. Addition of standard ATT to the therapeutic regimen results in more efficient depletion of the remaining bacteria. Inhaled mycobacteriophages should be tested for their ability to shorten the duration of treatment of tuberculosis from six months, down to maybe one month.

### 1.1.4 R&D Scale Formulations Manufacturing Facility, Drug Testing Lab (DTL), and Bioanalytical Facility for Preclinical and Clinical Pharmacokinetics as a 'Common Research and Technology Development Hub (CRTDH)'

Since its inception, the CRTDH has benefitted >200 pharmaceutical MSME by troubleshooting their technical problems related to manufacturing medicines; advising them on technology feasibility; conducting conferences, training and webinars and partnering them for novel technology development. A Form 37 License was received from the UP FSDA after joint inspection of the premises along with CDSCO. The facility can now to test medicines and raw material required to make them, for the purpose of quality assurance for release of manufactured batches of products into the market; and provide legally valid certificates of analysis. Currently, the facility is being used for development of direct-compression, film coated tablets of CDRI Compound S011-1793, and will be used for manufacture of Centinhale for the upcoming clinical trial.

### 1.1.5 Regulation of Transcription of Suppressors of Cytokine Signaling During Infection with *Mycobacterium tuberculosis* in Human Macrophages and Mice

*Mycobacterium tuberculosis* (Mtb) infection leads to upregulation of transcription of host genes coding for Suppressors of Cytokine signaling (SOCS) expression in host macrophages (Mf). SOCS proteins inhibit cytokine signaling by negatively regulating host signaling pathways that use the JAK/STAT pathway of signal transduction. We investigated this host-pathogen dialectic at the level of transcription. We used phorbol-differentiated THP-1 Mf infected with Mtb to investigate preferential upregulation of some SOCS isoforms that are known to inhibit signaling by

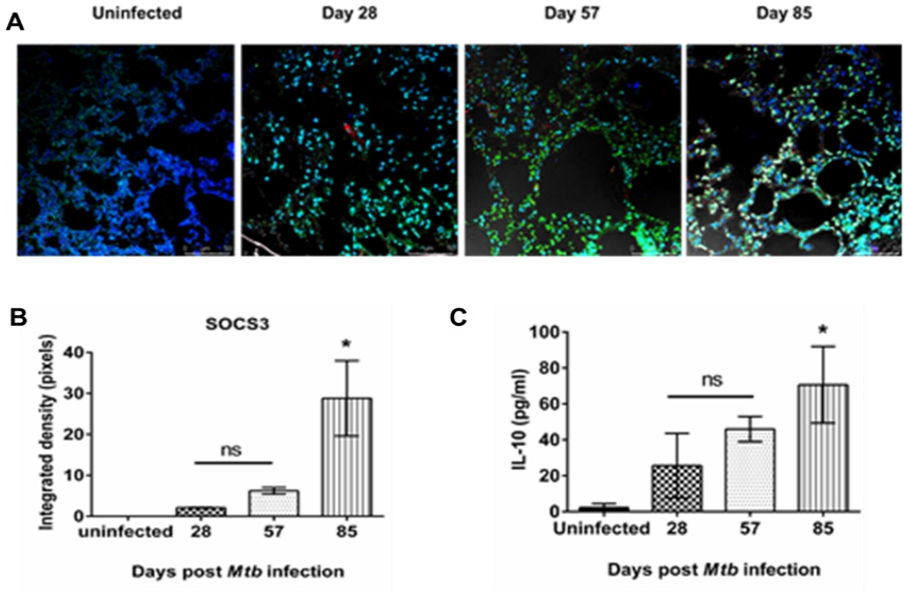



**Fig 2. (A) A**utophagic flux indicated by yellow puncta in lung tissue of infected mice. **(B)** Integrated density indicating extent of autophagic flux in the lungs following infection. **(C)** Interleukin (IL) 10 secreted by lung macrophages recovered from infected mice

*"The facility at CDRI is now getting ready to focus on translational research of Pharmaceuticals, Biologics, Phytopharmaceuticals and AYUSH products for humans"*

***- Dr. Sharad Sharma***
*Chief Scientist & Coordinator, Translational Research Group*

*"Safety and Risk are the two sides of the same coin, we are determined to draw that fine line so that new drugs can be developed within the safe window for a disease-free world"*

***- Dr. SK Rath***
*Chief Scientist & Coordinator, Translational Research Group*

IFN-γ, IL-12, and IL-6. We examined time kinetics of likely transcription factors and signaling molecules upstream of SOCS transcription, and survival of intracellular Mtb following SOCS upregulation. Our results suggest a plausible mechanism that involves induction of the prostaglandin PGE2 to induce the PKA/CREB axis, culminating in nuclear translocation of C/EBPβ to induce expression of SOCS1. Mtb-infected Mf secreted IL-10, suggesting a mechanism of induction of STAT3, which may subsequently induce SOCS3. We provide evidence of temporal variation in SOCS isoform exspression and decay. Small-interfering RNA-mediated knockdown of SOCS1 and SOCS3 restored the pro-inflammatory milieu and reduced Mtb viability. In mice infected with Mtb, SOCS isoforms persisted across Days 28- 87 post infection. Our results suggest that differential temporal regulation of SOCS isoforms by Mtb drives the host immune response towards a phenotype that facilitates the pathogen's survival.

### 1.1.6 Synergistic Delivery of Imatinib Through Multifunctional Nano-Crystalline Capsules, in Response to Redox Environment for Improved Breast Cancer Therapy

Chondroitin anchored crystalline nano-capsules bearing Imatinib (IMT), and Simvastatin (SMV) was developed using Poly (L-lactic acid) (PLLA) by two-step method, i.e., firstly, by synthesizing chondroitin (CSA) anchored simvastatin (SMV) using cystamine as a spacer (SMV-SS-CSA) for disulfide triggered glutathione (GSH) sensitive release and secondly, by developing Phenyl boronic Ester grafted Pluronic F68 (PEPF) for $H_2O_2$ responsive release. By combining these conjugates, we have prepared crystalline nano-capsules (CNs) for preferential targeting of CD44 receptors. The developed CNs were spherical when characterized through SEM, TEM, and AFM for surface morphology, while changes in particle size and crystalline structure were confirmed through Quasi-

Elastic light scattering (QELS) and Wide Angle X-ray Scattering (WAXS). The enhanced cellular uptake was noted in chondroitin-modified nano-capsules IMT/SMV-SS-CSA@CNs compared to unmodified nano-capsules IMT+SMV@CNs. IMT/SMV-SS-CSA@CNs displayed significantly higher G2/M phase arrest (76.9%) than unmodified nano-capsules. The prototype formulation (IMT/SMV-SS-CSA@CNs) showed an overall improved

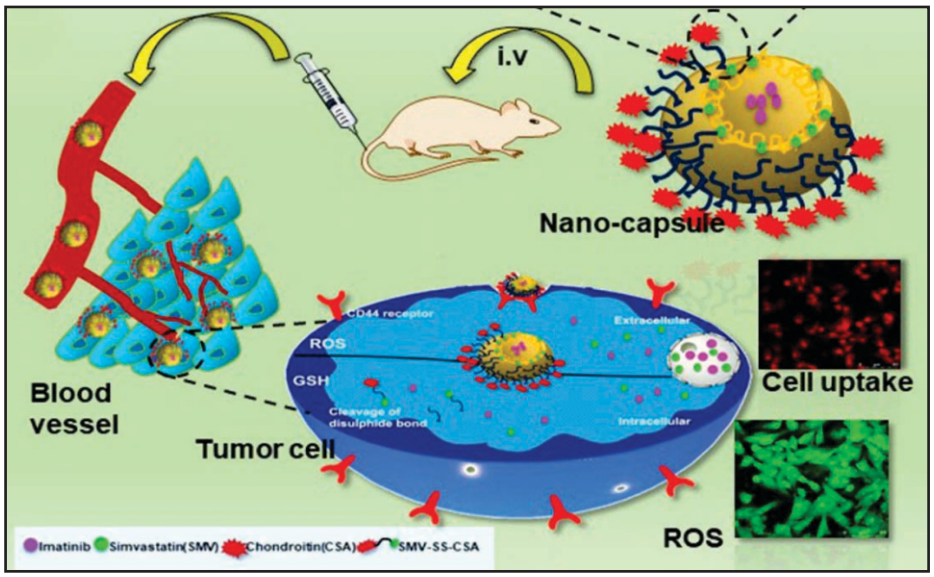



**Fig 3:** Schematic illustration of CD44 receptor mediated intracellular uptake of IMT loaded SMV-SS-CSA nano-capsules based on dual responsive.

pharmacokinetic profile in terms of both half-life and AUC0-α. When tested in the 4T1 subcutaneously injected tumor-bearing BALB/c mice model, the tumor growth inhibition rate of IMT/SMV-SS-CSA@CNs was significantly higher (91%) than the IMT+SMV combination. Overall, the findings suggest that the proposed dual responsive chondroitin-modified drug delivery could have a step forward in achieving spatial and temporal targeting at the tumor site. ***(Colloids Surf B Biointerfaces, 2023 Jun:226:113316.)***

### 1.1.7 Self-Assembled Redox-Sensitive Polymeric Nanostructures Facilitate the Intracellular Delivery of Paclitaxel for Improved Breast Cancer Therapy

A two-tier approach has been proposed for targeted and synergistic combination therapy against metastatic breast cancer. First, it comprises the development of a paclitaxel (PX)-loaded redox-sensitive selfassembled micellar system using betulinic acid"disulfide"D-α-tocopheryl poly(ethylene glycol) succinate (BA-Cys-T) through carbonyl diimidazole (CDI) coupling chemistry. Second, hyaluronic acid is anchored to TPGS (HA-Cys-T) chemically through a cystamine spacer to achieve CD44 receptormediated targeting. We have established that there is significant synergy between PX and BA with a combination index of 0.27 at a molar ratio of 1:5. An integrated system comprising both BA-Cys-T and HA-Cys-T (PX/BA-Cys-THA) exhibited significantly higher uptake than PX/BA-Cys-T, indicating preferential CD44-mediated uptake along with the rapid release of drugs in response to higher glutathione concentrations. Significantly higher apoptosis (42.89%) was observed with PX/BA-Cys-T-HA than those with BA-Cys-T (12.78%) and PX/BA-Cys-T (33.38%). In addition, PX/BA-Cys-T-HA showed remarkable enhancement in the cell cycle arrest, improved

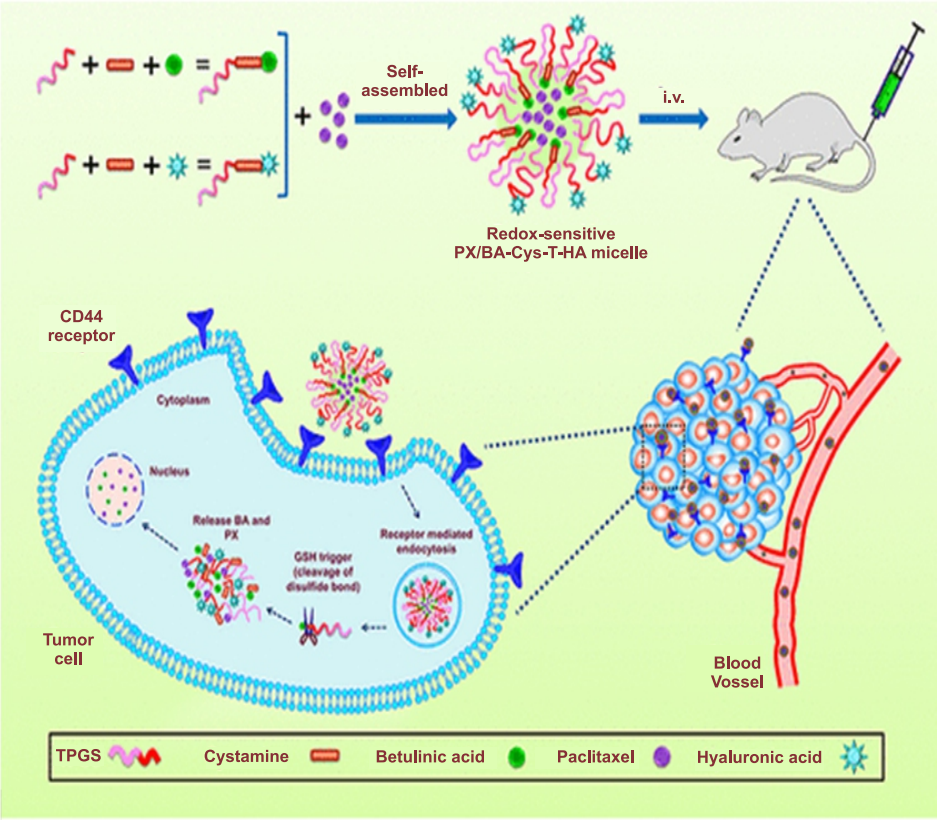



**Fig 4.** Self-assembled redox-sensitive polymeric nanostructures facilitate the intracellular delivery of paclitaxel for improved breast cancer therapy

*"A platform for continuous interaction and enrichment between research and preclinical development activities for developing new treatments"*

***- Dr. Sanjay Batra***
*Chief Scientist*
*Coordinator, Translational Research Group*

*"Empowering innovation through multidisciplinary research, including nano-therapeutics, pre-clinical pharmacokinetics, supporting IND-enabling data generation for CSIR-CDRI leads, and also offering cGMP-compliant clinical trial batch production facility."*

***- Dr. Prabhat Ranjan Mishra***
*Chief Scientist & Coordinator, Translational Research Group*

depolarization of the mitochondrial membrane potential, and induced excessive generation of ROS when tested in the MDA-MB-231 cell line. An *in vivo* administration of targeted micelles showed improved pharmacokinetic parameters and significant tumor growth inhibition in 4T1-induced tumor-bearing BALB/c mice. Overall, the study indicates a potential role of PX/BA-Cys-T-HA in achieving both temporal and spatial targeting against metastatic breast cancer (***Mol Pharm. 2023 Apr 3;20(4):1914-1932.***).

### 1.1.8 Surface-Modified Lyotropic Crystalline Nanoconstructs Bearing Doxorubicin and Buparvaquone Target Sigma Receptors through pH-Sensitive Charge Conversion to Improve Breast Cancer Therapy

In the current study, we aimed to develop lyotropic crystalline nanoconstructs (LCNs) based on poly(L-glutamic acid) (PLG) with a two-tier strategy. The first objective was to confer pH-responsive charge conversion properties to facilitate the delivery of both doxorubicin (DOX) and buparvaquone (BPQ) in combination (B + D@LCNs) to harness their synergistic effects. The second goal was to achieve targeted delivery to sigma receptors within the tumor tissues. To achieve this, we designed a pH responsive charge conversion system using a polymer consisting of poly(ethylenimine), poly(L-lysine), and poly(L-glutamic acid) (PLG), which was then covalently coupled with methoxybenzamide (MBA) for potential sigma receptor targeting. The resulting B + D@LCNs were further modified by surface functionalization with PLG"MBA to confer both sigma receptor targeting and pH-responsive charge conversion properties. Our observations indicated that at physiological pH 7.4, P/B + D-MBA@LCNs exhibited a negative charge, while under acidic conditions (pH 5.5, characteristic of the tumor microenvironment), they acquired a positive charge. The particle size of P/B + D-MBA@LCNs was determined to be 168.23 ± 2.66 nm at pH 7.4 and 201.23 ± 1.46 nm at pH 5.5. The crystalline structure of the LCNs was confirmed through small angle X-ray scattering (SAXS) diffraction patterns. Receptor-mediated endocytosis, facilitated by P/B + D-MBA@LCNs, was confirmed using confocal laser scanning microscopy and flow cytometry. The P/B + D-MBA@LCNs formulation demonstrated a higher

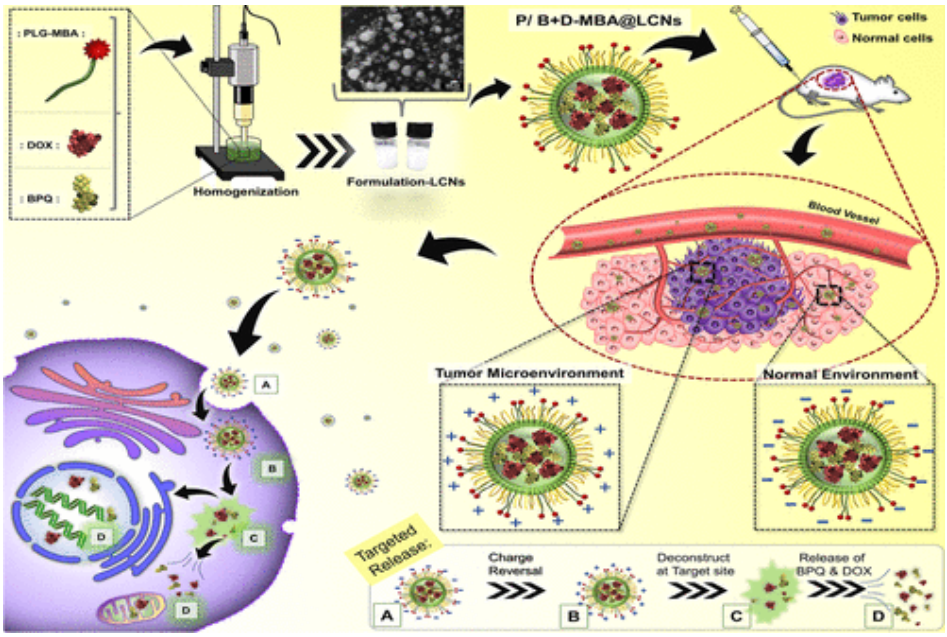



**Fig 5.** pH-Sensitive Charge-Reversal System for Buparvaquone (BPQ) and Doxorubicin (DOX) Delivery with Enhanced Therapeutic Efficacy

rate of G2/M phase arrest (55.20%) compared to free B + D (37.50%) and induced mitochondrial depolarization (59.39%) to a greater extent than P/B + D@LCNs (45.66%). Pharmacokinetic analysis revealed significantly improved area under the curve (AUC) values for both DOX and BPQ when administered as P/B + D-MBA@LCNs, along with enhanced tumor localization. Tumor regression studies exhibited a substantial reduction in tumor size, with P/B + D-MBA@LCNs leading to 3.2- and 1.27-fold reductions compared to B + D and nontargeted P/B + D@LCNs groups, respectively. In summary, this two-tier strategy demonstrates substantial promise for the delivery of a drug combination through the prototype formulation. It offers a potential chemotherapeutic option by minimizing toxic effects on healthy cells while maximizing therapeutic efficacy. (***Biomacromolecules 2023, 24, 12, 5780–5796)***

### 1.1.9 Ratiometric Codelivery of Paclitaxel and Baicalein Loaded Nanoemulsion for Enhancement of Breast Cancer Treatment

The most prevalent clinical option for treating cancer is combination chemotherapy. In combination therapy, assessment and optimization for obtaining a synergistic ratio could be obtained by various preclinical setups. Currently, *in vitro* optimization is used to get synergistic cytotoxicity while constructing combinations. Herein, we co-encapsulated Paclitaxel (PTX) and Baicalein (BCLN) with TPP-TPGS1000 containing nanoemulsion (TPP-TPGS1000-PTX-BCLN-NE) for breast cancer treatment. The assessment of cytotoxicity of PTX and BCLN at different molar weight ratios provided an optimized synergistic ratio (1:5). Quality by Design (QbD) approach was later applied for the optimization as well as characterization of nanoformulation for its droplet size, zeta potential and drug content. TPP-TPGS1000-PTX-BCLN-NE significantly enhanced cellular ROS, cell cycle arrest, and depolarization of mitochondrial membrane potential in the 4T1 breast cancer cell line compared to other treatments. In the syngeneic 4T1 BALB/c tumor model, TPP-TPGS1000-PTX-BCLN-NE outperformed other nanoformulation treatments. The pharmacokinetic, biodistribution and live imaging studies pivoted TPP-TPGS1000-PTX-BCLN-NE enhanced bioavailability and PTX accumulation at tumor site. Later, histology studies confirmed nanoemulsion non-toxicity, expressing new opportunities and potential to treat breast cancer. ***(Int. J Pharmaceutics (643), 2023, 123209.)***

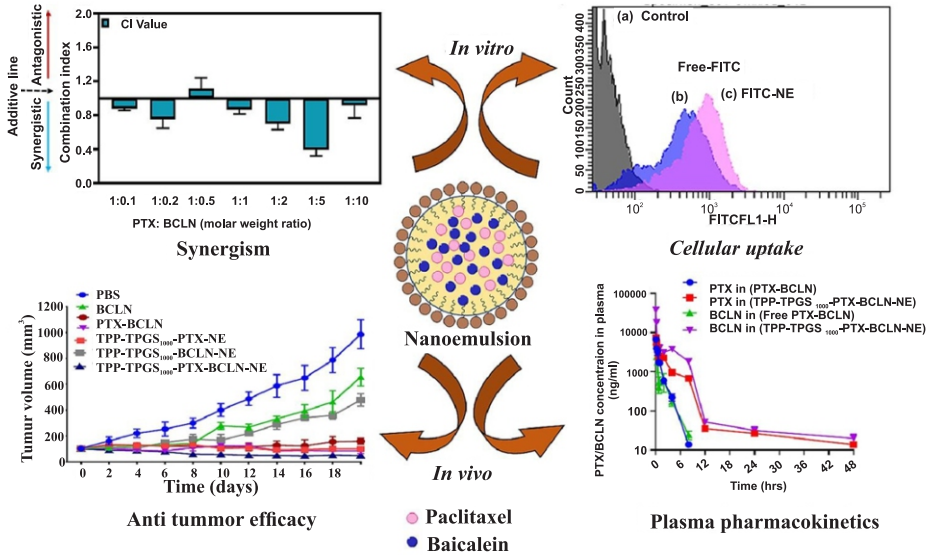



**Fig 6.** Ratiometric codelivery of Paclitaxel and Baicalein loaded nanoemulsion for enhancement of breast cancer treatment

*"Translating bench-to-bedside"*

***- Dr. Manoj Kumar Barthwal***
*Senior Principal Scientist & Coordinator, Translational Research Group*

### 1.1.10 Formulation of Cream and Gel Formulations Bearing Plant Extracts

Topical cream and gel formulations have been developed to enhance the administrability of the methanolic extract from plants. Initially, the excipients were subjected to solubility, compatibility, and optimization. We have already optimized the placebo cream and gel formulations using a central composite design. The composition of optimized formulation was used to prepare the formulation incorporating plant extracts. For cream formulation, the oil phase was prepared by melting the waxes at 75°C and mixing the ingredients uniformly. The aqueous phase was prepared by dissolving the water-soluble ingredients in deionized water. The aqueous phase was warmed to 75–80°C until all ingredients were dissolved. When the aqueous and oil phase were at the same temperature, the aqueous phase was slowly added to the oil phase with moderate agitation. The plant extract was added to the mixture followed by the addition of triethanolamine and it was kept under stirring resulting in the formation of cream. Further, for the formulation of the Topical Gel (5% and 10%), Carbopol 940 and HPMC in a ratio of 2:1 was dispersed in 40°C warm deionized water with stirring. The resulting solution was stored at room temperature overnight until a monophasic system was observed. Further preservative and triethanolamine were added to form a clear gel. The polyherbal formulations constituting three and five extracts using the above optimized formula were prepared. 5% and 10% polyherbal formulations with 5 plants extracts *viz. Curcuma longa, Mimosa pudica, Mikania micrantha, Lantana camara* and *Ageratum conyzoides* and 5% and 10% polyherbal formulations with 3 plant extracts *viz. Curcuma longa, Mimosa pudica* and *Mikania micrantha* were prepared and compared with marketed formulations (Himax and Betadine). The formulated gel and cream were evaluated for organoleptic characteristics, spreadability, pH values, viscosity measurement and extrudability study. Subsequently, these formulations were subjected to assessment of wound healing activity.

### 1.1.11 A Quality by Design Approach for Developing SNEDDS Loaded with Vemurafenib for Enhanced Oral Bioavailability

Vemurafenib (VMF) is a practically insoluble (<0.1 µg/mL) and least bioavailable (1%) drug. To enhance its oral bioavailability and solubility, we formulated a reliable self-nano emulsifying drug delivery system (SNEDDS). A Quality by Design (QbD) approach was used to optimize the ratio of Capryol 90, Tween 80, and Transcutol HP. VMF loaded SNEDDS was characterized for its size, polydispersity index, zeta potential, drug content, and transmittance. The *in-vitro* release profile of the drug loaded in SNEDDS was compared to the free drug in two media, pH 6.8 and 1.2, and the

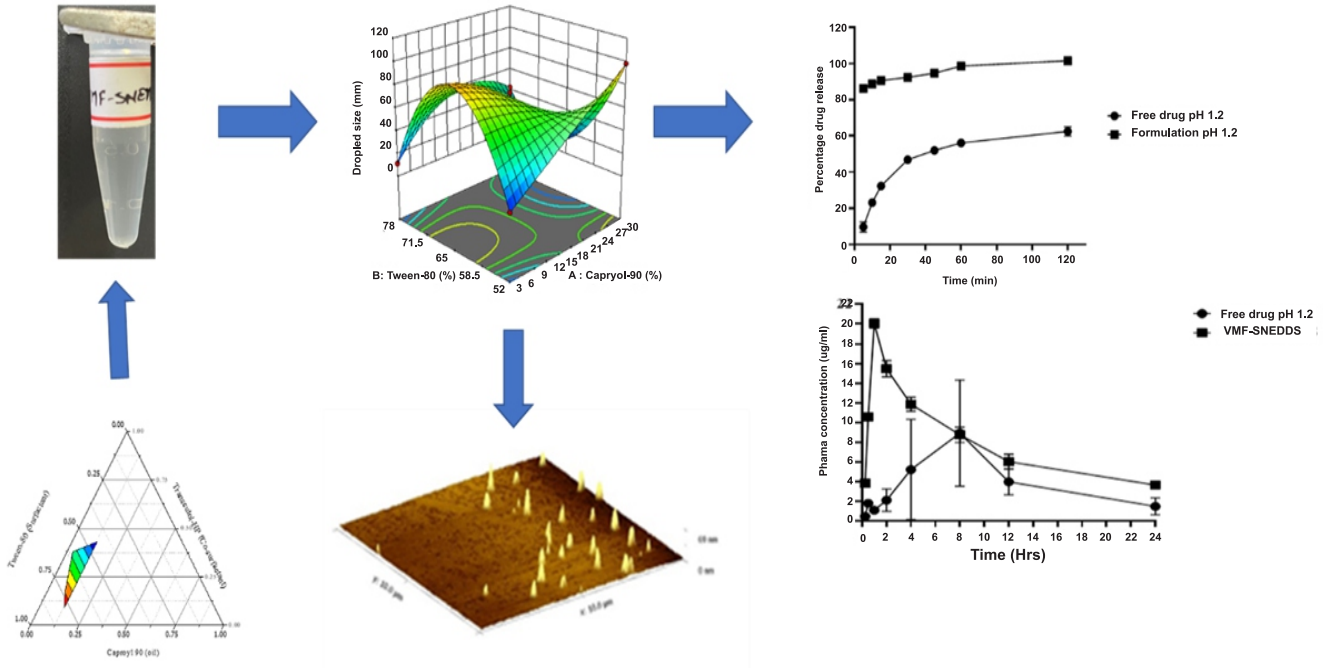



**Fig. 7: Developed SNEDDS showing enhanced dissolution and bioavailability**

data obtained was analysed with different mathematical models. A reverse-phase ultra-pressure liquid chromatography (UPLC) technique with high sensitivity and selectivity was developed and validated for the quantification of VMF in analytical and bioanalytical samples. Dissolution efficiency for SNEDDS was estimated using different models, which proved that the developed novel SNEDDS formulation had a better *in-vitro* dissolution profile than the free drug. A 2.13-fold enhanced oral bioavailability of VMF loaded SNEDDS compared to the free drug demonstrates the superiority of the developed formulation. ***(AAPS PharmSciTech 25, 14 (2024).)***

### 1.1.12 Technology Transfer of a Validated RP-HPLC Method for the Simultaneous Estimation of Andrographolide and Paclitaxel in Application to Pharmaceutical Nanoformulation

Many analytical methods are reported for simultaneous estimation of pharmaceutical dosages form. However, only a few are reproducible at an industrial scale. The proposed research aims to establish a technology transfer (TT) protocol between two laboratories (Lab-X, originator) with binary and (Lab-Y, receiver) with quaternary high-performance liquid chromatography (HPLC) system. Thus, utilizing reverse-phase HPLC (RP-HPLC), a robust, sensitive and repeatable analytical method has been developed, validated and TT between two laboratories for simultaneous estimation of Andrographolide (AG) and Paclitaxel (PTX). The method has been developed on a Phenomenex Luna C18 column (150 x 4.6, 5) sustained at 40°C and validated as per the ICH Q2 (R1) regulatory guideline and TT USP chapter 1224. The mobile phase consisted of MilliQ (pH = 3) and a combination of acetonitrile and methanol (1:1) in the ratio 50:50 with a flow rate of 0.45 mL/min, linear gradient elution in both labs. The AG and PTX were detected on the PDA detector at 224 and 227 nm wavelength with retention time of 4.5 ± 0.34 and 8.2 ± 0.02 min and limit of detection was found 0.028 ± 0.004 µg/mL, and 0.028 ± 0.0007 µg/mL, whereas limit of quantification as 0.086 ± 0.011 µg/mL and 0.088 ± 0.0014 µg/mL respectively in both labs. Throughout, this approach we have proved that proposed method is repeatable in both labs, and it can be used to quantify AG and PTX in developed pharmaceutical nano-formulations. ***(J Chromatogr Sci. 2024 Apr 23;62(4):356-363)***

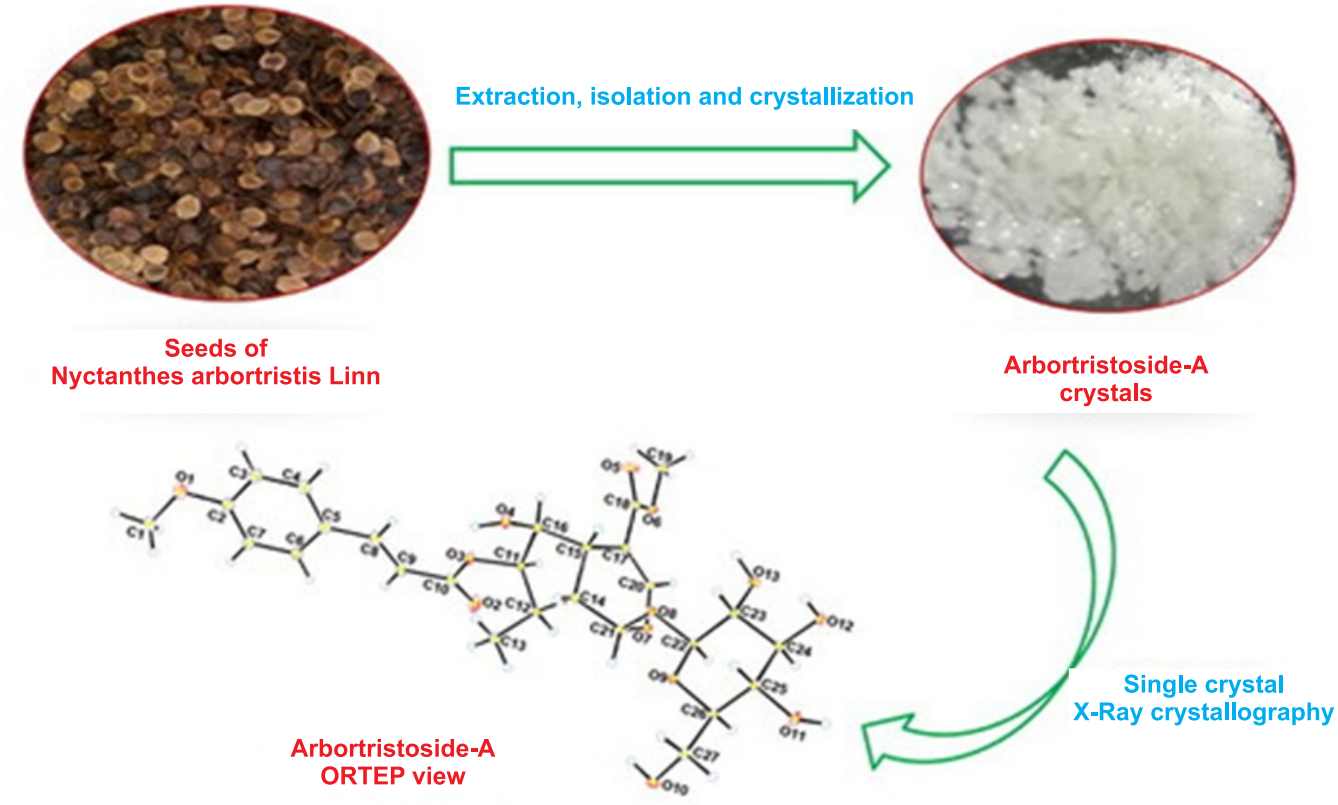



**Fig. 8 :** Structural Elucidation of Arbortristoside-A from *Nyctanthes arbor-tristis* Seeds Using X-ray Crystallography

### 1.1.13 Isolation of Arbortristoside-A from *Nyctanthes arbor-tristis* Seeds and its Structural Validation by X-Ray Crystallographic Analysis

Arbortristoside-A was isolated from seeds of *Nyctanthes arbor-tristis* Linn. using standard extraction and purification techniques. The isolated compound was then subjected to single crystal X-ray crystallographic analysis to determine its molecular structure (Fig. 8). This technique provided detailed insights into the connectivity and arrangement of atoms within Arbortristoside-A, confirming its chemical identity with high accuracy. The crystallographic analysis aimed to resolve prior structural discrepancies reported in literature and establish a reliable foundation for further studies on the compound's chemical, computational, and physiological properties. The results of this analysis contribute to a better understanding of Arbortristoside-A and its potential pharmaceutical applications. ***(Nat Prod Res. 2023 Jun 27:1-7).***

### 1.1.14 Development and Validation of Simultaneous Quantification Method for Gemcitabine and Betulinic Acid: Augmenting Industrial Application

Combinatorial treatment utilizing a nucleoside analogue gemcitabine (GEM), with a pentacyclic triterpenoid betulinic acid (BET), has exhibited empowering efficacy in the therapy of cancer. It reduces the advancement of collagen and enhances the saturation of tumor treatments. With advancements in nanotechnology, the co-loaded formulation calls for a validated method of measurement. The proposed work entails a robust, simple, and economical analytical method for the simultaneous estimation of GEM and BET through RP-HPLC. Orthophosphoric acid (0.1%)—acetonitrile was considered as the mobile phase for the detection of GEM and BET at 248 nm and 210 nm with retention times of 5 min and 13 min, respectively. The method was further validated as per regulatory guidelines, with all parameters found within the limit. The developed method with adequate resolution and quantification was found to be linear, accurate, precise, robust, and stable with intra- and inter-day variabilities of less than 2%. The method was found specific for GEM and BET with no matrix interference of drug-spiked FBS samples. To demonstrate the applicability of the developed method, a nano-formulation containing GEM and BET was prepared and assessed for various parameters including encapsulation efficiency, loading efficiency, drug release, and drug stability. The method developed can be a possible tool for the simultaneous quantification of GEM-BET in analytical and biological samples. ***(Biotech 13, 267 (2023)).***

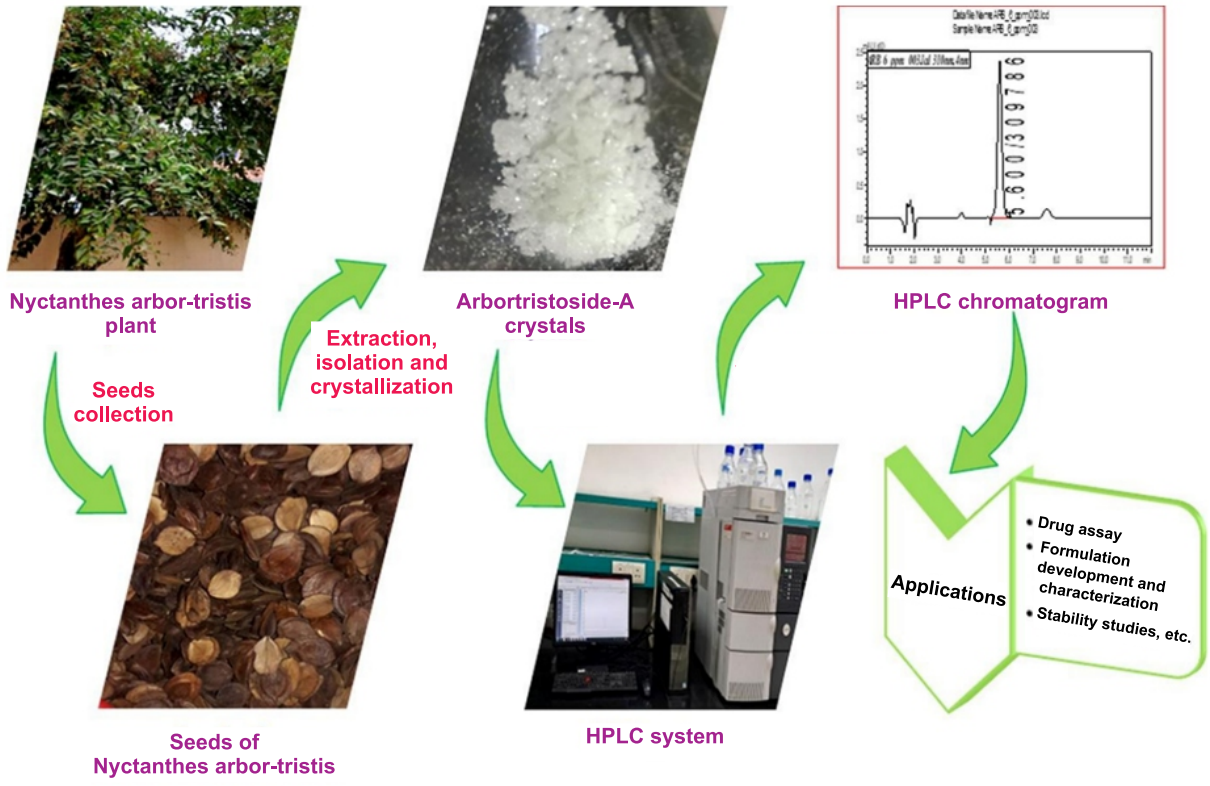



**Fig. 9.** HPLC Method development and pharmaceutical applications of Arbortristoside-A

### 1.1.15 Quantification of Arbortristoside-A Isolated from *Nyctanthes arbor-tristis* using HPLC: Method Development and Pharmaceutical Applications

Arbortristoside-A (Arbor-A) is a naturally occurring iridoid glycoside and herbal-based lead molecule with proven medicinal potential. Aiming at the development of an efficient analytical tool for the quantification of Arbor-A in pharmaceutical dosage forms, in the presented work, we developed an economical, fast, and sensitive RP-HPLC-UV method and validated the procedure as per the ICH guidelines, Q2(R1). The chromatographic separation was accomplished under the optimised experimental conditions using an HPLC system with an LC-2010 autosampler, a PDA detector, and a Phenomenex C18 column with the mobile phase composed of a 70:30 (v/v) water-acetonitrile mixture eluting isocratically at a flow rate of 1 mL/min at ambient temperature, and UV detection at 310 nm. Arbor-A showed a sharp peak at the retention time of 5.60 min and exhibited linearity (R2 = 0.9988) with LOD and LOQ of 0.50 µg/mL and 1.50 µg/mL, respectively. The accuracy of the method was 98.33-101.36 % with acceptable intra-day and inter-day precisions as well as robustness (<2% RSD). To ratify the applicability of the presented approach in emerging pharmaceuticals, a nanoformulation loaded with Arbor-A was designed and analysed utilising the provided methodology. The method has also enabled to determine the degradation kinetics of Arbor-A under stress conditions, etcetera, employing forced degradation and short term stability studies. ***(Journal of Chromatography B Volume 1233, 1 February 2024, 123985).***

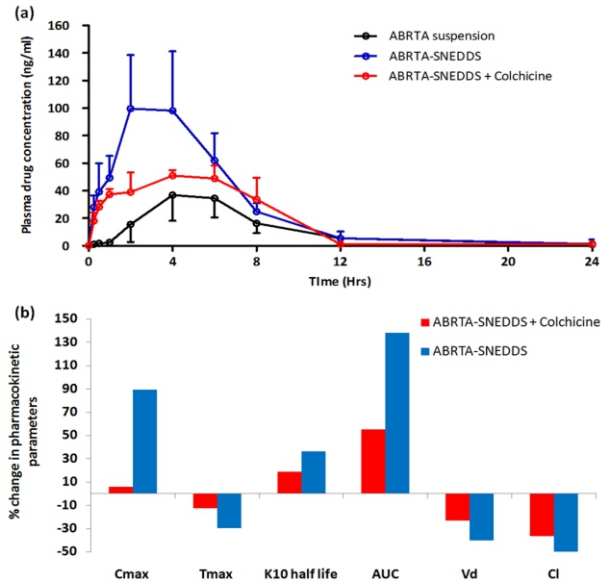



**Fig. 10.** Bioavailability enhancement of ABRTA

**Bioavailability enhancement of Abiraterone acetate:** Abiraterone acetate (ABRTA) is clinically beneficial in management of metastatic castration-resistant prostate cancer. With highlighted low solubility and permeability, orally hampered treatment of ABRTA necessitate high dose to achieve therapeutic efficacy. To triumph these challenges, we aimed to develop intestinal lymphatic transport facilitating lipid based delivery to enhance bioavailability. ABRTA containing self nano emulsified drug delivery (ABRTA-SNEDDS) were statistically optimized by D-optimal design using design expert. Optimized formulation was characterized for particle size, thermodynamic stability, *in vitro* release, *in vivo* bioavailability, intestinal lymphatic transport, *in vitro* cytotoxic effect, anti-metastatic activity and apoptosis study. Moreover, hemolysis and histopathology studies have been performed to assess pre-clinical safety. Nano sized particles and successful saturated drug loading was obtained for optimized formulation. *In vitro* release upto 98.61 ± 3.20% reveal effective release of formulation at intestinal pH 6.8. ABRTA-SNEDDS formulation shows enhanced *in vivo* exposure of Abiraterone (2.5 fold) than ABRTA suspension in Sprague Dawley rats. *In vitro* efficacy in prostate cancer (PC-3) cell line indicates 3.69 fold higher therapeutic potential of nano drug delivery system. Hemolysis and histopathology study indicates no significant toxicities to red blood cells and tissues respectively. Apparently, an opportunistic strategy to increasing bioavailability of ABRTA *via* intestinal lymphatic transport will create a viable platform in rapidly evolving chemotherapy. Enhanced translational utility of delivery was also supported through *in vitro* therapeutic efficacy and safety assessments.

**Phytosome as Drug Delivery System of Formononetin**: Formononetin (FNT), a methoxy isoflavone, is a potential phytoconstituent utilized for refurbishing fractures in bone tissue. Conceding to its involvement in first-pass metabolism followed by

**Table:** Pharmacokinetic parameter of Free and Total FNT from Pure FNT and FNT-PC. All values are represented as mean ± SD, (n=3).

| PK parameter | Free FNT from Pure FNT | Total FNT from Pure FNT | Free FNT from FNT-PC | Total FNT from FNT-PC |
|---|---|---|---|---|
| AUC0-24(hr*/ng/mL) | 251.44 ± 63.67 | 5482.90 ± 1276.11 | 508.04 ± 175.16 | 1305 ± 390.70 |
| AUC0-∞(hr*/ng/mL) | 278.27 ± 66.68 | 6509.66 ± 720.47 | 611.43 ± 254.86 | 1550..1 ± 723.50 |
| Cmax(ng/mL) | 16.67 ± 6.60 | 327.67 ± 100.72 | 110.20 ± 16.70 | 192.0 ± 53.80 |

glucuronidation, its absorption efficacy is limited. Hence, it belongs to the BCS class II classification. We designed the present work to enhance FNT oral bioavailability by using Phospholipids (PL) as a promising carrier. Formononetin Phospholipid Complex (FNT-PC) was prepared by the solvent evaporation method and characterized. FNT-PC was prepared by solvent evaporation method and characterization (FNT-PC) was performed using aqueous/n-octanol solubility and partition coefficient, FTIR, NMR, SEM, and *in vivo* pharmacokinetic study in female SD rats at 50mg/kg. Physicochemical properties like aqueous/n-octanol solubility and partition coefficient were enhanced in FNT-PC. The FTIR spectrum confirmed there was

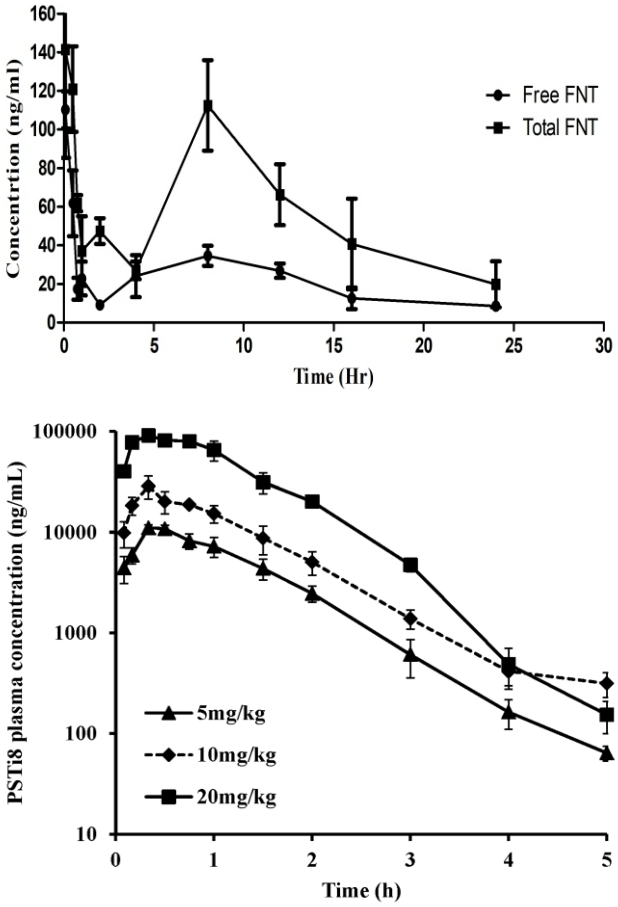



**Fig. 11.** PK pancreastatin inhibitor PSTi8

no involvement of functional groups in the preparation of FNT-PC. Whereas, the NMR study resulted in the attachment of carbon (C-8) position of FNT by replacing the quaternary amine of PL to form FNT-PC. When scrutinized for its surface morphology, the FNT-PC exhibited the amorphous geometry that remarkably enhanced the dissolution of FNT ($p<0.05$) from its pure form. This dissolution effect was also affirmed by the per-oral administration of FNT-PC in female Sprague Dawley (SD) rats at 50 mg/kg dose. The pharmacokinetic profile showed the free FNT levels were markedly increased, correspondingly decreasing the conjugated FNT levels in rat plasma. To summarize, FNT-PC could substantially reduce the first-pass metabolism with enhanced free concentration, improving oral bioavailability for therapeutic use.

**Pharmacokinetics of pancreastatin inhibitor PSTi8 :** PSTi8, a pancreastatin inhibitory peptide that is effective in the treatment of diabetic models. This study was aimed to investigate the pharmacokinetic (PK) properties of PSTi8 in Sprague Dawley rats for the first time. *In vitro* and *in vivo* PK studies were performed to evaluate the solubility, stability in plasma and liver microsomes, plasma protein binding, blood-plasma partitioning, bioavailability, dose proportionality, and gender difference in PK. Samples were analyzed using the validated LC-MS/MS method. The solubility of PSTi8 was found to be 9.30 and 25.75 mg/mL in simulated gastric and intestinal fluids, respectively. The protein binding of PSTi8 was estimated as >69% in rat plasma. PSTi8 showed high stability in rat plasma and liver microsomes and the blood-plasma partitioning was >2. The bioavailability of PSTi8 after intra-peritoneal and subcutaneous administration was found to be 95.00±12.15 and 78.47±17.72 %, respectively in rats. PSTi8 showed non-linear PK in dose proportionality studies and has no gen-der difference in PK behavior in rats. The high bioavailability of PSTi8 may be due to high water solubility and plasma protein binding, low clearance and volume of distribution. Our *in vitro* and *in vivo* findings will support the development of PSTi8 as an antidiabetic agent.

## 1.2 Toxicity studies

### 1.2.1 Mechanism of Alcohol-Induced Toxicity in Glial Cells

Alcohol can act as a teratogen and can cause developmental abnormalities in the developed brain both structurally and functionally as other organs. Glial cells play a crucial role in alcohol metabolism and protect neurons from toxic effects of alcohol. However, chronic alcohol exposure can lead to uncontrollable levels of reactive oxygen species, resulting in the death of glial cells and exposing neuronal cells to the toxic effects of alcohol. The exact molecular mechanism of alcohol-induced glial cell death has not been fully explored. This study reported that different concentrations of alcohol induce different expressions of ER stress markers in glial cells, focusing on the role of endoplasmic reticulum (ER) stress. Alcohol-induced concentration-dependent toxicity in both cells also induced oxidative stress, leading to mitochondrial damage. The expression of p53 and apoptotic proteins was significantly up-regulated after alcohol exposure, while Bcl2 (anti-apoptotic) was downregulated. The signalling pathway for

ER stress was activated and up-regulated marker proteins in a concentration-dependent manner. Cells pre-treated with BAPTA-AM and NAC showed significant resistance against alcohol assault compared to other cells. These *in vitro* findings will prove valuable for defining the mechanism by which alcohol modulates oxidative stress, mitochondrial and ER damage leading to glial cell death.

### 1.2.2 Mechanism of Mitochondrial Dysfunction and Metabolic Profiling in Hepatocellular Carcinoma

Hepatocellular carcinoma poses a significant health challenge and is often diagnosed at advanced stages. Metabolic reprogramming; a hallmark of Hepatocellular Carcinoma involves alterations in various metabolic or nutrient-sensing pathways within liver cells to facilitate the rapid growth and progression of tumours. The role of STAT3-NFκB in metabolic reprogramming is now investigated. DiethyInitrosamine (DEN) administered to animals showed decreased body weight and elevated level of serum enzymes along with ultrastructural alterations. Increased phosphorylated signal transducer and activator of transcription-3 (p-STAT3), phosphorylated nuclear factor kappa B (p-NFκβ), dynamin-related protein 1 (Drp-1) and alpha-fetoprotein (AFP) expression enhance the carcinogenicity as revealed in immunohistochemistry (IHC). The enzyme-linked immunosorbent assay (ELISA) concentration of IL-6 was found to be elevated in a time-dependent manner both in blood serum and liver tissue. Moreover, immunoblot analysis showed increased levels of p-STAT3, p-NFκβ and IL-6 stimulated the upregulation of mitophagy proteins such as Drp-1, Phosphatase and tensin homolog (PTEN)-induced putative kinase 1 (PINK-1). Meanwhile, downregulation of Poly [ADP-ribose] polymerase 1 (PARP-1) and cleaved caspase 3 suppresses apoptosis and enhanced expression of AFP supports tumorigenesis. The mRNA level of STAT3 and Drp-1 was also found to be significantly increased. Furthermore, we performed high-field 800 MHz Nuclear Magnetic Resonance (NMR) based tissue and serum metabolomics analysis to identify metabolic signatures associated with the progression of liver cancer. The metabolomics findings revealed aberrant metabolic alterations in liver tissue and serum of $75^{th}$ and $105^{th}$ days of intervention groups in comparison to control, $15^{th}$ and $45^{th}$ days of intervention groups. Tissue metabolomics analysis revealed the accumulation of succinate in the liver tissue samples, whereas, serum metabolomics analysis revealed significantly decreased circulatory levels of ketone bodies (such as 3-hydroxybutyrate, acetate, acetone, etc.) and membrane metabolites suggesting activated ketolysis in advanced stages of liver cancer.

### 1.2.3 Assessment of Tissue Toxicity in Various Disease Conditions In cancer

Histologic Assessments of major organs isolated from mice after tumor regression study using H & E stain analysis of the PBS-treated control group exhibit defined anatomy, regular-shaped cells, and round and sickle-shaped large blue nuclei. In contrast, the RB and DOX-based formulation-treated groups exhibit cells with a confined nucleus and shrinking morphology. CPP-Cu (Au@CL-DR) and Cu (Au@CL-DR) treated groups have a significantly higher apoptosis rate than other formulations. Administration of RB with DOX raises severe concerns about toxicity in vital organs, and targeted formulation is applicable to reduce the toxicities in these organs. In contrast, RB-CL, DOX-CL, CL-DR, and Au@CL-DR cause substantial hepatocyte and cardiomyocyte apoptosis in liver and heart sections, respectively. This is clear evidence that administration of Cu(Au@CL-DR) and CPP-Cu(Au@CL-DR) formulations significantly reduce the toxicity in vital organs compared to the RB-CL, DOX-CL, CL-DR, Au@CL-DR. Histopathological assessment of the kidneys, lungs, and spleens indicates minimal substantial pathological alterations between the Cu(Au@CL-DR), CPP-Cu(Au@CL-DR), and control groups.

In TB infections Histologic evaluation of lung tissues at different time points of 2, 14, 28, and 56 days showed moderate perivascular and peribronchiolar mononuclear inflammatory cells in KOC and WT-infected lungs. The architecture of parenchyma involved epithelioid macrophages, fewer lymphocytes, and granulocytes almost all the time. KO-infected lungs showed minimum perivascular and peribronchiolar mononuclear inflammatory cells at nearly all time points. In general, KOC and WT-infected lungs showed prominent lesions with significant potential for increased severity, while in KO-infected lungs, the amount of change presented barely exceeds but can be considered to be within normal limits. No abnormality was detected in the control lungs, and sections showed standard lung parenchyma, alveoli, and bronchi architecture.

In another set of experiments histopathology studies were performed with WT and KD infected and uninfected control lungs at different time points of 2, 7, 14, 21, 35, and 56 days. Haematoxylin & Eosin (HE) staining showed no abnormality in the alveoli and bronchial epithelium in uninfected control lungs at 2, 14, 35, and 56 days. While WT and KD-infected lungs were detected with mild multifocal perivascular lymphocytes, fewer inflammatory cells were present at two days. The architecture of parenchyma involved alveolar macrophages in the alveoli and epithelial hyperplasia at two days of infection in both WT and KD-infected lungs. The 14- and 35-day lungs were detected with severe diffused perivascular

lymphocytes and elevation in inflammatory cells in both WT and KD, but WT reflected more of these phenotypes. The architecture of parenchyma involved the presence of alveolar macrophages in the alveoli and epithelial hyperplasia at 35 days. The 56-day lungs showed minimal focal perivascular lymphocytes, fewer inflammatory cells, and the presence of epithelial hyperplasia in both WT and KD-infected lungs.

### 1.2.4 Regulatory Toxicity studies

We conduct regulatory studies both in GLP and non-GLP mode. A number of studies done this year and completed to decide the fate of the molecule. We also have collaborations with Ministry of Ayush for Regulatory Toxicity studies. Some studies of the following molecules have been completed. They are a) NMITLI-118 AF1, b) NMITLI-PHPL, c) S011-1793, d) CDRI 4655 EF, e) CDRI S016-1348, f) CDRI S016-1271, g) Dhatri Lauha, h) S017-622 etc. Few molecules were also studied using Quick Tox package. They are T2W, T3W,NTA and ALRT 7WE.

## 1.3 Essential Safety Pharmacology Studies of NMITLI-118 AF1, NMITLI- PHPL and S-016-1348

Essential safety pharmacology studies were conducted for assessing the safety of NMITLI-118 AF1 (phyto-pharmaceutical positioned for Anti-stroke), NMITLI- PHPL (phyto-pharmaceutical positioned for Bone health), S-016-1348 (NCE, positioned for Colon Cancer). Multiple doses including the effective dose and doses that were at least 20 times more than the effective dose were used to ascertain the safety of the phyto-pharmaceutical or NCE respectively. In certain cases, compound plasma concentrations were also taken into account while finalizing the treatment doses. All doses were administered only once by oral route. Subsequently safety pharmacology parameters were assessed. Whole body plethysmography was done to assess respiration in rats. Parameters estimated included tidal volume, frequency and rate of respiration, inspiration and expiration time, inspiratory and expiratory flow and enhanced pause. Besides this pulse oxymetry in rats was performed to measure blood oxygen saturation. For CNS studies in mice body temperature, gross behavior, motor activity, neuromuscular coordination and sensory reflexes were ascertained. All the studies were successfully completed. Subsequently CVS studies covering BP, Heart Rate and QT interval will be performed with the above phyto-pharmaceuticals and NCE for drawing the final conclusion.

## 1.4 Clinical Trial

The Phase I trial of S007-867 (anti-thrombotic) and S007-1500 (Fracture healing) is now ready for initiation. The Phase III trial of Picroliv as a phytopharmaceutical for NAFLD is initiated this year in six Centres.

# 2 Microbial Infections

## Vision :

To decipher the biology of microbial infections and undertake the discovery and development of novel therapeutics against drug-resistant microbial pathogens.

## Goals :

- Development of new drugs/drug combinations and delivery systems as therapeutic interventions for infections caused by mycobacterial, fungal and ESKAPE pathogens
- Investigation of disease biology and host-pathogen interactions
- Identification of unique targets and pathways in pathogens for designing future interventions
- Development of recombinant bacterial strains and new animal models for exploring disease pathogenesis and PK/PD studies
- Studying disease epidemiology and susceptibility of Indian populations to severe disease manifestation

**First Row (L to R):** Dr. Virendrakumar Prajapathi, Dr. Pintu Kumar Mandal, Dr. Y.K. Manju, Dr. Mukesh Pasupuleti, Dr. Namrata Rastogi, Dr. Namrata Singh, Dr. Radha Rangarajan, Dr. B.N. Singh (Area Coordinator), Dr. Prabhat Ranjan Mishra, Dr. Ashish Arora, Dr. Ravindra Kumar and Dr. Madhav N Mugale

**Second Row (L to R):** Dr. Rabi S Bhatta, Dr. Ramesh Chintakunta, Dr. Malleshwara Rao Kurram, Dr. Sidharth Chopra (Area Coordinator), Dr. Damodar N Reddy, Dr. Gautam Panda (Area Coordinator), Dr. M. I Siddiqui, Dr. Arunava Dasgupta, Dr. Jiaur R Gayen, Dr. Kishore Mohanan

*"Tuberculosis continues to be a global menace mainly due to emerging multidrug resistance strains. We work to tackle this problem taking multipronged approach in our drug discovery research"*

***- Dr. BN Singh***
*Chief Scientist &*
*Area Coordinator*

## 2.1 Progress in Biological screening

### 2.1.1 Assay Summary of Compounds Screened Against *Mycobacterium tuberculosis*

| Compounds received | Activity (μM) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | > 50 | 50 | 25 | 12.5 | 6.25 | 3.12 | 1.56 | 0.79 |
| 170 | 134 | 11 | 08 | 03 | 7 | 3 | 1 | 3 |

### 2.1.2 Biological Screening Summary for ESKAPE Pathogens

A total of 521 compounds were screened in whole cell antibacterial activity against ESKAPE pathogens. 29 hits were identified. Hits are being further optimized for improved efficacy.

## 2.2 Progress in Fundamental Research

### 2.2.1 Molecular Dissection Studies of TAC1, a Transcription Activator of *Candida* Drug Resistance Genes of the Human Pathogenic Fungus *Candida albicans*.

The up-regulation of ABC transporters Cdr1p and Cdr2p that efflux antifungal azole drugs are a leading cause of Multi-Drug Resistance (MDR) in the white fungus *Candida albicans*. *C. albicans* was reported to infect patients following the recent Covid-19 pandemic after they were given steroids for recovery. Previously, the *TAC1* gene was identified as the transcriptional activator of *Candida* drug resistance genes (*CDR1* and *CDR2*) and has no known human homologs. This makes it a good target for the development of novel antifungals. We, therefore, carried out the molecular dissection study of *TAC1* to understand the functional regulation of the ABC transporter

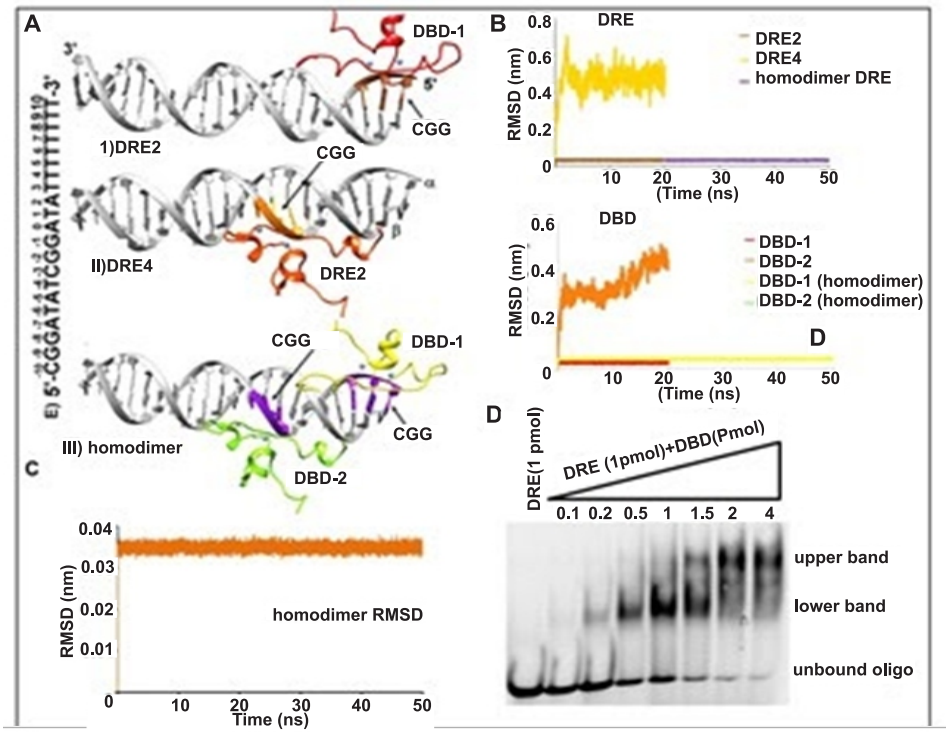



**Fig. 1.** Structural assembly of *TAC1* DBD DRE in *C. clegans*

genes (*CDR1* and *CDR2*) under its control. The N-terminal DNA Binding Domain (DBD) of Tac1p interacts with the Drug Responsive Element (DRE) present in the upstream promoter region of *CDR1* and *CDR2* genes of *C. albicans*. The interaction between DBD and DRE recruits Tac1p to the promoter of *CDR* genes. The C-terminal Acidic Activation Domain (AAD) of Tac1p interacts with the TATA box Binding Protein (TBP) and thus recruits TBP to the TATA box of *CDR1* and *CDR2* genes. Taking a cue from a previous study involving a *TAC1* deletion strain that suggested that Tac1p acts as a xenobiotic receptor, in this study, we identified that the Middle Homology Region (MHR) of Tac1p acts as a probable xenobiotic binding domain (XBD) which plays an important role in *Candida* drug resistance. In addition, we studied the role of Tac1p in the regulation of some lipid profiling genes and stress response genes since they also contain the DRE consensus sequence and found that some of them can respond to xenobiotic stimuli. (***Front. Microbiol., 2023*, https://doi.org/10.3389/fmicb.2023.994873).**

### 2.2.2 Development of Novel Cryptic Antimicrobial Peptides Analogs using the Artificial Intelligence and Machine Learning Methods Guided by the Evolutionary Signatures.

ESKAPE pathogens pose a global threat to human health and are the leading cause of death throughout the world. We have developed YRA15-13 and YRA15-23, a novel glutathione s-transferase derived peptide analog with inhibitory activity against *P. aeruginosa* ATCC 25668, a gram-negative bacterium. Peptides have a low rate of hemolysis, high plasma stability, and significantly lower *P. aeruginosa* bacterial numbers in bum wound infection models. Peptides kill bacteria by disrupting their membrane thus there is a low probability that bacteria could develop resistance against them. YRA15-13 and YRA15-23 can be effective topical antibacterial drugs against antibiotic-resistant *P. aeruginosa* skin infections. ***(Curr Res Microb Sci. 2023 Mar 17; 4:100183. doi: 10.1016/j.crmicr.2023.100183).***

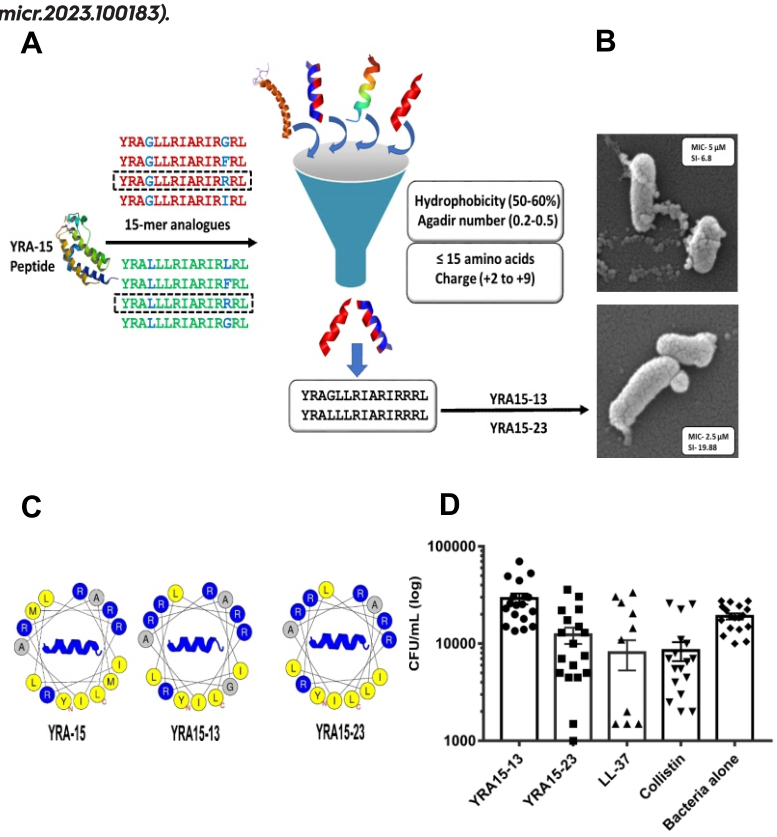



**Fig. 2. (A)** Schematic representation of the peptides designing and the biophysical properties of the hit molecules. **(B)** Scanning electron microscopy images showing the mode of action as membrane permeabilization. **(C)** Helical wheel projection of the hit peptides showing the characteristic distribution of charged and hydrophobic amino acids in the hit peptides. **(D)** Bacterial load on the skin surface after treating the peptides.

*"Antimicrobial resistance is a global healthcare concern disproportionately affecting developing countries. Our group aims to systematically discover and deliver novel antimicrobials to mitigate this silent pandemic"*

***- Dr. Sidharth Chopra***
*Senior Principal Scientist & Area Coordinator*

*"Preventing antimicrobial resistance together and affordable healthcare for Indian Patients"*

***- Dr. Gautam Panda***
*Chief Scientist &*
*Area Coordinator*

### 2.2.3 Development of a Mouse Model of *Mycobacterium tuberculosis* Persisters:

Persistence of *Mycobacterium tuberculosis* (Mtb) is one of the challenges to successful treatment of tuberculosis (TB). *In vitro* models of non-replicating Mtb are used to test the efficacy of new molecules against Mtb persisters. The H37Ra strain is attenuated for growth in macrophages and mice. We validated H37Ra-infected immunocompetent mice for testing anti-TB molecules against slow/non-replicating Mtb *in vivo*. Swiss mice were infected intravenously with H37Ra and monitored for CFU burden and histopathology for a period of 12 weeks. The bacteria multiplied at a slow pace reaching a maximum load of ~ $10^6$ in 8-12 weeks depending on the infection dose, accompanied by time and dose-dependent histopathological changes in the lungs. Surprisingly, four-weeks of treatment with isoniazid-rifampicin-ethambutol-pyrazinamide combination caused only 0.4 $log_{10}$ and 1 $log_{10}$ reduction in CFUs in lungs and spleen respectively. The results show that ~40 % of the H37Ra bacilli in lungs are persisters after 4 weeks of anti-TB therapy. Isoniazid/ rifampicin monotherapy also showed similar results. A combination of bedaquiline and isoniazid reduced the CFU counts to <200 (limit of detection), compared to ~5000 CFUs by isoniazid alone. The study demonstrates an *in vivo* model of Mtb persisters for testing new leads using a BSL-2 strain. ***(Tuberculosis (Edinb). 2024 Mar;145:102479).***

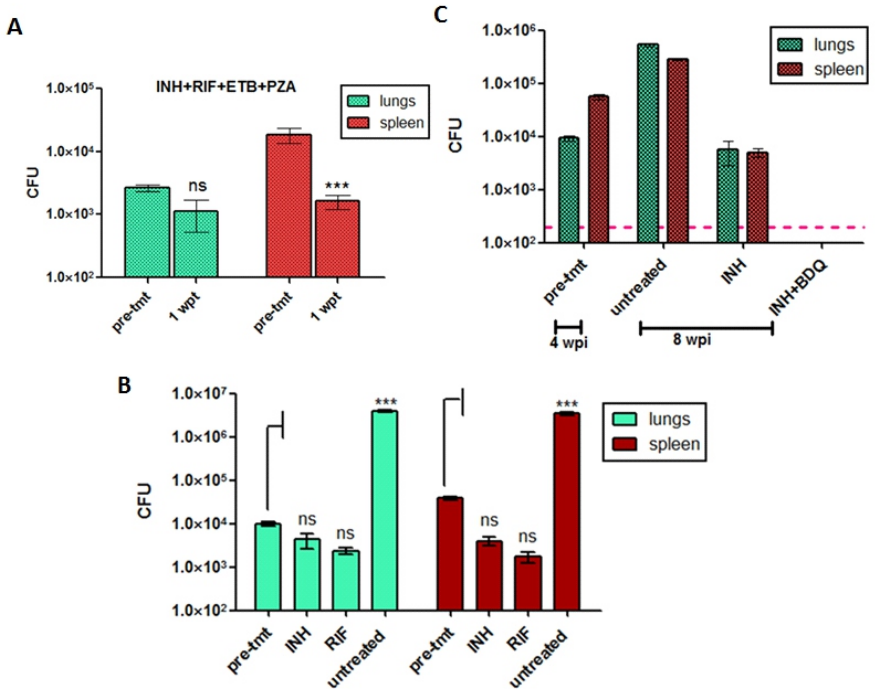



**Fig. 3. A.** Effect of 4 weeks treatment with first-line TB drugs on Mtb H37Ra infection in mice. **B.** Effect of 4 weeks INH/RIF monotherapy. **C**. Effect of bedaquiline on INH-tolerant Mtb H37Ra in mice.

### 2.2.4 *Mycobacterium tuberculosis* Malate: Quinone Oxidoreductase Contributes to *in vitro* Stress Tolerance and *in vivo* Survival.

*Mycobacterium tuberculosis* (Mtb) is the causal organism of tuberculosis (TB) and approximately 10 million new cases of tuberculosis (TB) with approximately 1.5 million deaths (including deaths in people with HIV) were reported in the year 2021. *Mycobacterium tuberculosis* H37Ra (*Mtb*-Ra) ORF MRA_2875, annotated as malate:quinone oxidoreductase (mqo), is thought to have a role in TCA cycle in converting malate to oxaloacetate. A *Mtb*-R amqo knockout (KO) and KO complemented (KOC) strains were developed. Under normal *in vitro* conditions, KO showed no growth defect but showed reduced CFU burden in macrophages and in mice lungs.

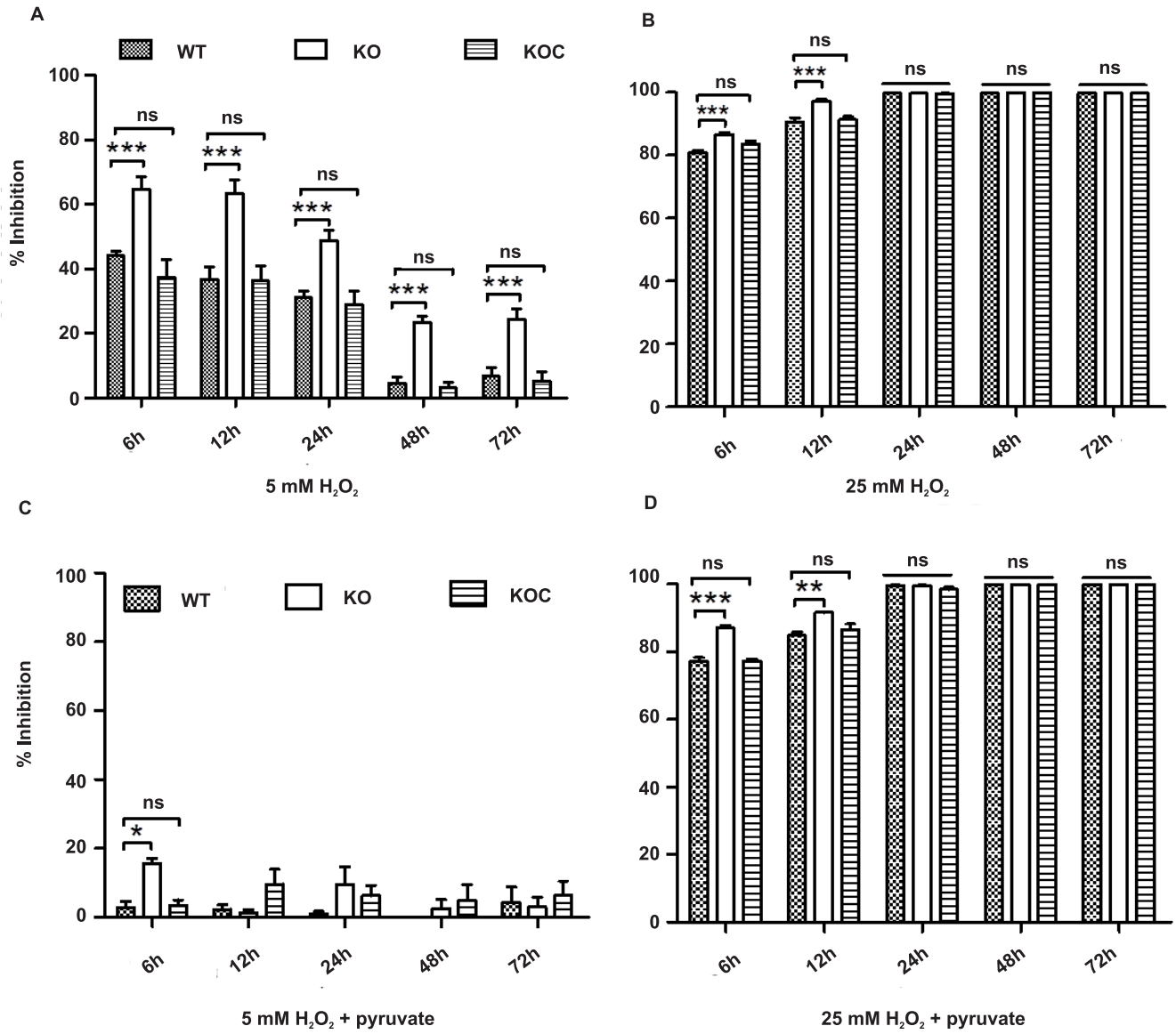
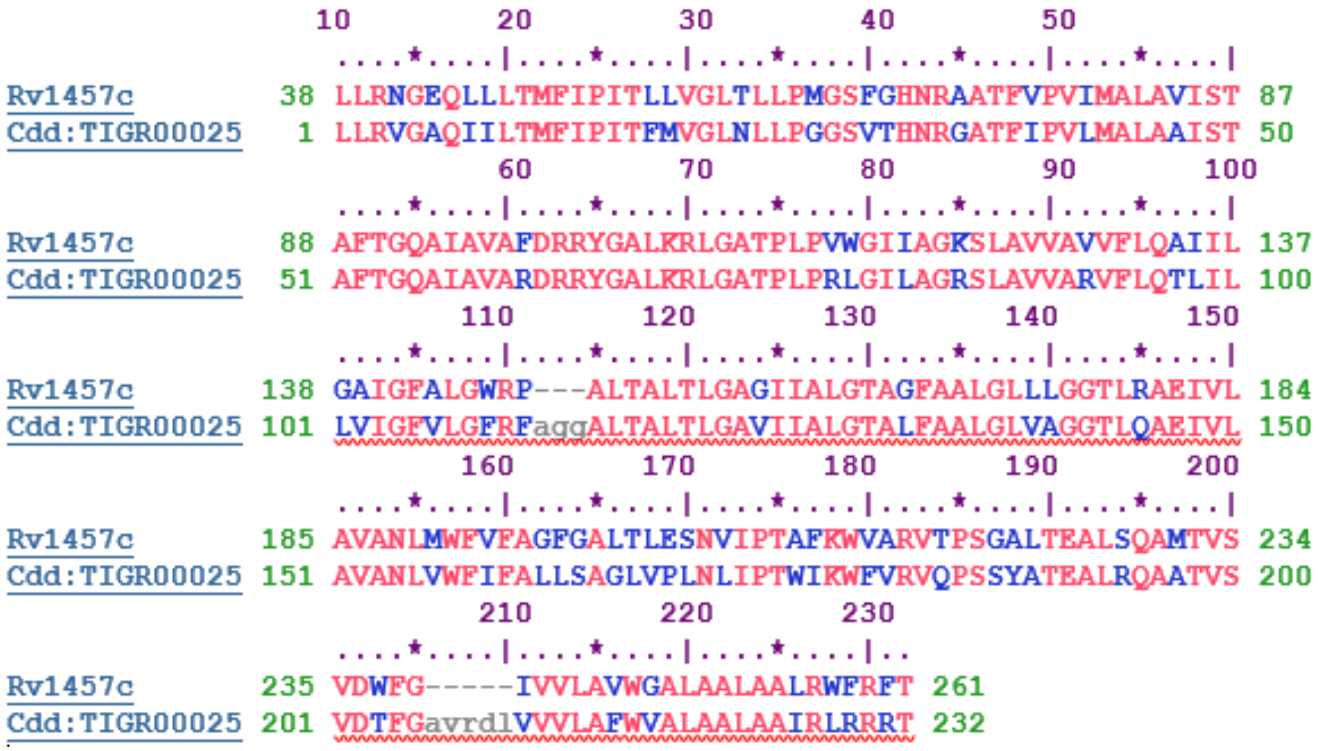



**Fig. 4.** Inhibition studies in presence of peroxide stress and effect of scavenger. Inhibition of WT, KO, and KOC by $H_2O_2$ was studied by MABA assay, in Sauton's medium. 10 mM pyruvate was used as a ROS scavenger. Figures A and B show survival of WT, KO, and KOC at 5 and 25 mM $H_2O_2$, respectively. Figures C and D show inhibition of WT, KO, and KOC in presence of $H_2O_2$ and pyruvate. The KO, KOC, and WT refer to knockout, KO complemented, and wild-type strains, respectively. Student's *t*-test was used for significance analysis (ns= not significant *$p$<0.05, **$p$<0.01, ***$p$<0.001).

*In vitro* studies with KO showed reduced survival under oxidative and low pH stress. Transcript analysis of mqo showed increased expression levels under oxidative and low pH stress. This is the first study to show physiological relevance of mqo encoded by MRA_2875 in *Mtb*-Ra under oxidative and low pH stress. This study showed MRA_2875 encoded malate:quinone oxidoreductaseas a functional enzyme which contributes to oxidative stress and low pH tolerance, and survival in macrophages and in mice. ***(Microbes and Infection, Jan-Feb 2024, https://doi.org/10.1016/j.micinf.2023.105215).***

### 2.2.5 *In silico* Approach to Deduce the Structural and Functional Characteristics of the Rv1457c, an ABC Transporter Family Protein of *Mycobacterium tuberculosis*.

Multi-drug resistant tuberculosis (MDR-TB) poses a significant global health challenge. The process of drug efflux, along with the functioning of efflux transporters, is believed to contribute significantly to the emergence of drug-tolerant and drug-resistant strains of mycobacteria. This study focuses on investigating the role

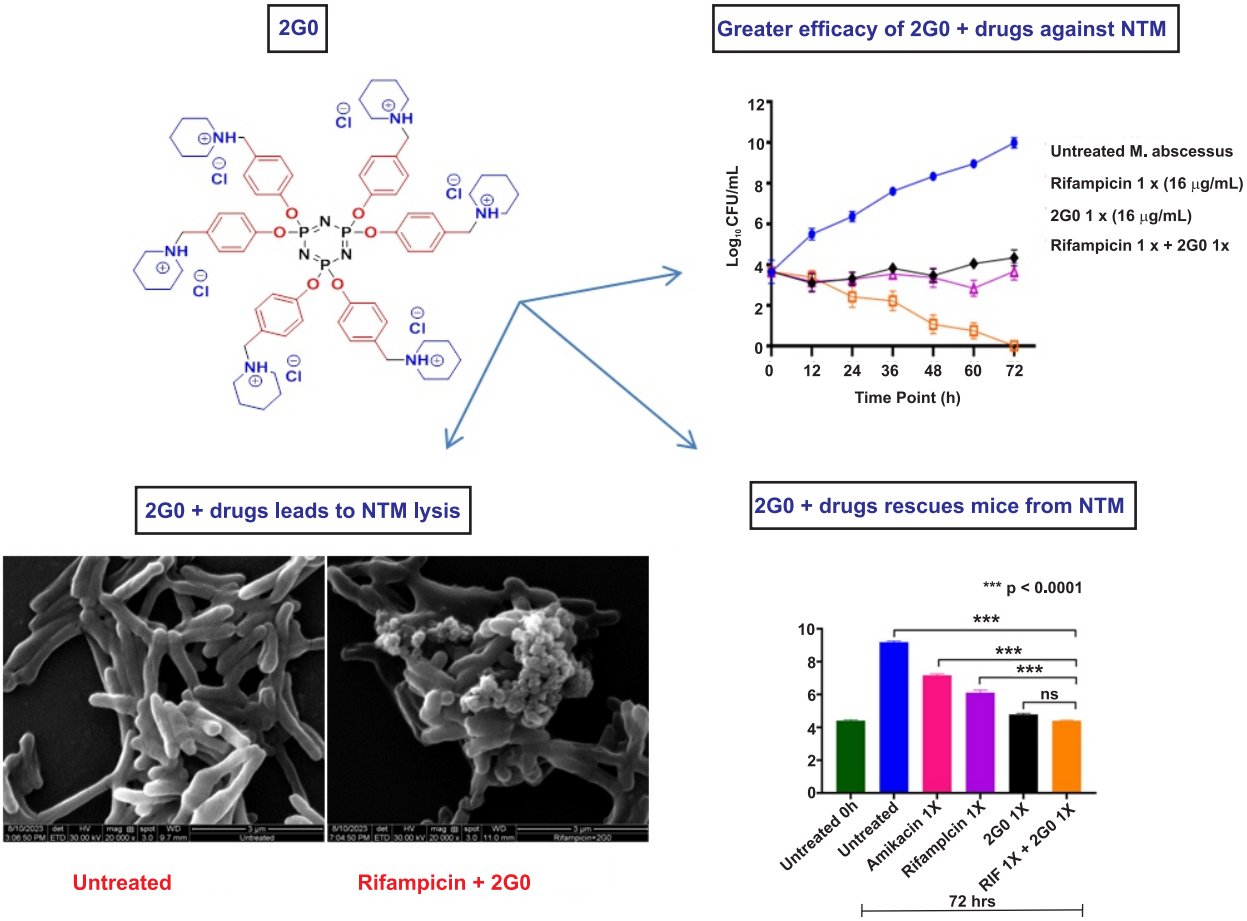



of a mycobacterial efflux pump protein as a facilitator of drug resistance. Rv1457c is identified as a member of the DrrB family, a paralogous group of efflux proteins prevalent in *Mycobacterium tuberculosis*. Conserved domain search analyses revealed its association with ATP-binding domain partners within an operon, suggesting its role in antibiotic resistance. Notably, sequence analysis indicates its prevalence among high-GC Gram-positive organisms. Comparative domain analysis suggests its relationship with a putative daunorubicin resistance efflux protein in *Streptomyces peucetius* and NodJ, a nodulation-triggering signal efflux protein.

Conserve domain analysis showed that 232 of 261 amino acids are conserved showing a very high confidence (e-value: 8.27e-60) in the identified domain. This model reflects a branch of a broader superfamily that also includes NodJ, a part of the NodIJ pair of nodulation-triggering signal efflux proteins. The members of this branch may all act in antibiotic resistance.

### 2.2.6 Polycationic Phosphorous Dendrimer Potentiates Multiple Antibiotics Against Drug-Resistant Mycobacterial Pathogens.

*Mycobacterium tuberculosis* (Mtb), causative agent of tuberculosis (TB) and non-tubercular mycobacterial (NTM) pathogens such as *Mycobacterium fortuitum, M. abscessus* are one of the most critical concerns worldwide due to increased drug-resistance resulting in increased morbidity and mortality. Therefore, focusing on developing novel therapeutics to minimize the treatment period and reducing the burden of drug-resistant Mtb and NTM infections are an urgent and pressing need. Previously, we identified a polycationic phosphorus dendrimers, 16/CEF/280 (2G0), active against Mtb strains with MICs of 2 µg/ml with selectivity index (SI) of 20. Further studies demonstrated that 2G0 is equipotently active against drug resistant Mtb strains as well as show a range of MIC between 4-16 µg/ml against different NTM strains. 2G0 potentiates activity of multiple classes of antibiotics against both against Mtb and NTMs.




Importantly, 2G0 showed significant *in vivo* efficacy in combination with Rifampicin, Linezolid, Bedaquiline and Clofazimine against NTMs which is better than individual drugs as well as control drugs. Taken together, this nanoparticle with intrinsic antimycobacterial properties has the potential to represents an alternate drug candidate and/or a novel delivery agent for antibiotics of choice for enhancing the treatment of drug-resistant mycobacterial pathogens. (***Biomed Pharmacother. 2024 Apr;173:116289. doi: 10.1016/j.biopha.2024.116289).***

# 3 Parasitic Infections

## Vision :

Discover new bioactives against Malaria, Leishmania and Filaria parasites and unfold new molecular and biochemical mechanisms related to diseases caused by them

## Goals :

- Discovery and development of new drugs/drug combinations and delivery systems as therapeutic interventions for parasitic diseases- malaria, leishmaniasis and filariasis
- Investigation of disease biology, host-pathogen interactions and immune evasion
- Identification of unique targets and pathways in pathogens for designing future interventions
- Development of new animal models for exploring disease pathogenesis and PK/PD studies
- Design and development of vaccine strategies for malaria and leishmaniasis

**Front Row (L to R):** Dr. Kishore Mohanan, Dr. Prem P Yadav, Dr. Saman Habib (Area Coordinator), Dr. Sanjay Batra (Area Coordinator), Dr. Niti Kumar, Dr. Bidyut Purkait, Ms. Shikha Mishra, Dr. Suresh Kalangi.

**Second Row (L to R):** Dr. Ramesh Chintakunta, Dr. Mrigank Srivastava, Dr. Damodar N Reddy, Dr. Namrata Rastogi, Dr. M.I Siddiqui, Dr. Kalyan Mitra, Dr. Arun Kumar Haldar, Dr. Amogh Sahasrabuddhe, Dr. Ajay K Srivastava, Mr. Ashan Manhas, Mr. Karthik R.

## Addressing Biological Processes for Designing new Strategies of Intervention in Parasitic Diseases and Anti-Parasitic Drug Discovery

### 3.1 Malaria

#### 3.1.1 An Important Zinc-Selective Transporter Exhibits Stage-Specific Targeting to the Apicoplast and Parasite Plasma Membrane of the Malaria Parasite

Replication and growth of the malaria parasite in human RBCs requires massive intake of zinc fluxes which would depend on the action of zinc transporters across the parasite plasma and organellar membranes. We used the uncharacterized *Plasmodium falciparum* Zrt-/Irt-like protein (*Pf*ZIP1) and specific antibodies generated against the recombinant protein to explore the subcellular localization, function, metal-ion selectivity, and response to cellular zinc levels. Expression of *Pf*ZIP1 was enhanced upon the depletion of cytosolic $Zn^{2+}$. Interestingly, the protein transitioned from the processed to unprocessed form through blood stages. It localized to the apicoplast in trophozoites and to the parasite plasma membrane in schizonts and gametocytes, thus suggesting stage-specific functional role. When assembled in proteoliposomes, the *Pf*ZIP1 dimer mediated $Zn^{2+}$ influx measured by stopped-flow fluorimetry. *Pf*ZIP1 exhibited preferential binding to $Zn^{2+}$ compared to $Fe^{2+}$. Domain deletion showed that the selectivity for zinc was driven by a C-terminal histidine-rich region conserved only in primate-infecting *Plasmodium* species; *Pf*ZIP1-ΔHis also had high affinity for iron (**Fig. 1**) ***(ACS Infect Dis. 2024 Jan 12;10(1):155-169).***

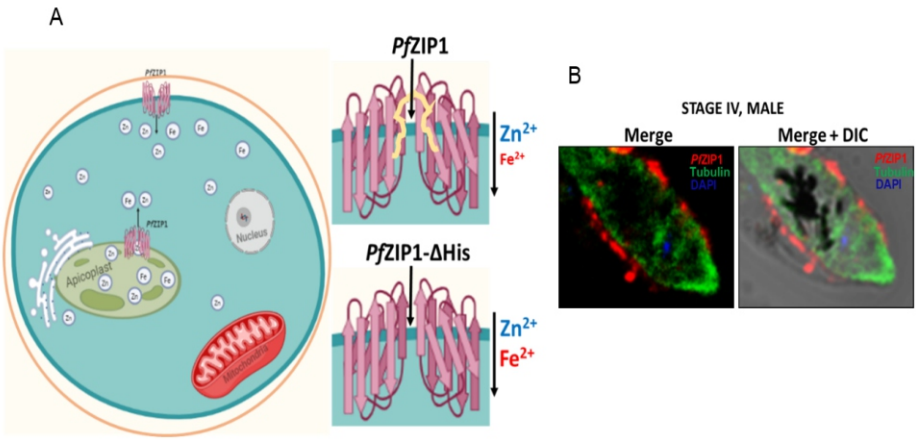



**Fig. 1. (A)** Dual localization of PfZIP1 and differential ion-selectivity of the full-length PfZIP1 and *Pf*ZIP1-ΔHis. **(B)** *Pf*ZIP1 localizes to the plasma membrane in gametocytes.

#### 3.1.2 Identification and validation of novel drug targets for the treatment of malaria

Reverse genetic approaches were used to discover new drug targets at distinct pathways in the malaria parasite. We investigated the role of cysteine proteases in Atg8 conjugation and deconjugation and found that *Plasmodium* consists of both activities. We disrupted the autophagy-related gene Atg4 and found that its critical of parasite development in the liver. Parasites lacking Atg4 failed to deconjugate Atg8 from the apicoplast membrane **(Fig. 2)**. Our data suggest that Atg4 is the primary deconjugating enzyme and another cysteine protease Otu cannot replace its function completely because it produces nonrecyclable Atg8. ***(Cell Mol Life Sci. 2023 Nov 1;80(11):344).***

*"Parasites throw up fascinating questions to be addressed and explored for future intervention strategies against infections. We continue to focus our research on fundamental parasite biology and host-pathogen interactions, and to direct attention towards drug discovery aspects"*

***- Dr. Saman Habib***
*Chief Scientist &*
*Area Coordinator*

*"A collaborative effort towards translating scientific discoveries into new treatments that improve patient health"*

***- Dr. Sanjay Batra***
*Chief Scientist &*
*Area Coordinator*

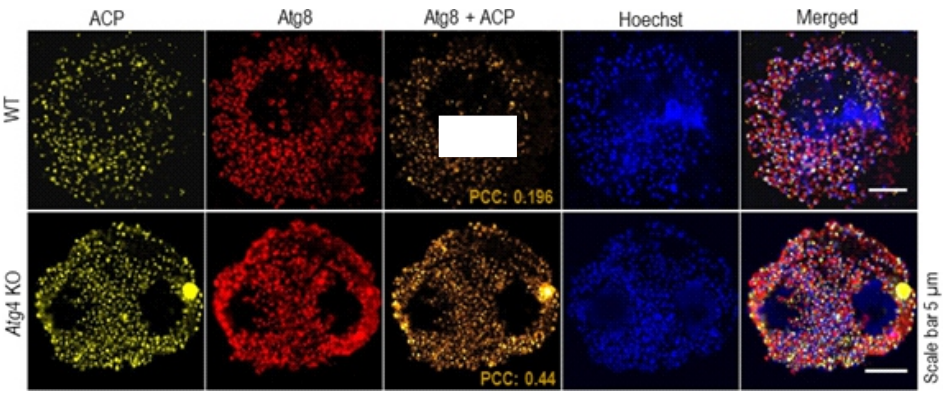



**Fig. 2.** Atg4 KO parasites failed to deconjugate Atg8 from the apicoplast.

Neddylation is a type of posttranslational modification known to regulate a wide range of cellular processes by covalently conjugating the ubiquitin-like protein Nedd8 to target proteins at lysine residues. We showed that neddylation plays an essential role in malaria transmission in *Plasmodium berghei* **(Fig. 3)**. We found that disruption of Nedd8 did not affect blood stage propagation, gametocyte development, gamete formation, or zygote formation while abolishing the formation of ookinetes and further transmission of the parasites in mosquitoes. ***(mBio. 2024 Apr 10;15(4):e0023224).***

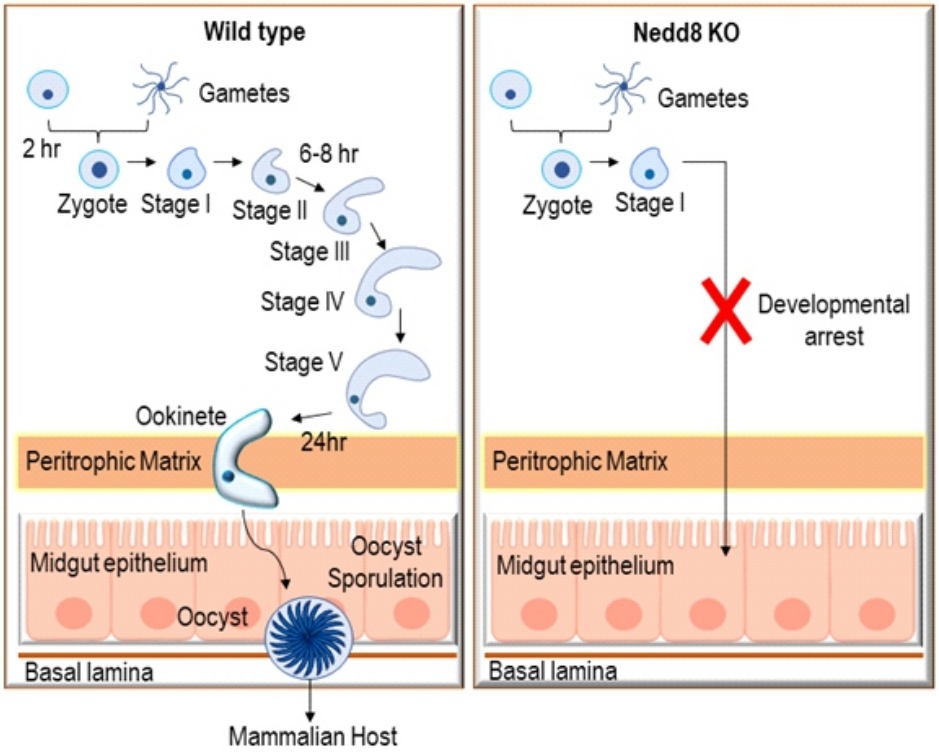



**Fig. 3.** Neddylation is essential for malaria transmission.

Parasite-mediated fatty acid modification is essential for liver-stage development. Disrupting *P. berghei* fatty acid modifying enzyme stearoyl-CoA Δ9-desaturase (Scd) resulted in impaired organelle biogenesis, and mutants could not form hepatic merozoites. Mice immunized with Scd mutant sporozoites confer long-lasting sterile protection against infectious sporozoite challenge **(Fig. 4)**. Thus, the Scd mutant parasites is an appealing candidate for inducing protective preerythrocytic immunity and hence its utility as a whole parasite vaccine. ***(Mol Microbiol, 2024).***

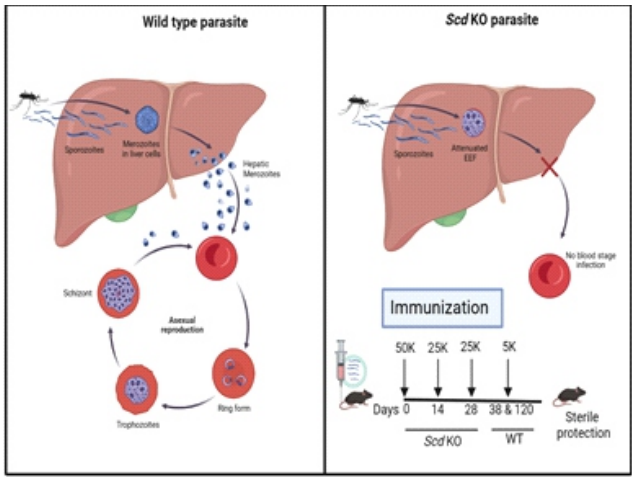



**Fig. 4.** Immunization of C57BL/6 mice with Scd KO parasites protects against the challenge of infectious sporozoites.

The O-fucosylation of the thrombospondin type I repeat (TSR) domain is important for the optimal folding and stability of TSR-containing proteins. The loss of POFut2 results in the reduced gliding motility and hepatocyte infectivity by sporozoites (**Fig. 5**). This phenotype is due to diminished level of TRAP that affected parasite gliding motility and hepatocyte infectivity. (***ACS Infect Dis., 2024***).

### 3.1.3 Distinct Conformational Dynamics of Parasite and Human HSP70-HSP110 Highlight Divergence in their Protein Folding Capacities

HSP70-HSP110 forms the central hub of the proteostasis machinery which coordinates between protein folding and degradation machinery. Interestingly, human malaria parasite has evolved a very diverged proteostasis machinery to maintain its metastable proteome in soluble and functional state. HSP70 is relatively conserved, but it's C-terminal is diverged. Its structural homolog, HSP110 which acts as nucleotide exchange factor to support the iterative HSP70-mediated protein folding cycles has diverged significantly from its human homolog. Conformational dynamics of *Pf*HSP70 and *Pf*HSP110 was probed through multiple μs-simulations and compared with respective human homologs. For HSP70, the interspecies comparison reveals enhanced flexibility in IA and IB subdomain within the conserved NBD, lesser solvent accessibility of the inter-domain linker and distinct dynamics of the SBDβ of *Pf*HSP70 in comparison to *Hs*HSP70. In the case of HSP110, notable contrast in the dynamics of NBD, SBDβ and SBDα was observed between parasite and human homologs. Our study suggests that differences in conformational dynamics may translate into species-specific differences in the chaperoning activities of HSP70-HSP110 in the parasite and human, respectively. ***(Biochimica et Biophysica Acta (BBA) - Proteins and Proteomics, 1871 (6), 2023, 140942).***

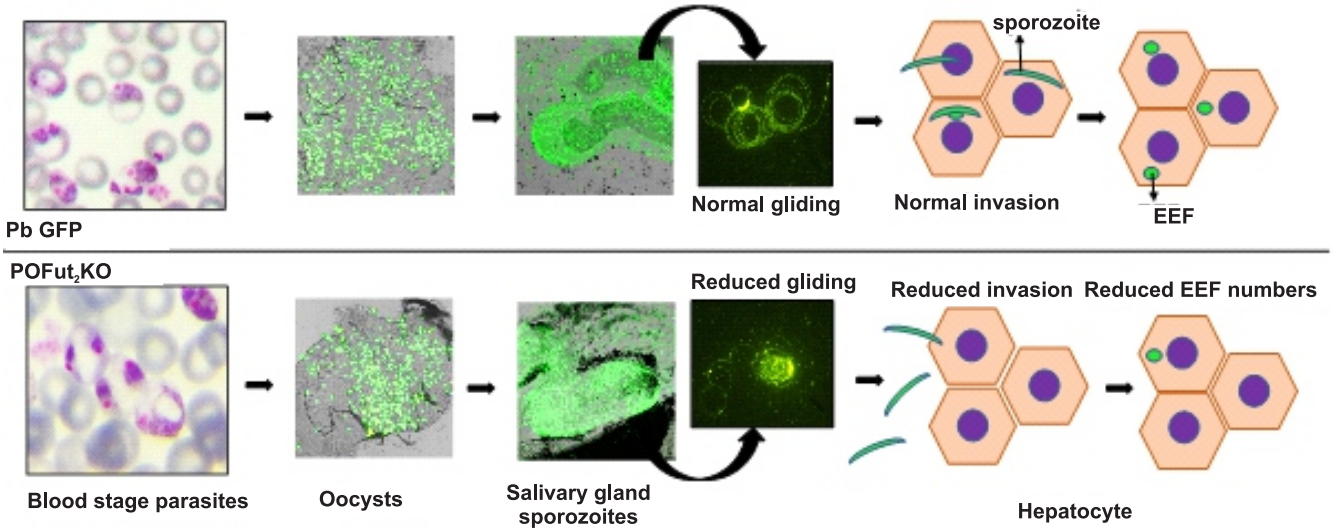



**Fig. 5**. Protein O-fucosyltransferase role in sporozoite gliding motility and hepatocyte invasion.

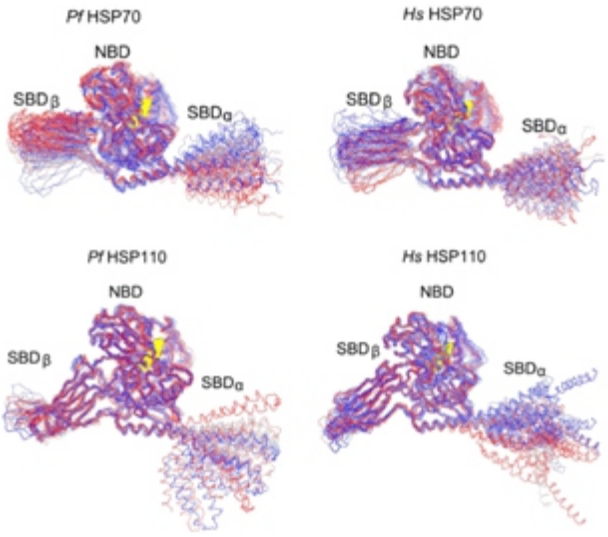



**Fig. 6**. Representation of domain movements of NBD, SBDβ and SBDα of *Pf* HSP 70 and *Pf* HSP110 and their human orthologs

## 3.2 Leishmaniasis

### 3.2.1 Buparvaquone Induces Ultrastructural and Physiological Alterations Leading to Mitochondrial Dysfunction and Caspase-Independent Apoptotic Cell Death in *Leishmania donovani*

The hydroxynaphthoquinone class of compounds demonstrate broad-spectrum activity against protozoan parasites. Buparvaquone (BPQ), a member of this class is the only drug licensed for the treatment of theileriosis. BPQ has shown promising antileishmanial activity but its mode of action is largely unknown. The aim of this study was to evaluate the ultrastructural and physiological effects of BPQ for elucidating the mechanisms underlying the *in-vitro* antiproliferative activity in *L. donovani*. Transmission and scanning electron microscopy analyses of BPQ-treated parasites revealed ultrastructural effects characteristic of apoptosis-like cell death, which include alterations in the nucleus, mitochondrion, kinetoplast, flagella and the flagellar pocket. Using flow cytometry, laser scanning confocal microscopy and fluorometry, we found that BPQ induced caspase-independent apoptosis-like cell death by losing plasma membrane phospholipid asymmetry and cell cycle arrest at sub-$G_0/G_1$ phase. Depolarization of mitochondrial membrane leads to generation of oxidative stress and impaired ATP synthesis followed by disruption of intracellular calcium homeostasis. Collectively, these findings provide valuable mechanistic insights and demonstrate BPQ's potential for development as an anti-leishmanial agent. **(Microscopy & Microanalysis, 2024 do : : 10.1093/man/ozae034)**

### 3.2.2 *Leishmania* Evasion Strategy Against Host's Ubiquitin-Immune Recognition of Parasitophorous Vacuoles (PVs) to Promote its Survival and Replication

Ubiquitination is known to regulate diverse cellular processes including decoration of parasitophorous vacuoles for their detection and destruction by hosts' innate immune response. Since PV ubiquitination is detrimental for pathogens, many microbial pathogens have developed the means to interfere in various ubiquitination pathways to promote their survival and replication inside host. We predict that *Leishmania* being a vacuolar pathogen, is subjected to host ubiquitin-immune recognition and drug-resistant (e.g., Antimony (Sb)-resistant) *L. donovani* are equipped with unique virulence factors to subvert PV ubiquitination pathways and establish severe infections. Our primary data suggests that *L. donovani (Ld)* containing vacuoles are decorated with ubiquitin and targeted by autophagy adaptors p62 / NDP52 to facilitate their delivery to the autolysosomal compartments. Interestingly, we have also found that Antimony-resistant *Leishmania* strains are more infective and more efficiently inhibit host ubiquitin immune recognition compared to Antimony-sensitive strains **(Fig. 7)**.

We hypothesise that *L. donovani* either secret its own deubiquitinating enzymes (DUBs) or hijack host's DUBs to block this ubiquitin immune recognition by host. *Leishmania* spp have their own DUBs which facilitate *Leishmania* amastigotes to replicate. It might not be surprising that one or more of these DUBs play important role in *Leishmania* pathogenesis and inhibit host's ubiquitin immune recognition to get resistance. Work is going on to explore the role of *Ld*-DUBs in parasite infection and to elaborate the potential of *Ld*-DUBs as drug targets in this parasite.

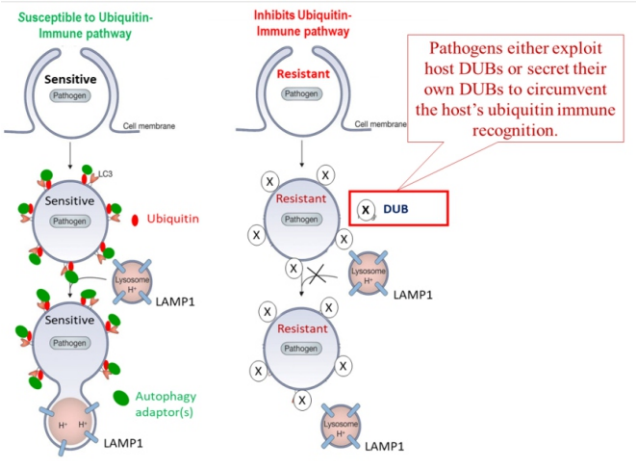
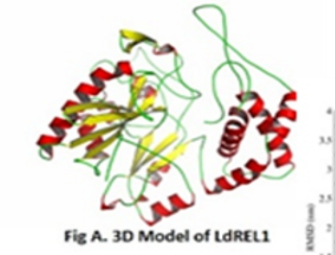
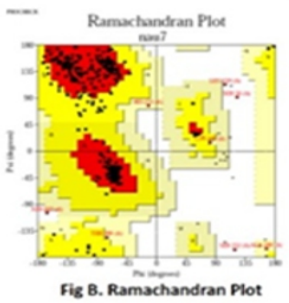



**Fig. 7.** Antimony-resistant *L. donovani* inhibits ubiquitination and subsequent recruitment of autophagy adaptor molecules p62 / NDP52, autophagy marker LC3 on pathogen containing vacuoles (PVs) which ultimately inhibit the delivery of PVs into autolysosomal compartment.

### 3.2.3 RNA Editing Ligase 1 (REL1) of *Leishmania donovani* as a Drug Target

To find small molecule inhibitors of the LdREL1 protein, virtual screening was performed with Maybridge compound library (55,000 compounds). Ligand and protein preparation, and grid generation were performed using the GLIDE module of Schrodinger suite prior to virtual screening. Subsequently, the three different protocols under the Glide module, namely, HTVS (High-Throughput Virtual Screening), SP (Standard-Precision), and XP (eXtra-Precision) were utilized for virtual screening. 19 compounds were identified based on their docking score (**Fig. 8**). These were then screened against *L. donovani* amastigotes in the macrophage-amastigotes model. Out of these, two compounds, DP00739 and XBX00210, were found to be active with $IC_{50}$<10 µM (DP00739-2.47 µM and XBX00210-2.03 µM). Cytotoxicity of these two compounds against J774.1 cell line was checked and $CC_{50}$ was found to be 134 µM for DP00739 and 182 µM for XBX00210 (**Fig. 9**). An enzyme inhibition assay was also performed to know the inhibitor specificity towards the target enzyme, LdREL1. Initial results showed that these compounds moderately inhibit LdREL1 enzyme activity (**Fig. 10**). *In vivo* evaluation in the golden hamster model to check their ability to inhibit amastigotes multiplication inside the host will be checked. We have generated four analogs of the XBX00210 through SAR. Analogs of DP00739 will also be designed, synthesized and tested to identify more active LdREL1 inhibitors.



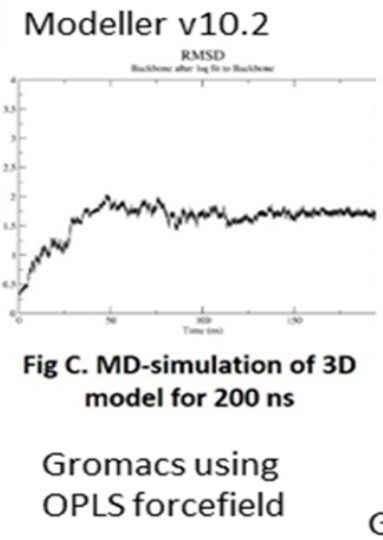




**Table 1. Virtual screening identified 19 compounds based on docking score and H bonds**

| S.no | Compound | Docking Score (XP) | Hydrogen Bond |
|---|---|---|---|
| 1. | DP00739 | -9.755 | GLU41, TYR195, LYS197, ARG244, GLY246 |
| 2. | RJC02914 | -9.132 | LYS197, ARG244, GLY246 |
| 3. | NRB05186 | -9.044 | GLU41, TYR195, LYS197, ARG241 |
| 4. | BTB12859 | -8.589 | TYR195, LYS197, ARG244, GLY246 |
| 5. | RJF00700 | -8.557 | GLU41, TYR195, LYS197 |
| 6. | JFD01566 | -8.328 | TYR195, LYS197, ARG241 |
| 7. | BTB09310 | -8.095 | ARG244, GLY246 |
| 8. | XBX00210 | -7.991 | GLU41, TYR195, LYS197, ARG244 |
| 9. | JFD01950 | -7.898 | GLU41, TYR195 |
| 10. | RJC02917 | -7.875 | GLU41, TYR195, LYS197, ARG244 |
| 11. | KM07915 | -7.777 | ARG241, ARG244, GLY246 |
| 12. | NRB04496 | -7.761 | GLU41, ARG244, GLY246 |
| 13. | KM04035 | -7.716 | GLU41, GLY246 |
| 14. | BTB07000 | -7.560 | ARG241, ARG244 |
| 15. | RH00056 | -7.527 | GLU41, TYR195, LYS197, ARG241, GLY246 |
| 16. | BTB07953 | -7.518 | GLU41, LYS197, ARG244, GLY246 |
| 17. | SPB06836 | -7.467 | GLU41, LYS197, ARG244, GLY246 |
| 18. | BTB12864 | -7.400 | ARG244, GLY246 |
| 19. | SEW05246 | -7.151 | GLU41, ARG244, GLY246 |

GLIDE module of Schrodinger Suite

**Fig. 8**. Modeling and virtual screening to identify LdREL1 inhibitors. 19 compounds were identified as LdREL1 inhibitors based on the docking score and H bonds.

| S. no | Compound code | $IC_{50}$ (µM) (Anti-amastigote assay) | $CC_{50}$ (µM) (MTT Assay) | Selective Index (SI) (CC50/IC50) |
|---|---|---|---|---|
| 1 | **DP00739 (Active)** | **2.47** | **134** | **54** |
| 2 | RJC02914 | No Inhibition | Not Done | |
| 3 | NRB05186 | | | |
| 4 | BTB12859 | | | |
| 5 | RJF00700 | | | |
| 6 | JFD01566 | | | |
| 7 | BTB09310 | | | |
| 8 | **XBX00210(Active)** | **2.03** | **182** | **89** |
| 9 | JFD01950 | No Inhibition | Not Done | |
| 10 | RJC02917 | | | |
| 11 | KM07915 | | | |
| 12 | NRB04496 | | | |
| 13 | KM04035 | | | |
| 14 | BTB07000 | | | |
| 15 | RH00056 | | | |
| 16 | BTB07953 | | | |
| 17 | SPB06836 | | | |
| 18 | BTB12864 | | | |
| 19 | SEW05246 | | | |

**Fig. 9**. *In-vitro* anti-leishmanial screening of *in silico*-identified LdREL1 inhibitors

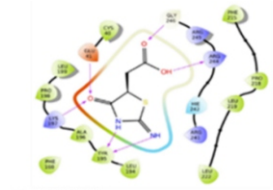
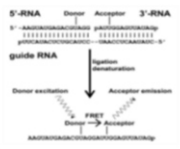




Fig. 2D interaction pose of LdREL1 inhibitors with the LdREL1 3D model



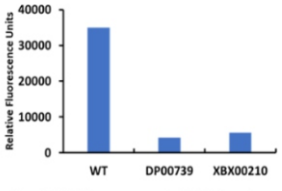




Fig. LdREL1 enzyme inhibition Assay

**Fig. 10**. *In silico* interaction of *in-vitro* active LdREL1 inhibitors with LdREL1 and their enzyme (LdREL1) specificity.

## 3.3 Lymphatic Filariasis

### 3.3.1 Inflammatory Eosinophils Accumulate in the Lungs of Mice during Filarial Manifestation of Tropical Pulmonary Eosinophilia

Tropical Pulmonary Eosinophilia (TPE), is a serious inflammatory disorder that is triggered by Eosinophils in response to the antigenic components of trapped microfilariae (Mf) in the lungs of some patients infected with filarial parasites.

We showed that the lungs of control and sensitized mice (that received only frozen Mf) had only resident eosinophils (rEos), while primary infection control mice (that received only live Mf) and TPE mice (that received both frozen and live Mf) showed both rEos and inflammatory eosinophils (iEos, **Fig. 11A**). Notably, rEos in TPE mice increased by nearly 8-fold as compared to control animals while more than 30-fold rise was seen in the case of TPE iEos in comparison to control animals (**Fig. 11B**).

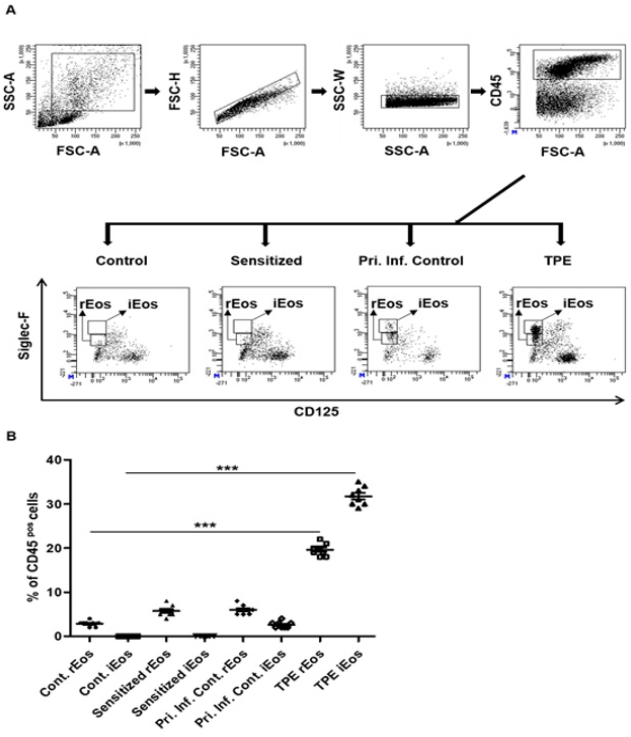



**Fig. 11. Gating strategy used for the identification of Eosinophil subset in mouse lung: (A)** Identification of resident (rEos, Siglec Fint CD125lo) and inflammatory eosinophils (iEos, Siglec Fhi CD125lo) in the lungs of mice based on the differential expression of Siglec-F and CD125 from different experimental groups is shown. Control and sensitized mice have only rEos, while primary infection control and TPE mice show both rEos and iEos in their lungs. **(B)** Scatter plot shows rEos and iEos as a percentage of total CD45+ cells present in the lungs of control, sensitized, primary infection control, and TPE mice.

Importantly, rEos and iEos steadily increased in the lung parenchyma and peripheral blood of mice on Day 4, Day 6, and Day 10 post live Mf challenge (**Fig. 12A**), but no rEos were detected in the alveolar compartment (**Fig. 12A**, BAL fluid dot plots). Further, cytospins from control mice showed the presence of symmetrical cell membrane and ring-shaped nucleus (**Fig. 12B**, right panel, top image), while iEos from TPE mice (TPE iEos) displayed asymmetrical cell membrane and segmented nucleus (**Fig. 12B**, right panel, middle image). At the same time, onset of TPE drove the accumulation of iEos which were morphologically and anatomically distinct from rEos (**Fig. 12B**, right panel, comparison between top and bottom cytospins).

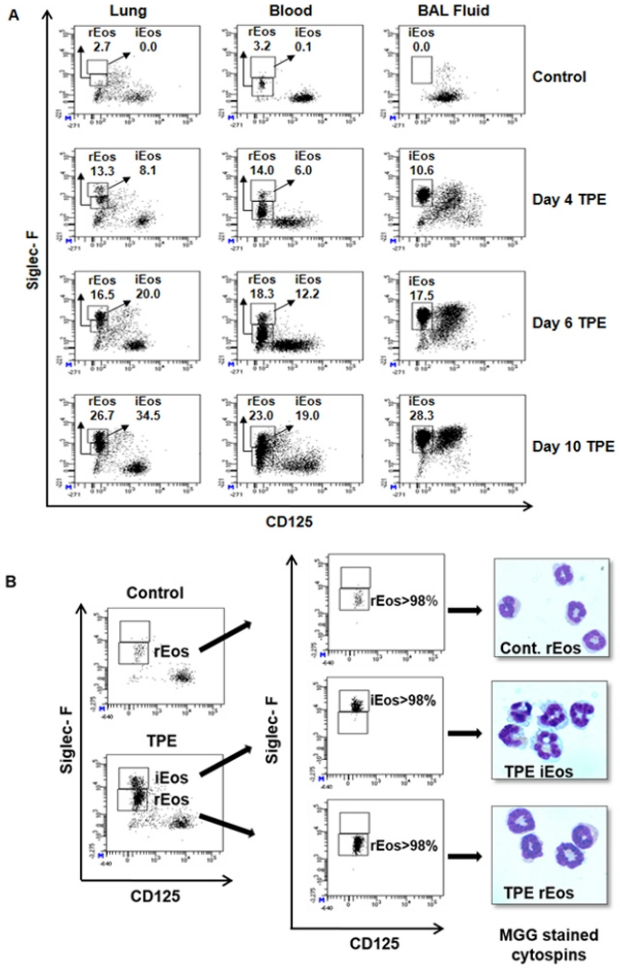



**Fig. 12. Recruitment kinetics and FACS-assisted sorting of eosinophil subsets. (A)** Dot plots show percentages of rEos and iEos present in the CD45$^+$ fraction from lung, blood, and BAL fluid of control and TPE mice at Day 4, Day 6, and Day 10 post-infection with live Bm-Mf. **(B)** Gating strategy used for the sorting of rEos and iEos from CD45$^+$ cells from the lungs of Control and TPE mice is shown. Post-sort dot plots (middle panel) illustrate very high purity (>98%) of the sorted cells. May-Grunwald-Giemsa-stained cytospins of sorted rEos and iEos indicate morphological differences between rEos and iEos (right panel). ***(Ganga et al., ACS Infect Dis., 2023).***

## 3.4. Medicinal Chemistry and Anti-Parasitic Drug Discovery

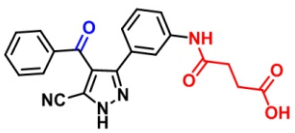
### 3.4.1 Synthesis and Biological Evaluation of Compounds as Antimalarials

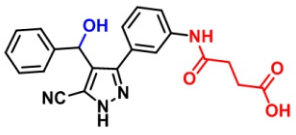
463 compounds comprising different synthetic/hybrid scaffolds and natural extracts were screened for asexual blood stage parasite killing *in vitro*. 34 synthetic compounds exhibited $IC_{50}$<1 µM in CQ-sensitive strain (PF3D7). Of these, S-022-0899, S-023-0218, S023-0908 exhibited promising antimalarial activity both in CQ-sensitive (K1 strain, $IC_{50}$ 0.047-0.3 µM) and resistant strain ($IC_{50}$ 0.2-0.4 µM) with $CC_{50}$ in the range of 5 µM-200 µM in Vero cells. Some of the salient findings are as follows-

A set of 14 compounds belonging to fused-isoquinolines and substituted pyrazoles were synthesized and screened against the CQS/CQR *P. falciparum*. Of them compound S-023-218 displayed promising activity which will be taken up for screening in the *in vivo* model.

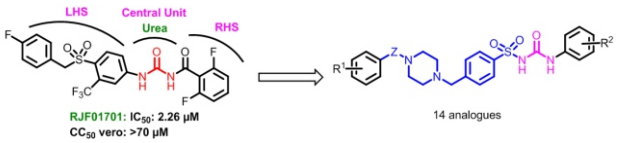
A benzothiazole hydrazone derivative of furylbenzamide (S023-0908) binds to non-canonical DNA structures such as G-quadruplexes. It displayed $IC_{50}$ of 47 nM in Pf 3D7 and 250 nM in K1 strains, but $CC_{50}$ was around 5 µM and 14 µM in Vero and HepG2 cells. Preliminary analysis showed that S023-0908 compound was negative in Ames test, suggesting it to be non-mutagenic. Initial PK studies showed that it is stable in mouse plasma and has low plasma protein binding. Further SAR is underway to reduce the cytotoxicity without compromising the activity.

Development of novel inhibitors targeting the enzyme serine hydroxymethyltransferase (SHMT) of *P. falciparum* is being pursued. In this context, synthesis of cyanopyrazole derivatives *via* multi-step was accomplished. Two new compounds of these series were prepared and evaluated for their antiplasmodial activity (S-024-176 and S-024-0177). Further synthesis of new compounds for developing SAR is underway.

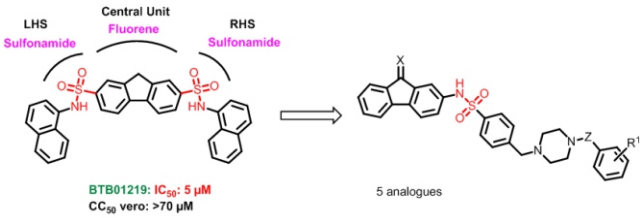



Screening of compounds from a commercial library against asexual blood stage cell lines, led to identification of two active compounds RJF01701, and BTB01219. In order to improve the bioactivity modifications in the original structure of RJF01701 were attempted leading to the synthesis of 14 molecules (S-023-0891, S-024-0030 to S024-0034, S-024-0055 to S024-0062). From this set of compounds, S-023-0891 displayed promising activity in blood stage as well as liver stage with good CC50 (IC50 (Pf 3D7): 3.99µM; $IC_{50}$(*P. berghei* liver): 9.5 µM; $CC_{50}$: 330 µM).




Simultaneously changes in the symmetrically substituted sulfonamide fluorene BTB01219, led to the synthesis of 5 new compounds (S-024-0063- S-024-0067). However, their bioactivities in blood stage and liver stage were not too encouraging.




Amongst the natural extracts, two extracts exhibited promising antimalarial activity 30-80 ng/ml in both CQ-sensitive and resistant strains and cytotoxicity in the range of 50-100 µg/ml.

### 3.4.2 Synthesis and Antileishmanial Evaluation of Compounds

A total of 200 compounds were screened for their inhibitory activity against *L. donovani* in the *in vitro* macrophage-amastigote model via luciferase assay. Out of these, 5 compounds (S-022-0795, 806-807, 818, S-023-0186) belonging to $\beta$-carboline-fused-imidazole class were found to be active with no cytotoxicity. The $IC_{50}$ values for these compounds ranged between 0.6-1.19 µM whereas the $CC_{50}$ was between 90-259 µM. The *in vivo* evaluation of these compounds is under progress. Another compound S-022-0807, a hybrid of Quinazolinone and Phenothiazine was also showed $IC_{50}$ of 2.5 µM and CC50 of 321 µM.

### 3.4.3 Anti-leishmanial Screening (non-CDRI Compounds)

Collaboration with ICT, Mumbai has been established for *in vivo* screening of three *in vitro* active nano-formulations of Amphotericin-B (Nano-AmpB, Lipo-AmpB and Micellar-AmpB). *In vitro* activity (in macrophage-amastigotes model) has been carried out.

### 3.4.4 Anti-filarial Drug Discovery

108 compounds belonging to different chemical classes viz., Quinazoline, Triazole, and Betacarboline-Triazole were screened for their anti-filarial activity using motility assay for both *Brugia malayi* adult worm, and *B. malayi* Microfilariae (Bm-Mf), and MTT reduction assay (for *B. malayi* adult worms only). None of the compounds showed promising adulticidal activity. However, PK studies with the nano-formulation of S-019-0277 (Quinoline-Triazole hybrid) that was previously found active against *B. malayi* adult worm was undertaken. Briefly, Nanostructured lipid carrier (NLC) was developed via a two-step process, involving hot homogenization followed by cold ultrasonication using Monostearin, Capryol 90, and S-019-0277. The developed formulation was optimized and characterized for quality control parameters in terms of particle size, monodispersity and entrapment efficiency. The developed formulation showed improved oral absorption (~ seven-fold higher) and PK profile with enhanced biological activity. Further work using the nanoformulation to assess dose proportionality and PK studies to assess linearity is in progress.

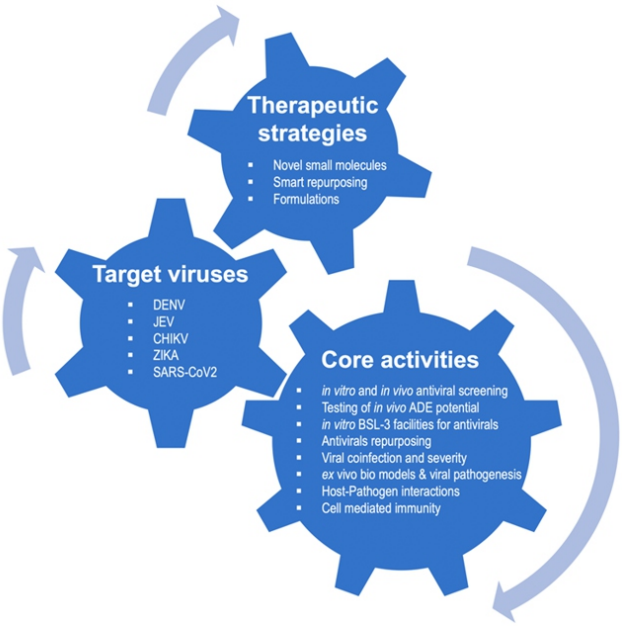
# 4 Viral Infections

## Vision :

Fundamental Research on infection pathogenesis with translational implications.

## Goals :

- Drug discovery for alleviating nationally important viral diseases
- Drug repurposing platforms for emerging viral diseases
- Diagnostics for early detection of viral diseases
- Safe and cost-effective Vaccine development




(From Left); Dr. Damodar Reddy, Dr. Kishore Mohanan, Dr. Ravishankar R, Dr. Raj K Tripathi, Dr. Ajay K Srivastava, Dr. M.I. Siddiqui and Dr. Chetan Meshram

## 4.1 Progress in Research and Development Program

### 4.1.1 Development of novel Anti-SARS-CoV2 compounds under the CSIR's Anti-Virus Mission

CSIR-CDRI is actively participating in the CSIR's Antiviral Mission, which is geared towards the Discovery & Pre-clinical Development of Antivirals for COVID-19. Among other things, the mission aims to enhance our collective capacity and preparedness to counter future viral disease scourges. CDRI has developed *in vitro* inhibition and target-engagement assays for m-Pro (mPRO figure attached), PL-Pro, as well as Spike-RBD-Human ACE2 interactions.

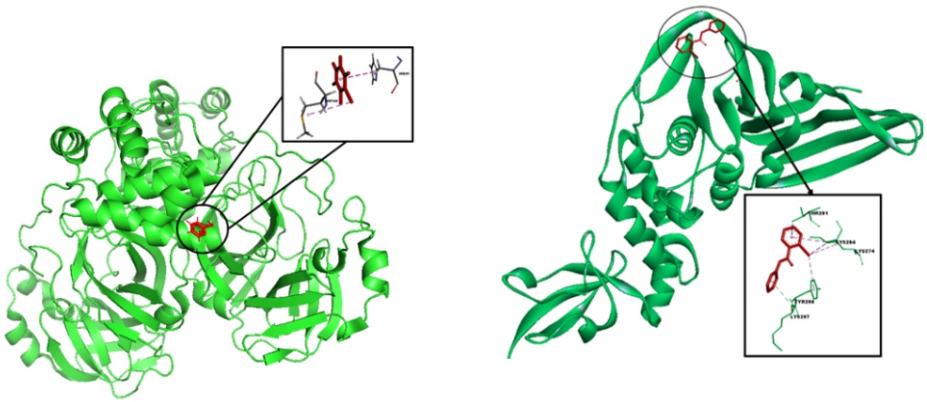


**Fig. 1.** Structures of mPRO and PL-Pro

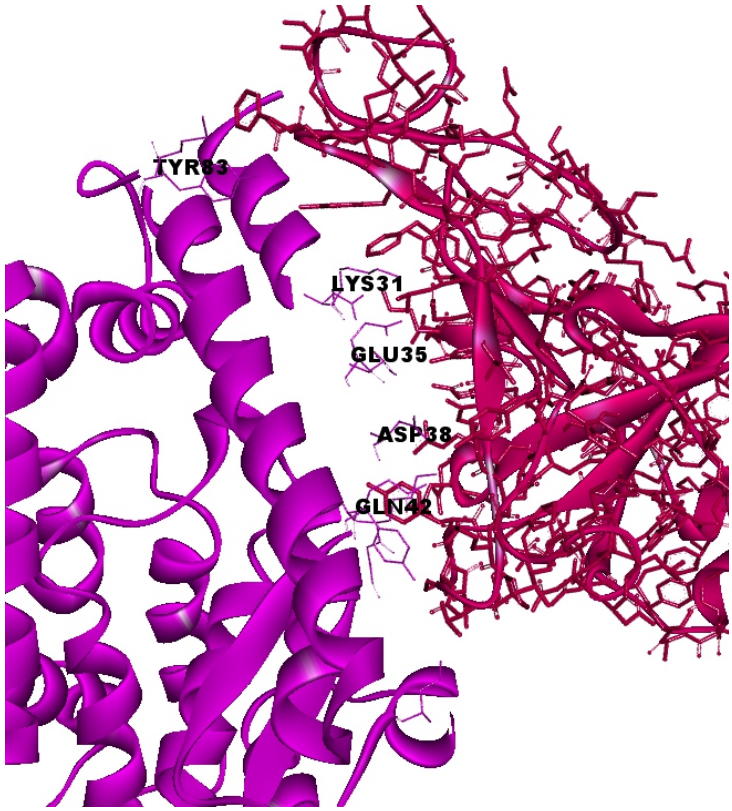



**Fig. 2.** Spike-RBD-Human ACE2 interaction

*"Development of small molecule based therapeutics against broader subsets of viral pathogens will enhance our ability to counter new challenges that crop up from time-to-time"*

***- Dr. Ravishankar R***
*Chief Scientist &*
*Area Coordinator*

*Virus-host protein interaction inhibitors would be future anti-viral therapeutics*

***- Dr. Raj Kamal Tripathi***
*Senior Principal Scientist & Area Coordinator*

These are available for collaborations and commercial users as per applicable terms and conditions of the Institute. During 2023-2024, our chemistry team synthesized 124 small molecules targeting mPro and Spike-Ace2 interaction inhibition. The *in vitro* SARS-CoV2 cell culture inhibition identified several primary hits with $IC_{50}$ in the submicromolar range. Two of the hits, CDRI-AKS-SPS-347 and CDRI-AKS-SPS-439, showing >99% virus replication inhibition at 0.5 µM concentration, have been selected for further developmental studies.

#### 4.1.2 Identification of novel hits towards anti-Dengue leads

Dengue is a disease scourge that affects both disadvantaged and well-off sections of our society and development of effective small-molecule therapeutics against it remains an important goal. Indole is a privileged heterocyclic compound. Its significance in medicinal chemistry is attributed to its widespread presence in numerous drugs, natural products, and drug-like molecules, showcasing a broad spectrum of biological activities. In clinical trials, Phenotypic screening has identified a promising drug candidate, JNJ-1802. JNJ-1802 targets the non-structural protein-3 (NS3) and NS4B proteins and inhibits the formation of a productive viral replication complex by blocking the NS3-NS4B interaction. Umifenovir (arbidol), which has a sulfenyl-group-containing indole core, is an example of an antiviral used for treating influenza and COVID-19 infections. Our team at CDRI is actively involved in the development of a synthetic method for 3-sulfenyle indoles and to explore the SAR in quest of a novel chemical space. Drawing inspiration from an interesting class of indole and indoline derivatives, a series of 3-sulfenyl indoles and an amide group-containing functionalized 3-sulfenyl indoles were synthesized, and their antiviral activities were evaluated. Out of the screened 40 compounds, a candidate was identified with $CC_{50}$ (>100 µM) and $IC_{50}$ (3.423 µM). Further development in this line is progressing. The Institute has joined hands with the *Drugs for Neglected Diseases Initiative* (DNDi) to help develop the hits in a collaborative manner.

#### 4.1.3 Design and synthesis of pyrazoloindoles that target the DENV NS3-NS4B interaction

As a part of the ongoing medicinal chemistry efforts to identify new chemical entities against dengue, an interesting class of pyrazoloindoles has been chosen for the synthesis and biological evaluation against the NS3-NS4B interactions. A series of 14 compounds have been synthesized for the initial evaluation using the synthesis strategy developed by our team. Initial results are encouraging.

#### 4.1.4 Antiviral Screening of compounds against viruses

We have validated *in vitro* cell-based assays for screening of potential antivirals against Dengue Virus (DENV), Japanese Encephalitis Virus (JEV), and Chikungunya Virus (CHIKV). By using our validated Flow Cytometry virus Neutralization Test (FRNT), we have screened in-house synthesized >300 compounds against DENVs, >30 compounds against JEV, and >25 compounds against CHIKV viruses. We have identified hits against DENVs and JEV from these potential antivirals. Moreover, we also carried out *in silico* screening of the Maybridge library. The *in silico*-identified molecules were subsequently tested *in vitro* against DENV and JEV. We found some initial hits which are being validated further.

### 4.2 Scientific & Technical Services

Our team has established a collaboration with 'Drugs for Neglected Diseases initiative' (DNDi) and are working to identify promising anti-dengue hits with them. We have tested about 100 compounds under the collaboration against DENV 1-4. Initial studies have identified promising scaffolds that are being developed and studied further.

Further, CSIR-CDRI has signed two

CDA with Emphascience Inc, Pittsford, NY and Focilite, Bengaluru, India respectively, to screen their anti-dengue compounds. Moreover, we have also signed agreement with Indian Institute of Technology, Kanpur for anti-dengue *in vivo* and *in vitro* assays. It is expected that these collaborations will bear fruit in the near future.

### 4.3 Establishment of CSIR-CDRI BSL3 Facility for virus research

While tackling unknown viral pathogens it is general practices to take utmost precautions and a BSL2$^{+}$/ BSL3 facility is helpful to jumpstart research on the pathogen. In this context, a CSIR-CDRI facility was made, supported partially through CSR funds, to conduct research and therapeutical development on viruses requiring a BSL2$^{+}$/ BSL3 facility. The facility will be useful in CSIR-CDRI and will be facilitate research on viruses of high public health importance in India. The facility is undergoing operational trials pending the required regulatory permissions.

*Every problem has a solution and if there is no solution, it's a matter of "Research".*

***- Dr. Ajay Srivastava***
*Principal Scientist &*
*Area Coordinator*

# 5 Metabolic Disorders

## Vision :

Cutting edge research and affordable healthcare for metabolic diseases including cardiovascular, hepatic, gut, pulmonary and inflammatory diseases

## Goals :

- Identification of small molecules and/or Phytopharmaceuticals for diseases such as NAFLD, cardiovascular, hepatic, gut, pulmonary and inflammatory diseases
- Clinic oriented research- Research collaboration and joint grant submissions with clinicians on cardio-metabolic disorders
- Building cohort of intestinal biopsies for identification of disease-associated genes in the areas of rheumatoid arthritis with the help of local hospitals
- Identification of NCEs for hepatic, pulmonary and cardiac fibrosis
- Identifying novel targets for heart failure drug development with emphasis on RNA binding proteins
- Target-based screening and establishment of fibroblast migration assays for immuno-modulatory disorders
- Identification of novel targets of cardiac hypertrophy with focus on metabolism
- Identification of gut microbiome modulators and studying the correlation of gut microbiome with cardiovascular and metabolic disorders

**Front Row (L to R):** Dr. Akhilesh Tamrakar, Dr. Anil N Gaikwad, Dr. Koneni V Sashidhara (Area Coordinator), Dr. Manoj K Barthwal (Area Coordinator), Dr. Amit Lahiri and Dr. Kashif Hanif

**Second Row (L to R):** Dr. Ajay Kumar Srivastava, Dr. Gautam Panda, Dr. Sachin Kumar, Dr. Baisakhi Moharana, Dr. Shashi Kumar Gupta, Dr. Kinshuk Raj Srivastava

## R&D Highlights

### 5.1 Anti-inflammatory Activity of Novel Pyrrole-Hydroxybutenolide Hybrids (5a-5u)

Inflammation is generally treated with Non-Steroidal Anti-Inflammatory Drugs(NSAIDs) or Steroidal Anti-Inflammatory Drugs(SAIDs). Although they are the standard drugs for treating many inflammatory conditions, they have serious side effects. NSAIDs cause serious gastrointestinal injuries and hepatotoxicity, whereas, SAIDs (mainly glucocorticoids) cause sodium retention, obesity, and osteoporosis. Butenolide is a core structural moiety of therapeutically important molecules and has anti-inflammatory properties. It's one of the most desirable scaffolds because it is simple to diversify. Similarly, pyrrole is also a well-known pharmacophore having great biological potential including anticancer, anti-malarial, and anti-viral properties. Considering their high versatility, they were incorporated into one frame and the resulting products (5a-5u) were screened for their anti-inflammatory properties.

First the pro-inflammatory cytokine TNF-$\alpha$ levels were evaluated in the culture supernatant of THP-1 cells which were pre-treated with 10mM of test compounds (5a-5u) and stimulated with LPS (50ng/ml). It was observed that 16 out of 19 test compounds showed significant inhibition of TNF-$\alpha$ secretion, among which 9 compounds showed more than 85% inhibition of TNF-$\alpha$ levels in LPS stimulated THP-1 monocytes. The compounds were also evaluated for their effect on inflammatory cytokine mediated NF-$\kappa\beta$ activation via reporter gene activity assay. It was observed that at 10mM concentration 7 of the test compounds showed more than 40% decrease in fold induction in reporter gene activity.

The compounds 5p and 5t were further assessed for their anti-inflammatory activity in carrageenan induced paw edema model in swiss mice. Mice treated with standard drug ibuprofen (200mg/kg) showed 78% inhibition and the mice pre-treated with 5p showed 61%, 62%, and 73% and 5t showed 49%, 60%, and 67% inhibition at 25mg/kg, 50mg/kg, and 100mg/kg dose respectively in carrageenan induced paw edema at 4 hours. At 6 hours the inhibition was observed to be 56%, 56% and 65% by 5p and 43%, 58%, and 62% by 5t at 25mg/kg, 50mg/kg, and 100mg/kg dose respectively.

The compounds 5p and 5t were then evaluated for their effect on inflammatory pathways. THP-1 cells were pre-treated for 1 hour with 10mM concentration of 5p and 5t and then stimulated with LPS (50ng/ml). It was observed that LPS considerably increased the ERK and JNK phosphorylation which was significantly reduced by 5p and 5t pre-treatment.

Based on the results, it may be suggested that compounds 5p and 5t show anti-inflammatory effects by reducing LPS induced phosphorylation of ERK and JNK MAP kinase proteins. (***Eur J Med Chem. 2023 Jun 5;254:115340***).

### 5.2 Comparative Efficacy of *Withania* extracts in Thioglycolate Induced Mice Peritonitis Model

*Withania somnifera* (L) Dunal (Solanaceae) commonly named Ashwagandha (WS) has been an integral part of traditional Indian medicine for centuries. *Withania somnifera* root extract exhibits anti-inflammatory properties, however comparative efficacy of water, alcoholic and hydro-alcoholic extracts is not known. *In vivo*, thioglycolate (TG) causes acute inflammatory response in mice peritoneal cavity having sequential phases of neutrophils influx at early stages of inflammation (up to 24 h) followed by a macrophage-enriched infiltrates at 72 h.

Present study was undertaken to evaluate the immune responses and anti-inflammatory effects among *Withania* extracts in thioglycolate induced mice peritonitis model.

Swiss mice (22-25g) were randomly

*"Striving to discover and develop solutions for metabolic diseases."*

***- Dr. Manoj Kumar Barthwal***
*Senior Principal Scientist & Area Coordinator*

*"Our group aspires to discover novel target-based drugs, phytopharmaceuticals, and molecular pharmacology to alleviate the metabolic disease burden"*

***- Dr. Kumaravelu J***
*Senior Principal Scientist & Area Coordinator*

divided in control, thioglycolate (4% w/v) and thioglycolate groups pre-treated with *Withania* alcoholic (WS-A 3.5%) hydro-alcoholic (WS-HA 1.5%) and water (WS-H 0.3%) extracts (210mg/kg p.o), Dexamethasone (10mg/kg) and Diclofenac (10mg/kg) as standard comparator drugs. All groups were sacrificed at 24 and 72 hours. Peritoneal lavage was collected and total cell count was performed using haemocytometer, Giemsa staining and flow cytometric analysis were done with hydroalcoholic extract (WS-HA 1.5%).

TG induced a significant increase in the total peritoneal cell counts when compared to control ($p < 0.0001$) indicating infiltration of immune cells in the peritoneal cavity. Pre-treatment with WS-HA, WS-H and WS-A significantly attenuated ($p < 0.0001$) infiltration of inflammatory cells both at 24 and 72 hours which was confirmed by Giemsa staining. Neutrophils and Macrophage subpopulation as assessed by GR1+ and $CD11b^+$ F4/80+ cells respectively by Flow cytometry were significantly enhanced in TG treated groups. However, pre-treatment with WS-HA 1.5% extract reduced their number.

Present study demonstrates inhibitory effect of WH, WA and W-HA extracts on neutrophil and macrophage migration in a mouse peritonitis model. Extracts showed similar anti-inflammatory effect however a better tendency was observed with WS-HA.

### 5.3 Msi2: A New Player Inside the Ring of Cardiovascular Diseases

Regulation of RNA stability and translation by RNA-binding proteins (RBPs) is a crucial process altering gene expression. Musashi family of RBPs comprising Msi1 and Msi2 is known to control RNA stability and translation. However, despite the presence of MSI2 in the heart, its function remains largely unknown. We for the first time reported the cardiac functions of MSI2. We confirmed the presence of MSI2 in the adult mouse, rat heart, and neonatal rat cardiomyocytes. Furthermore, Msi2 was found to be significantly enriched in the heart cardiomyocyte fraction. Next, using RNA-seq data and isoform-specific PCR primers, we identified Msi2 isoforms 1, 4, and 5, and two novel putative isoforms labeled as *Msi2* 6 and 7 to be expressed in the heart. Overexpression of Msi2 isoforms led to cardiac hypertrophy in cultured cardiomyocytes. Additionally, Msi2 exhibited a significant increase in a pressure-overload model of cardiac hypertrophy. We selected isoforms 4 and 7 to validate the hypertrophic effects due to their unique alternative splicing patterns. AAV9-mediated overexpression of *Msi2* isoforms 4 and 7 in murine hearts led to cardiac hypertrophy, dilation, heart failure, and eventually early death, confirming a pathological function for Msi2. Using global proteomics, gene ontology, transmission electron microscopy, seahorse, and transmembrane potential measurement assays, increased MSI2 was found to cause mitochondrial dysfunction in the heart. Mechanistically, we identified *Cluh* and *Smyd1* as direct downstream targets of Msi2. Overexpression of *Cluh* and *Smyd1* inhibited Msi2-induced cardiac malfunction and mitochondrial dysfunction. Collectively, we have shown that Msi2 induces hypertrophy, mitochondrial dysfunction, and heart failure. ***(Basic Res Cardiol. 2023 Nov 3;118(1):46.)***

### 5.4 Superior Lung Regeneration Capability of Exclusive Neonatal Lung-Derived Decellularized Extracellular Matrix (dECM) in an Emphysema Model

Impaired and limited alveolar regeneration upon injury advances pulmonary disorders and irreversibly affects millions of people worldwide. Adult mammals do not have a strong potential to regenerate functional lung tissues, while neonatal lungs robustly proliferate and regenerate the functional tissue within a week of birth upon injury. The differential composition of the extracellular matrix (ECM) of

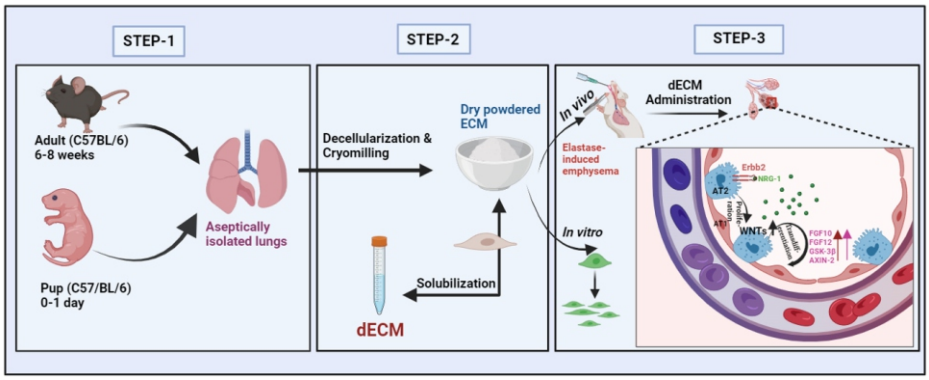



**Fig. 1.** Cartoon depicting Regenarate capacity of hung cells in an emphysema model.

neonatal tissues favors cellular proliferation and migration, fostering lung regeneration. Regardless, conventional ECM therapies employ adult-derived tissues. Therefore, the potential differences in regenerative properties of adult and neonatal lung ECM were investigated using *in vitro* and *in vivo* lung emphysema model. Decellularization of the neonatal and adult lungs was performed using freeze-thaw cycle method. Decellularization process was structurally characterized using SEM and immunostaining. *In vitro* treatment of neonatal lung-derived ECM (NECM) significantly enhanced the cellular migration and proliferation compared to adult-lung derived ECM (AECM) treated cigarette smoke-extract (CSE)-stimulated A549 cells. Following the administration of AECM and NECM, we observed a significant decline in emphysematous features and an improvement in lung functions in NECM group. NECM treatment increased the ratio of $HOPX^+/SpC^+$ cells with an active proliferation in $SpC^+$ cells shown by colocalization of $SpC^+/Ki67^+$ and $SpC^+/Brdu^+$ cells. Moreover, NECM treatment activated the Neureguline-1/Erbb2 signaling and fostered a regenerative environment by upregulating the expression of regenerative genes including FGF, WNTs and AXIN-2 as compared to AECM treatment. Our findings suggest the potential utilization of NECM as novel therapeutics in regenerative medicine, deviating from the conventional application of adult-derived ECM treatments in pre-clinical and clinical research.

### 5.5 Ormeloxifene, a Selective Estrogen Receptor Modulator, Protects Against Pulmonary Hypertension

Protective effect of 17β-estradiol is well-known in pulmonary hypertension. However, estrogen-based therapy may potentially increase the risk of breast cancer, necessitating a search for novel drugs. This study, therefore, investigated the ameliorative effects of a selective estrogen receptor modulator, ormeloxifene, in pulmonary hypertension. Cardiomyocytes (H9C2) and human pulmonary arterial smooth muscle cells (HPASMCs) were exposed to hypoxia (1% $O_2$) for 42 and 96 h, respectively, with or without ormeloxifene pre-treatment (1 µM). Also, female (ovary-intact or ovariectomized) and male Sprague-Dawley rats received monocrotaline (60 mg/kg, once, subcutaneously), with or without ormeloxifene treatment (2.5 mg/kg, orally) for four weeks. Hypoxia dysregulated 17β-hydroxysteroid dehydrogenase (17βHSD) 1 & 2 expressions, reducing 17β-estradiol production and estrogen receptors α and β in HPASMC but increasing estrone, proliferation, inflammation, oxidative stress, and mitochondrial dysfunction. Similarly, monocrotaline decreased plasma 17β-estradiol and uterine weight in ovary-intact rats. Further, monocrotaline altered 17βHSD1 & 2 expressions and reduced estrogen receptors α and β, increasing right ventricular pressure, proliferation, inflammation, oxidative stress,

*"Committed to translational science"*

***- Dr. KV Sashidhara***
*Senior Principal Scientist &*
*Area Coordinator*

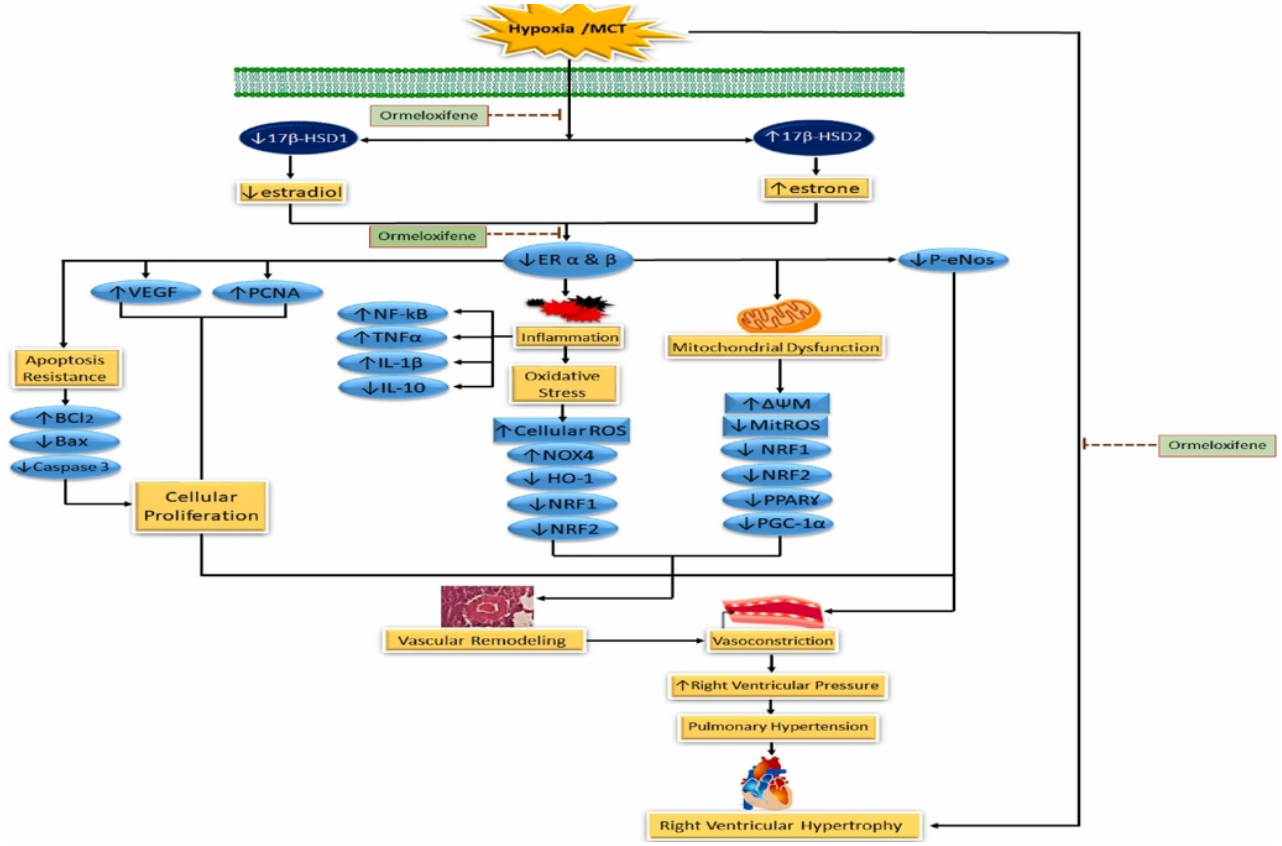



**Fig. 2.** The proposed pathway for the mechanism of Ormeloxifene action.

endothelial dysfunction, mitochondrial dysfunction, and vascular remodeling in female and male rats, with worsened conditions in ovariectomized rats. Ormeloxifene was less uterotrophic; however, it attenuated both hypoxia and monocrotaline effects by improving pulmonary 17β-estradiol synthesis. Furthermore, ormeloxifene decreased cardiac hypertrophy and right ventricular remodeling induced by hypoxia and monocrotaline. This study demonstrates that ormeloxifene promoted pulmonary 17β-estradiol synthesis, alleviated inflammation, improved the NOX4/HO1/Nrf/PPARγ/PGC-1α axis, and attenuated pulmonary hypertension. It is evidently safe at tested concentrations and may be effectively repurposed for pulmonary hypertension treatment. ***(Eur J Pharmacol. 2023 Mar 15; 943:175558***).

### 5.6 Microbiome and Mitochondria Mediated Immune Regulation During Inflammatory Disorders

Crohn's disease (CD) and ulcerative colitis (UC), the main clinical pathologies of inflammatory bowel disease (IBD), arise due to the inter-play of genes that regulate immune function. In the susceptible host, an altered gut flora leads to an unbalanced cytokine production and tight junction dysfunction resulting in chronic inflammation and pain in the intestine. Mitochondria has recently emerged as an important organelle that regulates antibacterial and antiviral immune pathways and these functions are intimately linked to their morphology. Cellular mitochondria constantly undergo fusion, fission, directed movement in the cell and mitophagy mediated clearance-collectively termed as 'mitochondrial dynamics'. We have demonstrated decreased mitochondrial electron transport chain complexes in the IBD patients and a dysregulated release of mitochondrially-derived reactive oxygen species (MT-ROS) suggesting dysfunctional mitochondria. There are multiple proteins that coordinate to regulate the mitochondrial dynamics and we focused on ORMDL3.

Genome wide association studies in inflammatory bowel disease has identified risk loci in *Orosomucoid like 3* (*ORMDL3*) gene to confer susceptibility to ulcerative colitis (UC), but the underlying functional relevance remains unexplored. Here, we found that a subpopulation of the UC patients who had higher disease activity shows enhanced expression of ORMDL3 compared to the patients with low score and the non-UC controls. We also found that the patients showing high *ORMDL3* mRNA expression has elevated IL-1β cytokine level indicating positive correlation. Further,

knockdown of ORMDL3 in the human monocyte derived macrophages resulted in significantly reduced IL-1β release. Mechanistically, we report for the first time that ORMDL3 contribute to mounting inflammatory response via modulating mitochondrial morphology and activation of NLRP3 inflammasome. Specifically, we observed an increased fragmentation of mitochondria and enhanced contacts with ER during ORMDL3 over-expression, enabling efficient NLRP3 inflammasome activation. We show that ORMDL3 that was previously known to be localized in ER, gets also localized to mitochondria-associated membranes and mitochondria during inflammatory conditions. Additionally, ORMDL3 interacts with mitochondrial dynamic regulating protein Fis-1 present in mitochondria associated membrane. Accordingly, knockdown of ORMDL3 in DSS-induced colitis mouse model showed reduced colitis severity. Taken together, we have uncovered functional role for ORMDL3 in mounting inflammation during UC pathogenesis by modulating ER-mitochondrial contact and dynamics. This article has been published in **Journal of Biological Chemistry** in press.

### 5.7 Involvement of HIF1α/Reg Protein in the Regulation of HMGB3 in Myocardial Infarction

Myocardial ischemia and infarction are the number one cause of cardiovascular disease mortality. Cardiomyocyte death during ischemia leads to the loss of cardiac tissue and initiates a signaling cascade between the area at risk and the infarct zone of the myocardium. Here, we sought to determine the involvement of damage-associated molecular patterns HMGB3 in myocardial ischemia and infarction. We used the left anterior descending coronary artery ligation model to study the involvement of HMGB3 in myocardial infarction. Our results indicated the presence of HMGB3 at a low level under normal conditions, while myocardial injury caused a robust increase in HMGB3 levels in the heart. Further, intra-cardiac injection of mabHMGB3 had improved cardiac function at day 3 by downregulating HMGB3 levels. In contrast, injection of recombinant rat HMGB3 for 7 days during the adaptation phase of myocardial ischemia improved cardiac functional parameters by increasing regenerative protein family expression. Further, to mimic the disease condition, rat ventricle cardiomyocytes and fibroblasts were exposed to hypoxia; we observed a significant upregulation in the HMGB3, HIF1α, and Reg1α levels. Endothelial cells exposed to recombinant HMGB3 increased the tubule length. Further, the mitochondrial oxygen consumption rate was reduced with the acute induction of recombinant HMGB3 on cardiomyocytes and fibroblasts.

HMGB3 plays a dual role during the progression of myocardial infarction. Clinically, post-myocardial infarction HMGB3 induced sterile inflammation needs to be tightly controlled effectively as it plays both a pro-inflammatory role and improves cardiac function during the cardiac remodeling phase. ***( Vascul Pharm 152 2023).***

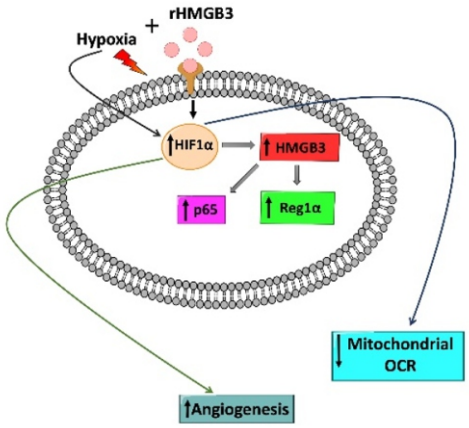



**Fig. 3. :** The cartoon depicts HMGB3 and hypoxia mediated Reg protein expression and angiogenesis during myocardial ischemia and infarction.

### 5.8 A Halimane Diterpene Isolated from *Polyalthia longifolia* Inhibits Adipogenesis and Ameliorates Dyslipidemia

Obesity is associated with a sedentary lifestyle due to greater energy consumption than expenditure. Excess fat in adipose tissue leads to hypertrophy and hyperplasia, which eventually, in further excess, results in hypoxia, inflammation, and lipopathy (adipose tissue deficiency). This is the leading cause of metabolic diseases. *Polyalthia longifolia (Sonn.)* Thwaites is a member of the Annonaceae family, also known as the Ashoka or Buddha tree, and is native to India. *Polyalthia,* meaning "many cures," has been used in Traditional Indigenous Medicine. Its extracts are well known for various biological potentials, including antioxidant, hepatoprotective, antibacterial, and anti-cancer activities. PLH (16-Hydroxy-ent-halima-5(10),13-dien-15,16-olide) is a halimane diterpene isolated from *Polyalthia longifolia*. It shows structural similarity with lovastatin. PLH inhibits adipogenesis in 3T3-L1 and C3H10T1/2 cell lines in a dose-dependent manner. PLH inhibits the early stage of adipogenesis by halting the mitotic clonal expansion in the G1 stage of the cell cycle. PLH reduced the adipogenic marker genes at both the transcript and protein levels. It activates the Wnt/β-catenin signaling pathway to inhibit adipogenesis. In the presence of FH535 (inhibitor of β-catenin signaling ), PLH could not impede adipogenesis. PLH reduces HFD-induced body weight, fat mass, eWAT weight, and adipose hypertrophy in HFD-fed dyslipidemic Syrian Golden Hamsters. PLH administration ameliorates HFD-induced dyslipidemia in Syrian Golden Hamsters. ***(Fitoterapia (2023) Vol 170, 105626).***

### 5.9 The Anti-adipogenic and Anti-dyslipidemic Potential of 3,3-DMAH-Inspired novel Oxazole Ammonium Salts Through AMPK Activation

Obesity is caused by cellular metabolic imbalances that affect overall energy homeostasis. The chronic discrepancy between energy consumption and expenditure leads to the formation of excess fats in the body. In our continuous efforts in drug discovery, we strive to enhance known pharmacophore structures to develop compounds with improved potency, safety, and efficacy. Here, we focused on modifying oxazole pharmacophores and evaluating their potential anti-adipogenic properties using the murine 3T3-L1 pre-adipocyte cell line as an *in vitro* model. Among the screened compounds, 19e (S-019-0137) emerged as a potent inhibitor of adipogenesis. Its efficacy was further validated in murine mesenchymal stem cells C3H10T1/2. Compound S-019-0137 exhibited a significant reduction in adipogenesis across all differentiation stages, particularly during the early phase. S-019-0137 demonstrated inhibition of mitotic clonal expansion in 3T3-L1 cells, suppressing the pathway responsible for cell cycle progression and lipid production. Mechanistically, its anti-adipogenic activity appears mediated through AMPK activation during differentiation. Interestingly, S-019-0137 enhances AMPK activation, oxygen consumption rate, and mitochondrial activity during early differentiation, suggesting a potential role in augmenting energy expenditure in differentiated adipocytes. *In vivo* studies of S-019-0137 unveiled anti-dyslipidemic effects, potentially impacting both liver and adipocyte metabolism. These findings underscore the promising therapeutic potential of S-019-0137 in combating adipogenesis and dyslipidemia. ***(EJMC, 262-2023, 115895).***

### 5.10 Unraveling of Redox Signaling in Hematopoietic Stem and Progenitors (HSPCs) and Neutrophil Functions

Blood cells are sustained by hematopoietic stem cells (HSCs) in a process termed hematopoiesis. The function of HSCs can be altered by signals extrinsic to stem cells like cytokines and the level of oxygen. For example, it was recently shown that a brief exposure to ambient oxygen decreases recovery of long-term repopulating HSCs and increases the potential of progenitor cells. There is mild extracellular acidosis and extracellular changes in pH due to accumulation of lactic acid in conditions of anaerobic metabolism of HSCs within bone marrow (BM), which might imply a role of extracellular pH also for regulating stem cell functions or directing stem cell fates. Upon *ex vivo* culture, hematopoietic stem cells (HSCs) quickly lose potential and differentiate into progenitors. The identification of culture conditions that maintain the potential of HSCs *ex vivo* is therefore of high clinical interest. In one study, we demonstrated that minor changes in the pH of *ex vivo* culture significantly improve the potential of HSCs via polyamines. Importantly, these data may contribute to enhanced HSC cultivation protocols for transplantation and gene therapy. Redox signaling plays key role in immune cells and hematopoiesis. However the role of RNS in hematopoiesis remains unclear and requires further investigation. We investigated the significance of inducible nitric oxide synthase/ nitric oxide (iNOS/NO) signaling in hematopoietic stem and progenitor cells (HSPCs) and hematopoiesis under steady-state and stress conditions. HSCs contain low levels of NO and iNOS under normal conditions, but these increase upon bone marrow stress. Our results challenge the conventional view of iNOS-derived NO as a cytotoxic molecule and highlights its intriguing role in HSPCs. Together, our findings provide insights into the crucial role of the iNOS-NO-mitochondrial axis in regulating HSPCs and hematopoiesis. Other studies in the lab are focused towards neutrophil heterogeneity and their clearance. Results so far from lab suggest drastic neutrophil plasticity in different metabolic organs. This led to identification of novel subset of neutrophils with inflammatory characteristics. We are also targeting neutrophil extracellular traps associated with various disease via identification of small molecule inhibitors.

# 6 Musculoskeletal Health and Disorders

## Vision

To undertake pioneering research in diseases of bone and muscle for discovering and developing affordable medicines

## Goals

- We focus on understanding metabolic bone diseases and muscle atrophy and address unmet clinical needs through discovery and development of the therapeutic candidates for these diseases
- Mechanism of pathobiology of musculoskeletal diseases
- Discovery of NCEs, NBEs and phyto-pharmaceuticals and repurposing of drugs for skeletal muscle atrophy and osteoporosis
- Discovery of RNA therapeutics towards precision medicine
- Targeting cellular senescence for mitigating age-related bone and muscle loss
- Biomarker discovery for clinical diagnosis of Osteoporosis
- Collaborative research with leading clinical experts and Indian industry
- Training future drug researchers

**First Row (L to R):** Dr. Koneni V Sashidhara, Dr. Ritu Trivedi, Dr. Naibedya Chattopadhyay, Dr. Divya Singh (Area Coordinator)
**Second Row (L to R):** Dr. Prabhat Ranjan Mishra, Dr. Atul Goel, Dr. Sanjay Batra, Dr. Arun K Trivedi, Dr. M.I. Siddiqui, Dr. Sanjeev Kanojia, Dr. Jiaur R Gayen, Dr. Kishore Mohanan (Area Coordinator)

*"The main focus of the musculoskeletal health research area encompasses the development of novel agents for bone-related disorders and muscle atrophy through modern drug design and scientific validation of traditional remedies"*

***- Dr. Divya Singh***
*Senior Principal Scientist & Area Coordinator*

## Progress in R&D Activities

### 6.1 A glucuronated Flavone TMMG Spatially Targets Chondrocytes to Alleviate Cartilage Degeneration Through Negative Regulation of IL-1β

Chondrocytes are the only resident cell types that form the extracellular matrix of cartilage. Inflammation alters the anabolic and catabolic regulation of chondrocytes, resulting in the progression of osteoarthritis (OA). The potential of TMMG, a glucuronated flavone, was explored against the pathophysiology of OA in both *in vitro* and *in vivo* models. The effects of TMMG were evaluated on chondrocytes and the ATDC5 cell line treated with IL-1β in an established *in vitro* inflammatory OA model. An anterior cruciate ligament transection (ACLT) model was used to stimulate post-traumatic injury *in vivo*. Micro-CT and histological examination were employed to examine the micro-architectural status and cartilage alteration. Further, serum biomarkers were measured using ELISA to assess OA progression. *In-vitro*, TMMG reduced excessive ROS generation and inhibited pro-inflammatory IL-1β secretion by mouse chondrocytes and macrophages, which contributes to OA progression. This expression pattern closely mirrored osteoclastogenesis prevention. *In-vivo* results show that TMMG prevented chondrocyte apoptosis and degradation of articular cartilage thickness, subchondral parameters, and elevated serum COMP, CTX-II, and IL-1β which were significantly restored in 5 and 10 $mg.kg^{-1}day^{-1}$ treated animals and comparable to the positive control Indomethacin. In addition, TMMG also improved cartilage integrity and decreased the OARSI score by maintaining chondrocyte numbers and delaying ECM degradation. These findings suggest that TMMG may be a prospective disease-modifying agent that can mitigate OA progression. ***(Biomedicine and Pharmacotherapy 2023, 163, 114809).***

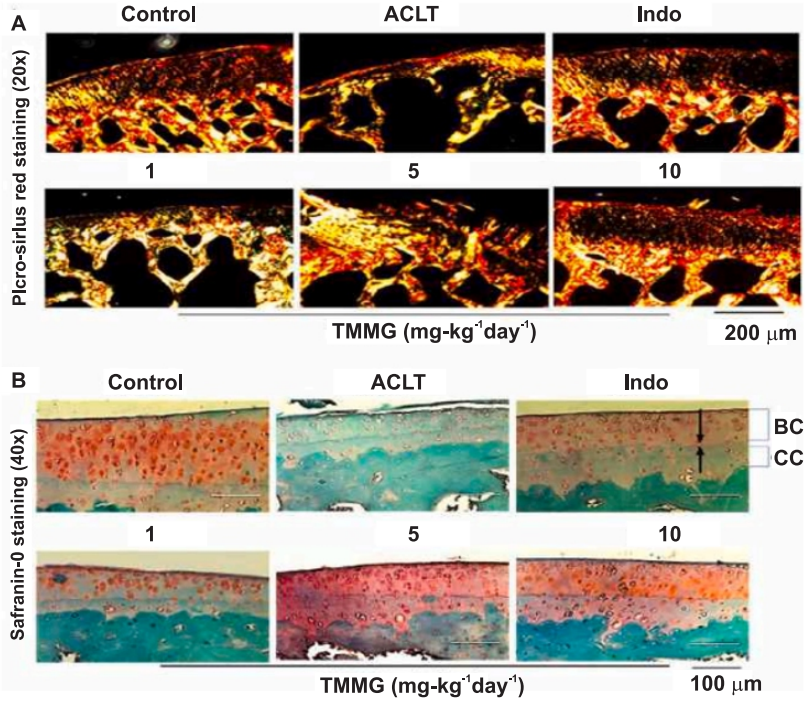



**Fig. 1.** TMMG prevented matrix degradation and cartilage thickness in the ACLT animals. The matrix component of cartilage was stained by **(A)** picro-sirius (20x) and **(B)** safranin-O staining (40x). The thickness of cartilage. All values in the study are expressed as Mean ± SEM (n = 3/group); *P < 0.05, * *P < 0.01, * **P < 0.001 compared to control and "P < 0.05, ""P < 0.01, """P < 0.001 versus TMMG and indomethacin treatment to ACLT animals. ***(Biomedicine and Pharmacotherapy 2023, 163, 114809).***

*"In this area, our ongoing quest is to identify and develop new therapeutic agents for musculoskeletal disorders"*

***- Dr. Kishor Mohanan***
*Senior Principal Scientist & Area Coordinator*

### 6.2 Bone fracture-healing properties and UPLC-MS analysis of an enriched flavonoid fraction from *Oxystelma esculentum*

*Oxystelma esculentum* has been used as a folk medicine to treat jaundice, throat infections, and skin problems. In the current study, the bone fracture-healing properties of a flavonoid-enriched fraction (Oxy50-60F) of *O. esculentum* were investigated in Swiss mice using a drill-hole injury model. Oxy50-60F (1 mg/kg/day, 5mg/kg/day, and 10 mg/kg/day) was administered orally (from the next day) after a 0.6 mm drill-hole injury in mice femur mid-diaphysis for 7 days and 14 days. Parathyroid hormone (40 µg/kg; 5 times/week) was given subcutaneously as the positive control. Confocal imaging for bone regeneration, micro-architecture of femur bones, *ex vivo* mineralization, hematoxyline and eosin staining, measurement of reactive oxygen species, and gene expression of osteogenic and anti-inflammatory genes were studied. Quercetin, kaempferol, and isorhamnetin glycosides were identified in the active fraction using mass spectrometry techniques. Our results confirm that Oxy50-60F treatment promotes fracture healing and callus formation at drill-hole sites and stimulates osteogenic and anti-inflammatory genes. Oxy50-60F administration to fractured mice exhibited significantly better micro-CT parameters in a dose-dependent manner and promoted nodule mineralization at days 7 and 14 post-injury. Oxy50-60F also prevents ROS generation by increasing expression of the SOD2 enzyme. Overall, this study reveals that Oxy50-60F has bone regeneration potential in a cortical bone defect model, which supports its use in delayed-union and non-union fracture cases. ***(Planta Medica; DOI: 10.1055/a-2192-2138).***

### 6.3 Design, Synthesis and Biological Evaluation of Novel Pyrimidine Derivatives as Bone Anabolic Agents Promoting Osteogenesis *via* BMP2/SMAD1 Signaling Pathway

Anti-resorptive inhibitors such as bisphosphonates are widely used but they have limited efficacy and serious side effects. Though, subcutaneous injection of teriparatide [PTH (1"34)] is an effective anabolic therapy but long-term repeated subcutaneous administration is not recommended. Henceforth, orally bio-available small-molecule-based novel therapeutics are unmet medical needs to improve the treatment. In this study, we designed, synthesized, and carried out a biological evaluation of 31 pyrimidine derivatives as potent bone anabolic agents. A series of *in vitro* experiments confirmed *N*-(5-bromo-4-(4-bromophenyl)-6-(2,4,5-trimethoxyphenyl) pyrimidin-2-yl) hexanamide (**18a)** as the most efficacious anabolic agent at 1 pM. It promoted osteogenesis by upregulating the expression of osteogenic genes (RUNX2 and Type 1 col) *via* activation of BMP2/SMAD1 signaling pathway. *In vitro* osteogenic potential was further validated using *in vivo* fracture defect model where compound **18a** promoted bone formation rate at 5 mg/kg. We also established the structure activity relationship and pharmacokinetic studies of the **18a. (*RSC Med Chem; DOI: 10.1039/D3MD00500C*).**

### 6.4 9-Demethoxy-Medicarpin: A Potential Bone Health Supplement for the Management of Protein Deficiency-Induced Bone Loss in Growing Rats

Human skeleton requires an adequate supply of many different nutritional factors for optimal growth and development. The role of nutrition in bone growth has piqued interest in recent years, especially in relation to maximizing peak bone mass and reducing the risk of osteoporosis. Protein deficiency-induced bone loss was induced in female growing rats. All experimental rodent diets were prepared as per recommendations for growing animals. 9-

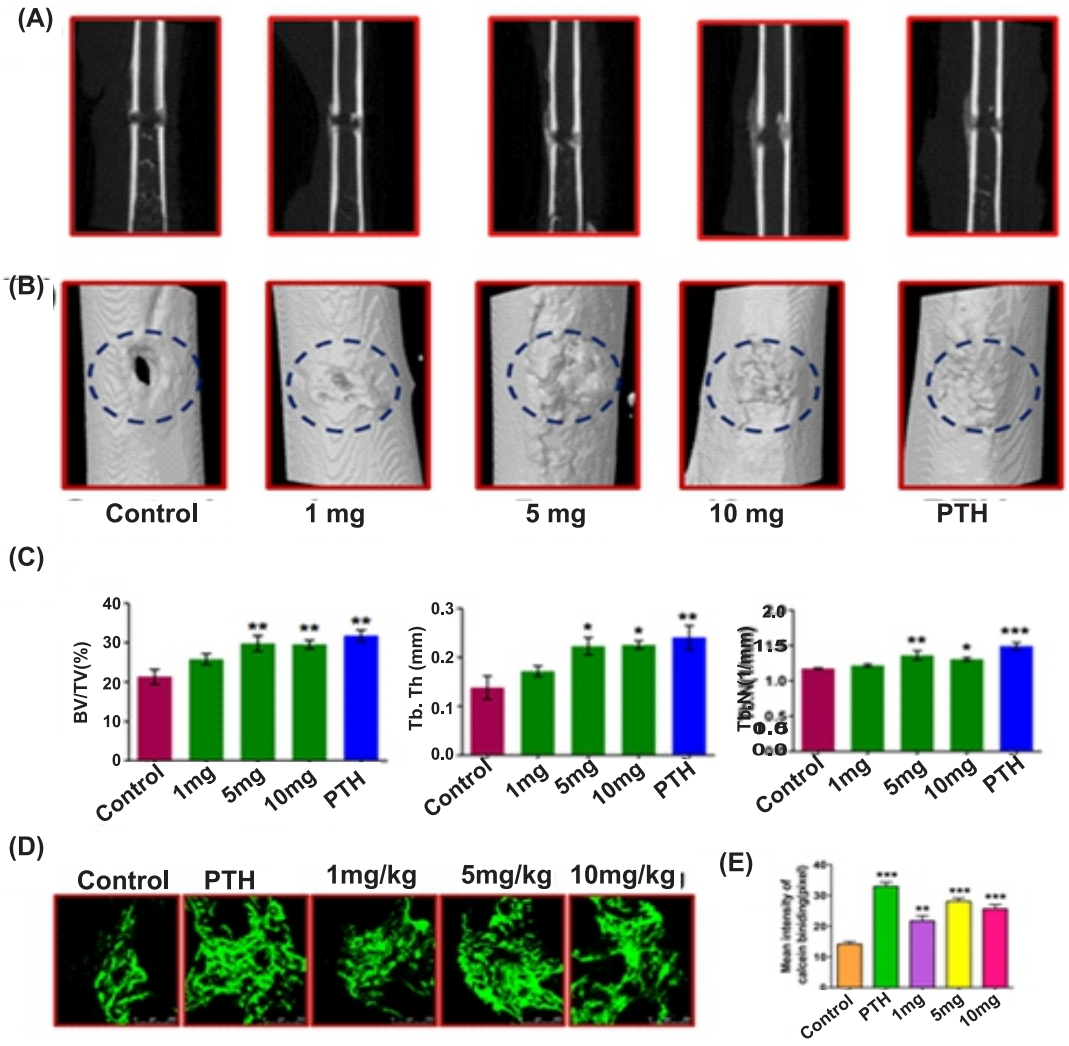



**Fig. 2.** *In Vivo* Fracture healing efficacy of bioactive compound (18a) in a mouse drill hole injury model

Demethoxy-medicarpin (DMM) treatment was given to growing Sprague Dawley (SD) rats at 1 mg and 10 mg dose orally for 30 days. Bones were collected for bone mineral density (BMD). Bone marrow cells were isolated from femur for calcium nodule formation. Serum samples were collected for biochemical parameters. We found that DMM treatment speeds up the recovery of musculoskeletal weakness by replenishing nutrients in proven rodent model. DMM supplementation for four weeks showed significantly increased vertebral, femur and tibial BMD compared with the untreated PD group. Albumin levels were significantly enhanced in treatment groups, in which 10 mg dose imparted a better effect. We conclude that DMM treatment led to increased BMD and biochemical parameters in protein deficient condition in growing rats and has potential as a bone growth supplement. ***(Bioorg Med Chem Lett; 10.1016/j.bmcl.2022.129118).***

### 6.5 Ring Finger E3 Ligase, RNF138 Inhibits Osteoblast Differentiation by Negatively Regulating Runx2 Protein Turnover

A few ubiquitin ligases have been shown to target Runx2, the key osteogenic transcription factor and thereby regulate bone formation. The regulation of Runx2 expression and function are controlled both at the transcriptional and post-translational levels. RING finger ubiquitin ligases of which RNF138 is a member are important players in the ubiquitin-proteasome system, contributing to the regulation of protein turnover and cellular processes. Here, we demonstrated that RNF138 negatively correlated with Runx2 protein levels in osteopenic ovariectomized rats which implied its role in bone loss. Accordingly, RNF138 overexpression potently inhibited osteoblast differentiation of mesenchyme-like C3H10T1/2 as well primary RCO cells *in vitro*, whereas overexpression of catalytically

inactive mutant RNF138Δ18-58 (lacks RING finger domain) had mild to no effect. Contrarily, RNF138 depletion copiously enhanced endogenous Runx2 levels and augmented osteogenic differentiation of C3H10T1/2 as well as RCOs. Mechanistically, RNF138 physically associates within multiple regions of Runx2 and ubiquitinates it leading to its reduced protein stability in a proteasome-dependent manner. Moreover, catalytically active RNF138 destabilized Runx2 which resulted in inhibition of its transactivation potential and physiological function of promoting osteoblast differentiation leading to bone loss. These findings underscore the functional involvement of RNF138 in bone formation which is primarily achieved through its modulation of Runx2 by stimulating ubiquitin-mediated proteasomal degradation. Thus, our findings indicate that RNF138 could be a promising novel target for therapeutic intervention in post-menopausal osteoporosis. ***(J Cell Physiol 2024 Feb 7. doi: 10.1002/jcp.31217)***

### 6.6 Role of Mitochondrial Sirtuin in Aging Bone Loss Conditions

The study aims at assessing the role of SIRT 5 in skeletal development and biology. Till date, seven homologs of sirtuins have been identified. These are Sirtuins 1-7. Sirtuins act predominantly as $NAD^+$-dependent deacetylases for a wide range of target proteins, which are crucial for various biological processes. Role of sirtuins like Sirt- 1, 2, 3, 6 and 7 has been explored in regulation of bone homeostasis and osteogenic differentiation. Deletion of Sirt-1 and 3 KO mice exhibited decrease in cortical and trabecular bone volume. Similarly, Sirt-6 and 7 KO mice also reveal significant deficiencies and dip in trabecular and cortical bone mass and BMD. Sirt-2 deletion on the other side exhibited a higher total bone volume. Though, all these studies are available, there are no reports on role of Sirt-4 and 5 in regulation of osteoblast functions and how they affect bone homeostasis. Sirt-5 (NAD dependent protein deacylase), regulates protein substrates involved in glycolysis, the TCA cycle, fatty acid oxidation, electron transport chain, ketone body formation, nitrogenous waste management, and ROS detoxification, among other processes. Sirt-5 plays pivotal roles in cardiac physiology and stress responses. Sirt-5 is implicated in neoplasia, as both a tumor promoter and suppressor in a context-specific manner, and may serve a protective function in the setting of neurodegenerative disorders. Hence, it seems imperative to study the role of Sirt-5 in bone homeostasis and osteoblastogenesis. We hypothesized that Sirt-5 may be playing a critical and important role in bone homeostasis and a therapeutic intervention that activates or abolishes Sirt-5 may be an effective strategy in treatment of aging bone loss conditions such as osteoporosis. Preliminary data has shown that Sirt-5 knockdown decreased the level of osteogenic markers at both transcriptional and translational level. Knockdown of Sirt-5 also decreased the levels of mitochondrial biogenesis markers including mitochondrial membrane potential.

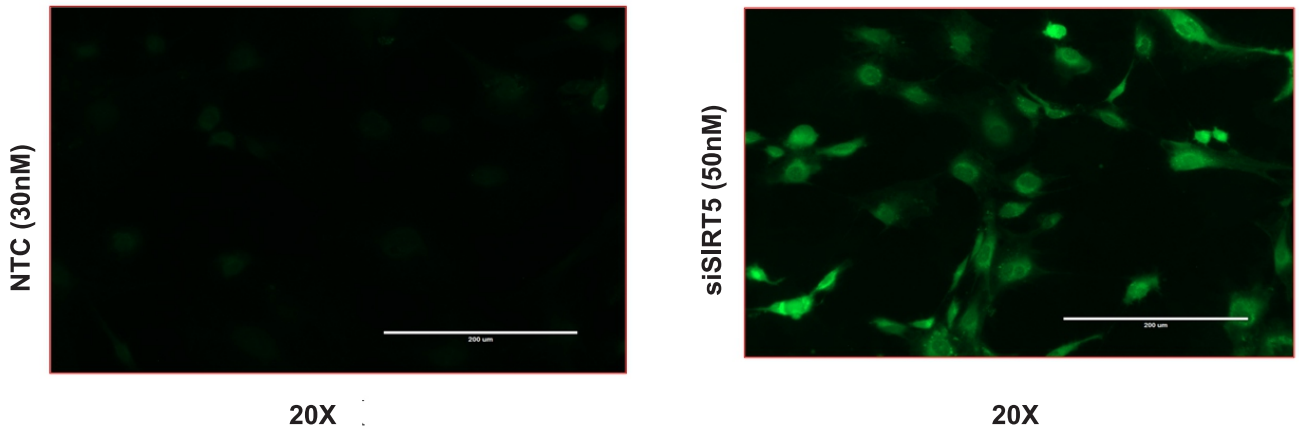



**Fig. 3.** DCHFDA staining at 48 h of treatment

# 7 Cancer

## Vision :

To undertake fundamental & translational research focusing on cancers of national relevance

## Goals :

- Affordable cancer care for Indian patients
- Deep understanding of disease biology for new target discovery
- Development of Indian patient centric preclinical cancer models
- Natural product driven cancer therapy

**Front Row (L to R):** Dr. Jayanta Sarkar, Dr. Dibyendu Banerjee, Dr. Dipak Datta (Area Coordinator), Dr. Gautam Panda, Dr. Arun K Trivedi, Dr. Shakil Ahmed, Dr. Sohail Akthar and Dr. Asif Ali

**Second Row (L to R):** Dr. Valmik S Shinde, Dr. Kishore Mohanan, Dr. Damodar Reddy, Dr. Dipankar Koley (Area Coordinator), Dr. Giaur R Gayen, Dr. Malleshwara Rao Kurram, Dr. Ramesh Chintakunta

## 7.1 Recent Developments

Being a Nodal laboratory, Cancer Biology Division of CDRI is leading the PAN CSIR Cancer Research Program to make Cancer Care Affordable for Indian patients.

Title of the Project is **"Empowering Women's Health: Focusing on Breast and Gynaecological Cancers of Indian Relevance".**

### 7.1.1 Process Development of to be Off-Patented APIs

New Synthesis of Nintedanib, its key starting materials and key synthetic intermediates and their uses thereof

### 7.1.2 Promising Leads

| Program | Indications | Lead optimization | IND-enabling | Phase I |
|---|---|---|---|---|
| Smac mimetic S-016-1348 | Colon cancers, Breast cancer | | | |
| PARP inhibitor | Breast cancer | | | |

## 7.2 R&D Highlights

### 7.2.1 Loss of PERK Function Promotes Ferroptosis by Downregulating Slc7a11 (System $Xc^-$) in Colorectal Cancer

Ferroptosis, a genetically and biochemically distinct form of programmed cell death, is characterised by an iron-dependent accumulation of lipid peroxides. Therapy-resistant tumor cells display vulnerability toward ferroptosis. Endoplasmic Reticulum (ER) stress and Unfolded Protein Response (UPR) play a critical role in cancer cells to become therapy resistant. Tweaking the balance of UPR to make cancer cells susceptible to ferroptotic cell death could be an attractive therapeutic strategy. To decipher the emerging contribution of ER stress in the ferroptotic process, we observe that ferroptosis inducer RSL3 promotes UPR (PERK, ATF6, and IRE1α), along with overexpression of cystine-glutamate transporter SLC7A11 (System $Xc^-$). Exploring the role of a particular UPR arm in modulating SLC7A11 expression and subsequent ferroptosis, we notice that PERK is selectively critical in inducing ferroptosis in colorectal carcinoma. PERK inhibition reduces ATF4 expression and recruitment to the promoter of SLC7A11 and results in its downregulation. Loss of PERK function not only primes cancer cells for increased lipid peroxidation but also limits *in vivo* colorectal tumor growth, demonstrating active signs of ferroptotic cell death *in situ*. Further, by performing TCGA data mining and using colorectal cancer patient samples, we demonstrate that the expression of PERK and SLC7A11 is positively correlated. Overall, our experimental data indicate that PERK is a negative regulator of ferroptosis and loss of PERK function sensitizes colorectal cancer cells to ferroptosis. Therefore, small molecule PERK inhibitors hold huge promise as novel therapeutics and their potential can be harnessed against the apoptosis-resistant condition. ***(Redox Biol 2023 Sep: 65:102833).***

*"Our group aims to discover, develop & deliver affordable health care solution for Indian Cancer Patients"*

***- Dr. Dipak Datta***
*Senior Principal Scientist & Area Coordinator*

*"Aspiring to develop therapeutics for gynaecological cancers"*

***- Dr. Dipankar Koley***
*Senior Principal Scientist &*
*Area Coordinator*

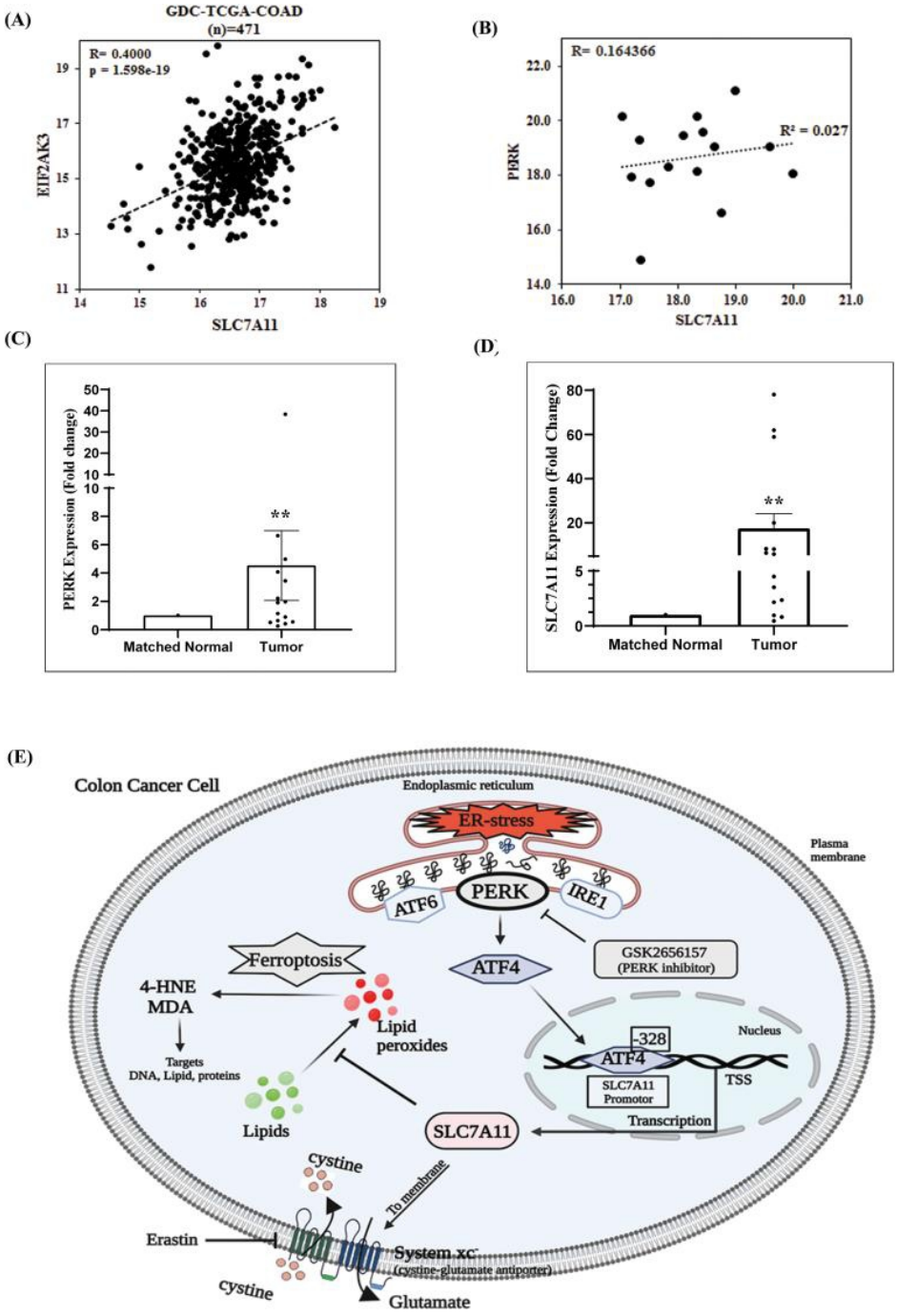



**Fig. 1** PERK (EIF2AK3) and SLC7A11 are positively correlated in human colorectal tumors (**A**) GDC TCGA COAD patient data were acquired from the Xena browser, and a correlation graph was plotted between EIF2AK3 (PERK) and SLC7A11. R (Pearson's correlation coefficient) (**B**) RT-PCR in matched non-malignant (Normal) and malignant tumor samples of colorectal cancer patients showed the correlation between delta Ct of EIF2AK3 (PERK) and SLC7A11. (**C–D**) Total RNA was isolated from colorectal cancer patient tumor tissue samples along with their respective matched non-malignant counterparts, reverse transcribed, and RT-qPCR was performed for PERK and SLC7A11 expression analysis. 18s is used as an internal control. Fold change in mRNA expression in (**C**) PERK and (**D**) SLC7A11 is shown in bar diagram; Columns, the average value of fold change as compared to control; error bars ± SEM. *p < 0.05, compared to control, n = 15. **(E)** The findings are illustrated in a graphical abstract showing how selectively PERK arm of ER stress regulates ferroptosis in colorectal cancer.

### 7.2.2 AIP4 Regulates Adipocyte Differentiation by Targeting C/Ebpα for Ubiquitin-Mediated Proteasomal Degradation.

Adipogenesis, that is, the formation of terminally differentiated adipocytes is intricately regulated by transcription factors where CCAAT/enhancer binding protein alpha (C/EBPα) plays a key role. In the current study, we demonstrate that E3 ubiquitin ligase AIP4 negatively regulates C/EBPα protein stability leading to reduced adipogenesis. While AIP4 overexpression in 3T3-L1 cells preadipocytes inhibited lipid accumulation when treated with differentiation inducing media (MDI), AIP4 depletion was sufficient to partially promote lipid accumulation even in the absence of MDI. Mechanistically, overexpression of AIP4 inhibited protein levels of both ectopically expressed as well as endogenous C/EBPα while catalytically inactive AIP4 failed. On the contrary, AIP4 depletion profoundly enhanced endogenous C/EBPα protein levels. The observation that AIP4 levels decrease with concomitant increase in C/EBPα levels during adipocyte differentiation further indicated that AIP4 negatively regulates C/EBPα levels. We further show that AIP4 physically interacts with C/EBPα and ubiquitinates it leading to its proteasomal degradation. AIP4 promoted K48-linked ubiquitination of C/EBPα while catalytically inactive AIP4-C830A failed. Taken together, our data demonstrate that AIP4 inhibits adipogenesis by targeting C/EBPα for ubiquitin-mediated proteasome degradation. ***(J Cell Biochem. 2023 Jul;124(7):961-973).***

### 7.2.3 Ormeloxifene, A Nonsteroidal Antifertility Drug Promotes Megakaryocyte Differentiation in Leukemia Cell Line K562.

Ormeloxifene (ORM) (3,4-trans-2,2-dimethyl-3-phenyl-4-p-(β-pyrrolidinoethoxy) phenyl-7-methoxychroman), world's first nonsteroidal selective estrogen receptor modulator approved for contraception in India has been shown to have potential anticancer activities. Here, we show that ORM can induce megakaryocyte and myeloid (granulocytic) but not erythroid differentiation in multipotent human myeloid leukemia cell line K562. We show that ORM at an $IC_{50}$ of 7.5μM can induce morphological changes similar to megakaryocytes in K562 cells. ORM led to increase in levels of megakaryocytic differentiation markers (CD41 and CD61) as well as key transcription factors GATA1 and AML1. We further show that ORM induces megakaryocytic differentiation in K562 cells through ERK activation and induction of autophagy in a fashion similar to other known inducers of megakaryocytic differentiation such as phorbol esters. In addition, as shown earlier, we yet again observed that ORM led to activation of caspases since their inhibition through pan-caspase inhibitor mitigated megakaryocytic differentiation as they led to significant decrease in CD41 and CD61. Because induction of megakaryocytic differentiation in K562 involves growth arrest and exit from cell cycle, we also observed an increase in levels of p21 and p27 with decrease in c-Myc protein levels in K562 cells treated with 7.5 μM ORM for 24 and 48 h, respectively. Taken together, these findings indicate that ORM can markedly induce megakaryocytic differentiation in K562 cells. ***(Cell Biol Int 2023 Jul;47(7):1247-1258).***

### 7.2.4 Machine Learning and Biological Evaluation-Based Identification of a Potential Mmp-9 Inhibitor, Effective Against Ovarian Cancer Cells Skov3.

MMP-9, also known as gelatinase B, is a zinc-metalloproteinase family protein that plays a key role in the degradation of the extracellular matrix (ECM). The normal function of MMP-9 includes the breakdown of ECM, a process that aids in normal physiological processes such as embryonic development, angiogenesis, etc. Interruptions in these processes due to the over-expression or downregulation of MMP-9 are reported to cause some pathological conditions like neurodegenerative diseases and cancer. In the present study, an integrated approach for ML-based virtual screening of the Maybridge library was carried out and their biological activity was tested in an attempt to identify novel small molecule scaffolds that can inhibit the activity of MMP-9. The top hits were identified and selected for target-based activity against MMP-9 protein using the kit (Biovision K844). Further, MTT assay was performed in various cancer cell lines such as breast (MCF-7, MDA-MB-231), colorectal (HCT119, DL-D-1), cervical (HeLa), lung (A549) and ovarian cancer (SKOV3). Interestingly, one compound *viz*., RJF02215 exhibited anti-cancer activity selectively in SKOV3. Wound healing assay and colony formation assay performed on SKOV3 cell line in the presence of RJF02215 confirmed that the compound had a significant inhibitory effect on this cell line. Thus, we have identified a novel molecule that can inhibit MMP-9 activity *in vitro* and inhibits the proliferation of SKOV3 cells. Novel molecules based on the structure of RJF02215 may become a good value addition for the treatment of ovarian cancer by exhibiting selective MMP-9 activity. ***(J Biomol Struct Dyn. 2023 Jul 28:1-19).***

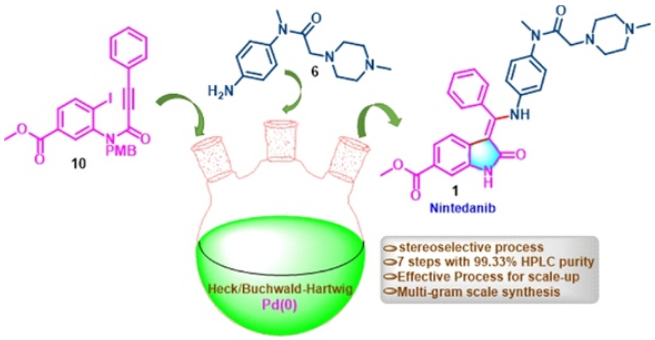
### 7.2.5 Selective COX-2 Inhibitor Etoricoxib's Liposomal Formulation Attenuates M2 Polarization of TAMs and Enhances its Anti-Metastatic Potential.

COX-2 inhibition in pro-tumoral M2 polarization of Tumor-Associated Macrophages (TAMs) underscore the improved prognosis and response to cancer therapy. Thus, etoricoxib, a COX-2 inhibiting NSAID drug is highly effective against tumorigenesis, but its compromised solubility and associated hepatotoxicity, and cardiotoxicity limit its clinical translation. In view of the

consequences, the proposed study entails the development of a liposomal formulation for etoricoxib and evaluates its anticancer potential. ***(Pharm Res. 2023 Feb;40(2):551-566).***

### 7.2.6 Stereoselective Construction of 3-(aminoalkylidene)Oxindoles in One-Pot: Development of a Novel, Robust and Scalable Process for the Multigram-Scale Preparation of Nintedanib

A palladium-catalyzed novel stereoselective Heck/Buchwald-Hartwig cascade reaction of substituted N-(2-iodophenyl) propiolamides and amines has been established to furnish a series of 3-(aminoalkylidene)oxindole scaffolds with good yields. In addition, we report the development of a robust, scalable, and convergence approach leading to the synthesis of nintedanib (1) Salient features of the approach include the production of key oxindole intermediate 17 *via* our advanced Heck/Buchwald-Hartwig reaction cascade, which enables the reduction of the number of synthetic steps. Moreover, our approach avoids the expensive column chromatography purification method for all synthetic steps. Further, we also disclosed an alternative route toward the synthesis of another kinase inhibitor hesperadin (2) following the above-mentioned cascade method. ***(Org. Process Res. Dev.* 2024, 28, 3, 754–769).**




### 7.2.7 A Scalable and Eco-friendly Total Synthesis of Poly (ADP-Ribose) Polymerase Inhibitor Olaparib

A scalable total synthesis of a potent poly(ADP-ribose) polymerase (PARP) enzyme inhibitor, Olaparib (Lynparza), approved by U.S. FDA and EMA for ovarian cancer, is disclosed. The process is operationally simple, highly atom economical and environmentally benign as compared to the existing literature route of Olaparib. Herein, we report an eco-friendly synthesis of Olaparib using commercially available inexpensive starting materials, in only four steps with 51% overall yield. This synthesis comprises the key steps of generation of conjugated enolate from 2-acetylbenzoic acid to produce α-arylated product under transition metal-free conditions followed by ring construction of the final phthalazinone scaffold affording Olaparib. An alternative synthesis of another PARP inhibitor, AZD2461, using the same protocol is also reported. Highlighting this work is the phosphonate-free synthesis, as opposed to the Horner-Wadsworth-Emmons olefination reaction utilized previously which requires the synthesis of a phosphonate precursor. ***(Green Chem.*, 2023,25, 9097-9102).**


### 7.2.8 Expression of Interlinked Cancer Germline Antigens (CGAs) and p53 can be explored for the Early Detection of Cervical Cancer

Cervical cancer (CaCx) is the 4$^{th}$ most common malignancy among women worldwide. CaCx develops pathologically at the cervix's squamo-columnar junction, which undergoes continual metaplastic changes during female's adolescence, sexual life, and pregnancy. Females between the ages of 18 and 30 who are undergoing a peak metaplastic transformation are at a high risk of getting CaCx due to High-Risk Human papillomavirus infections (HR- HPV). The probability of HPV infection and cervical cancer usually increase by early marriage, polyamory, multiparity, smoking, poor genital health, a diet with low antioxidants, long-term contraceptive use, and lack of awareness. The viral onco-proteins E6 and E7 are mainly responsible for the malignant phenotype by restricting the activity of tumor suppressor proteins p53 and pRb respectively. These tumor suppressor proteins p53 and pRb are actually essential for the regulation of Cell cycle progression, DNA repair and apoptosis; hence, the destruction or inactivation of these proteins by HPV E6 and E7 protein; leads to uncontrolled growth of the cells and finally result into CaCx malignancy. The diagnosis and treatment of HPV (Human Papilloma Virus) positive and HPV negative is not distinctly defined due to the heterogeneity and complexity of the disease. HPV positive tumor is easy to treat till some extent due to the action of immune cells; which assist the clearance of HPV infection. Whereas, HPV negative tumor cells are more aggressive and invasive in nature and therefore mortality rate is very high as compare to HPV positive tumor cells. Therefore, HPV negative cancer becomes a challenge for the physician to establish a correct diagnosis, prognosis and treatment. Mortality rate of cervical cancer in women also increases

due to the lack of early signs and symptoms which is the major concern for cervical cancer diagnosis. Therefore, characterisation of early biomarkers can be helpful to diagnose the disease at early stage. Cancer germline antigens (CGAs) are the potential candidates in this scenario because of its high immunogenicity and lack of expression in normal somatic tissues. CGAs are reported to express only in germ cells and cancer cells.

PP1 is a major serine/threonine protein phosphatase, which normally regulates the phosphorylation status of a large number of important cellular regulatory proteins. Its activities include the regulation of chromosome structure during mitosis and also following DNA damage through de-phosphorylation of histones, and control of centrosome disjunction through antagonism of Nek2A kinase activity. The normal function of PP1γ2 had been reported in the testis but we reported its aberrant expression in somatic tumor and characterized PP1γ2 as a CGA marker for CaCx. Previous studies also proposed that p53 can regulate the expression of PP1γ as well. Another protein family POTE referred to Prostate, Placenta, Ovary, Testis and Embryo as its expression had been reported in these organs only. POTEE and POTEF have been reported as CGAs for lung, ovarian and colorectal cancer, whereas we confirmed their expression in CaCx cell lines, including HeLa and CaSki; which are HPV 18 and HPV 16 positive cell lines respectively (negative for p53 and pRb); and compared with HPV negative CaCx cell line C33A (positive for p53 and pRb).

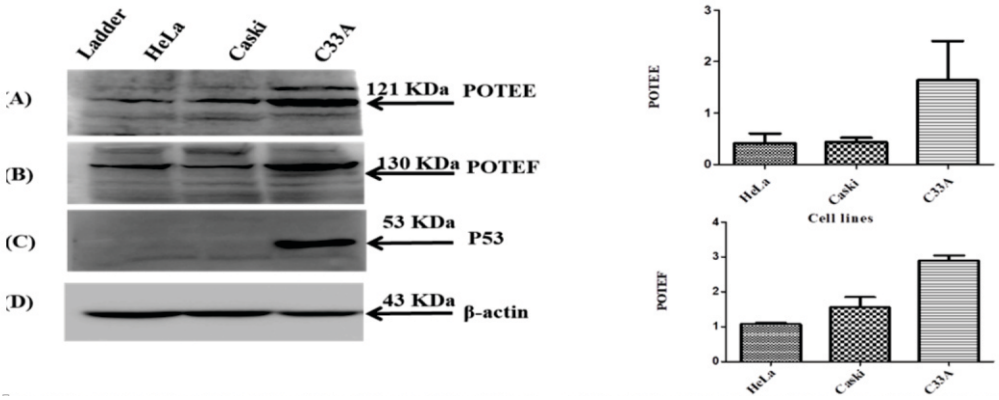



**Fig.2.** HPV positive cervical cancer cell lines express E6 which can inactivate or inhibit the expression of tumor suppressor gene p53. POTEE and POTEF expression are upregulated along with p53 in HPV negative cervical cancer cell line C33A. This data suggest that POTEE & POTEF might have role as tumor suppressor.

To find the link for the expression between p53 and PP1γ2; expression of p53 along with POTEE and POTEF was observed after the silencing of PP1γ2 in C33A cell line through shRNA of PP1γ2; where expression of p53 as well as POTEE and POTEF was found to

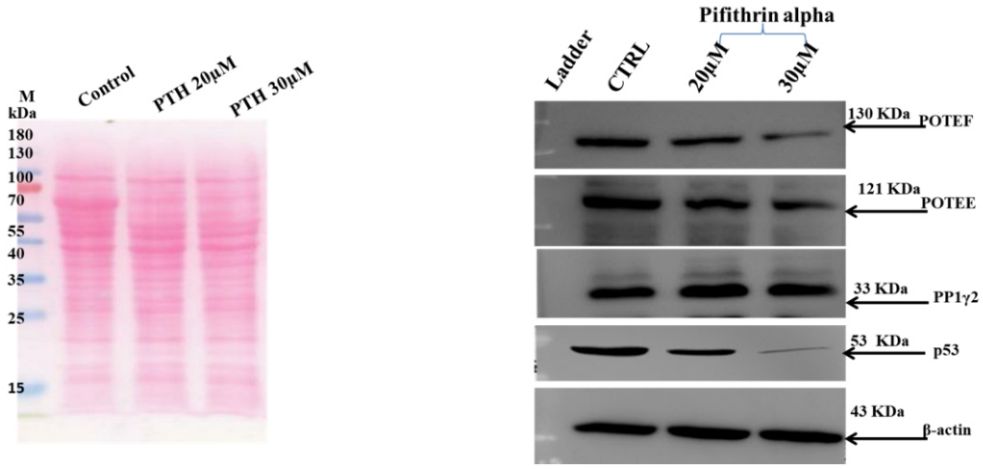



**Fig.3.** Treatment of p53 inhibitor Pifithrin-α-nitro cyclin in C33A cell line; Reduction in p53 expression with increasing conc. of inhibitor; simultaneous downregulation in expression of POTEE, POTEF and PP1γ2. β-actin was used as internal control.

be down-regulated. As E6 protein of HPV is known to degrade p53; hence, HPV negative CaCx cell line (C33A) is known to be p53 positive. Therefore, in another experiment of C33A; p53 inhibitor Pifithirin alpha-nitro cyclic was used to inhibit p53 expression, where down-regulated expression of PP1γ2, POTEE and POTEF was observed.

At the same time, HPV positive CaCx cell lines HeLa and Caski (where p53 expression was lost) were used for p53 induction by chemotherapeutic drugs (Doxorubicin, Cisplatin and Actinomycin-D); where up-regulated expression of p53 also demonstrated the increased expression of PP1 γ 2 along with POTEE and POTEF. The present study shows that introducing the chemotherapy drugs Actinomycin-D, Doxorubicin and Cisplatin can reactivate p53 by halting the transcription or activating the ATM or ATR pathways in cervical carcinoma cells. Moreover, the p53 reactivation is associated with an extensive biological response, including the induction of the programmed cell death as well as declination of cell cycle. Therefore, expression of various CGAs (PP1 γ 2, POTEE and POTEF) and p53 are seem to be interlinked and also can be explored further for the early diagnostic and therapeutic purposes of CaCx.

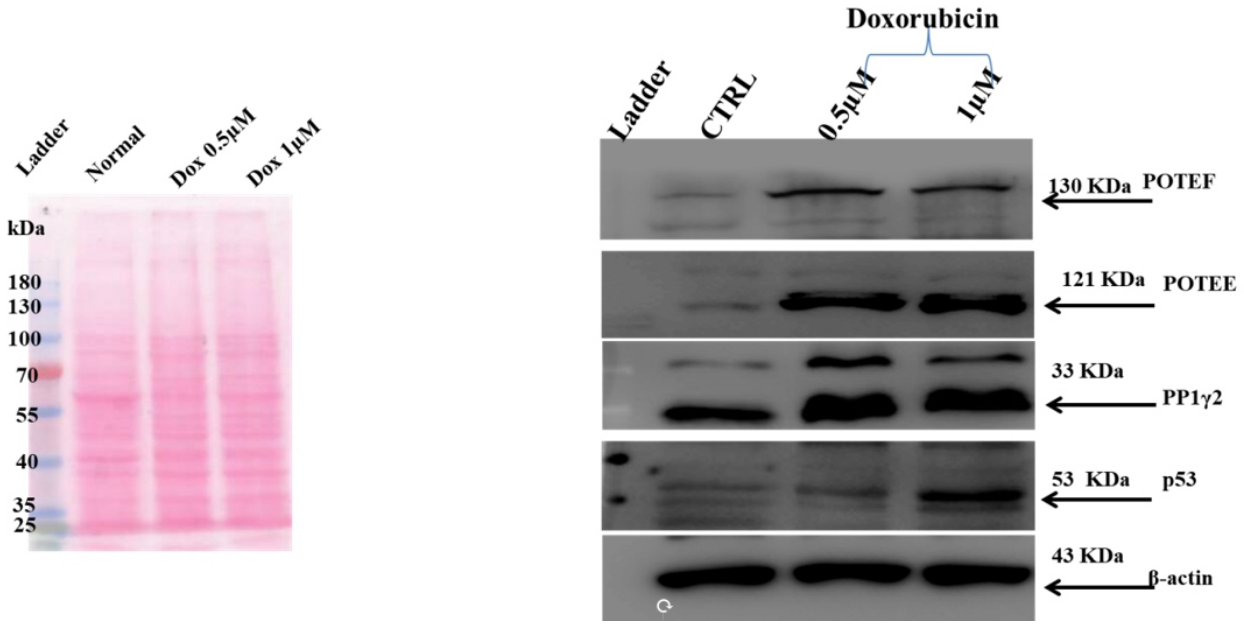
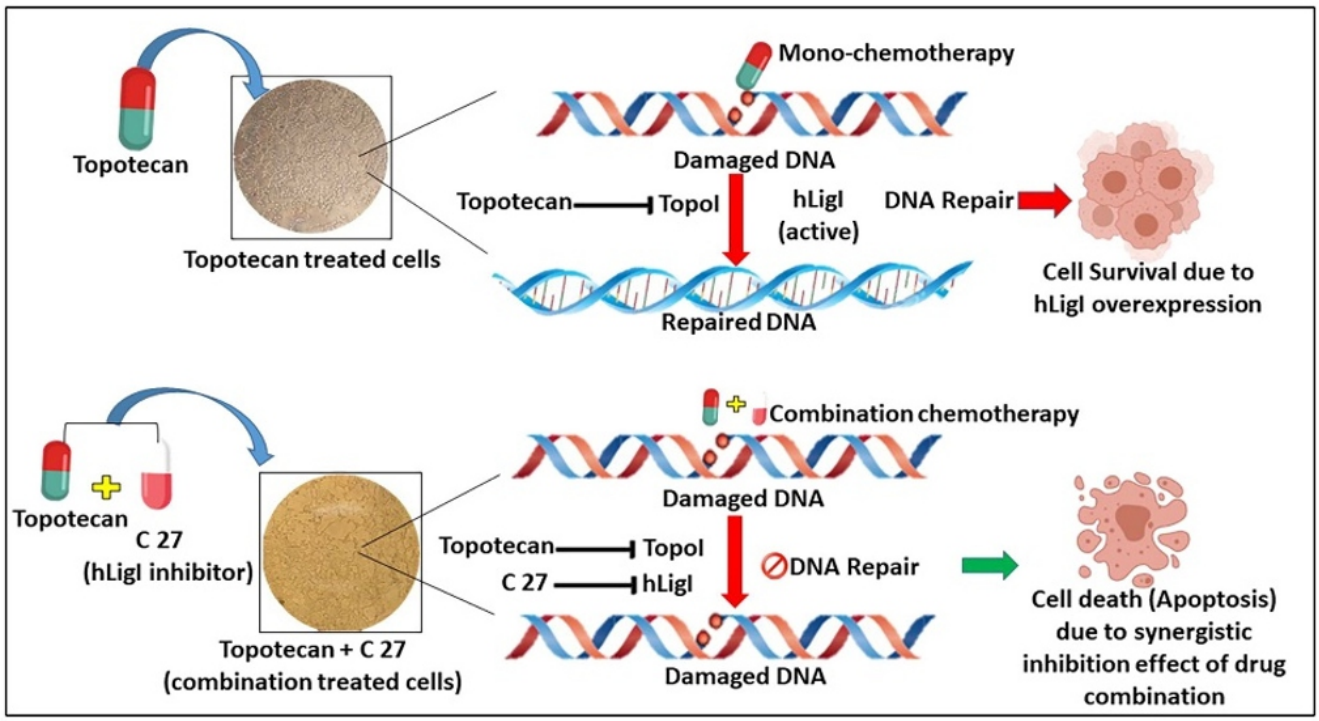



**Fig.4.** Treatment of CaSki cell line with chemotherapeutic agent Doxorubicin; Remarkable increase in expression of p53 at 1μM concentration; simultaneous upregulation in expression of POTEE, POTEF and PP1γ2. This indicates the p53 regulation related to expression of CGAs. β-actin was used as internal control.

### 7.2.9 The synergy between human DNA ligase I and topoisomerase 1 unveils new therapeutic strategy for the management of colorectal cancer

DNA topoisomerase 1 (Topo 1) is a pivotal player in various DNA processes, including replication, repair, and transcription. It serves as a target for anticancer drugs like camptothecin and its derivatives (Topotecan and SN-38/Irinotecan). However, the emergence of drug resistance and the associated adverse effects, such as alopecia, anemia, dyspnea, fever, chills, and painful or difficult urination, pose significant challenges in Topo 1-targeted therapy, necessitating urgent attention. Human DNA Ligase 1 (hLig I), recognized primarily for its role in DNA replication and repair of DNA breaks, intriguingly exhibits a DNA relaxation activity akin to Topo 1. This raised the hypothesis that hLig I might compensate for Topo 1 inhibition, contributing to resistance against Topo 1 inhibitors. To explore this hypothesis, the team assessed the efficacy of hLig I inhibition alone and in combination with Topo 1 in cancer cells. As anticipated, the overexpression of hLig I was observed after Topo 1 inhibition in colorectal cancer cells, affirming our hypothesis. Previously identified as an inhibitor of hLig I's DNA relaxation activity, compound 27 (C 27), when combined with Topotecan, demonstrated a synergistic antiproliferative effect on colorectal cancer cells. Notably, cells with downregulated hLig I (via siRNA, inhibitors, or genetic manipulation) exhibited significantly heightened

sensitivity to Topotecan. This observation strongly supports the concept that hLig I contribute to resistance against clinically relevant Topo 1 inhibitors in colorectal cancers. In conclusion, the findings offer evidence for the synergistic impact of combining hLig I inhibitors with Topotecan in the treatment of colorectal cancers, providing a promising strategy to overcome resistance to Topo 1 inhibitors. **(J Biomol Str Dynamics, https://doi.org/10.1080/07391102.2023.2297817)**



# 8 Neurological Disorders

## Vision :

Conduct fundamental research to push the frontiers of understanding in neuropathic pain, cerebral stroke, major depression, and neurodegenerative disorders with the overarching goal of establishing novel druggable targets and advancing therapeutic strategies

## Goals :

- Discovery and characterization of synthetic and phytopharmaceutical lead candidates for neuropathic pain, treatment-refractory depression, cerebral stroke, and neurodegenerative diseases
- To establish a Magnetic Resonance Imaging (MRI) platform for longitudinal studies of neuropsychiatric disorders such as major depression, neuropathic pain & neurodegenerative diseases using pharmacological and transgenic rodent models
- Development of genotype-specific patient-derived brain organoid model system and brain tissue bank to support fundamental studies to understand the underlying molecular, cellular and synaptic/trans-synaptic mechanisms of neurodegenerative disorders
- To establish robust manual and automated electrophysiology platforms to enable measurement of field potentials and currents live animals as well as in isolated cells & tissue sections
- To establish new assays & model systems to delineate the brain ageing mechanism and discover druggable targets
- Development of NCEs and phytopharmaceutical-based therapeutics for neuropathic pain, treatment refractory depression, cerebral stroke, and neurodegenerative disorders

**First Row (L to R):** Dr. Sanjay Batra, Dr. Atul Goel, Dr. Aamir Nazir, Dr. Prem N Yadav (Area Coordinator), Dr. Prem P Yadav (Area Coordinator), Dr. Sonia Verma and Dr. Shubha Shukla

**Second Row (L to R):** Dr. Valmik S Shinde, Dr. Damodar Reddy, Dr. Aravind S Kshatri, Dr. Ajay K Srivastava, Dr. Kishore Mohanan, Dr. Malleshwara Rao Kurram, Dr. Ramesh Chintakunta, Dr. Kinshuk R Srivastava,

## Progress in R&D

### 8.1 Establishment of hERG Screening Facility Using Patch Clamp Electrophysiology

A state-of-the-art hERG screening service has been established in the institute with the funding support of CSIR. Our services will provide quick and reliable information regarding the potential cardiac toxicity of the compounds. This facility is comprised of a computer-controlled amplifier, low-noise digitizer, microscope with fluorescence illumination system, motorized micromanipulators, gravity-fed perfusion system, anti-vibration table with faraday cage, micropipette puller, fire polisher and industry leading data acquisition and analysis programs. All the internal and external users (both academic and industry) will get benefited from this facility.

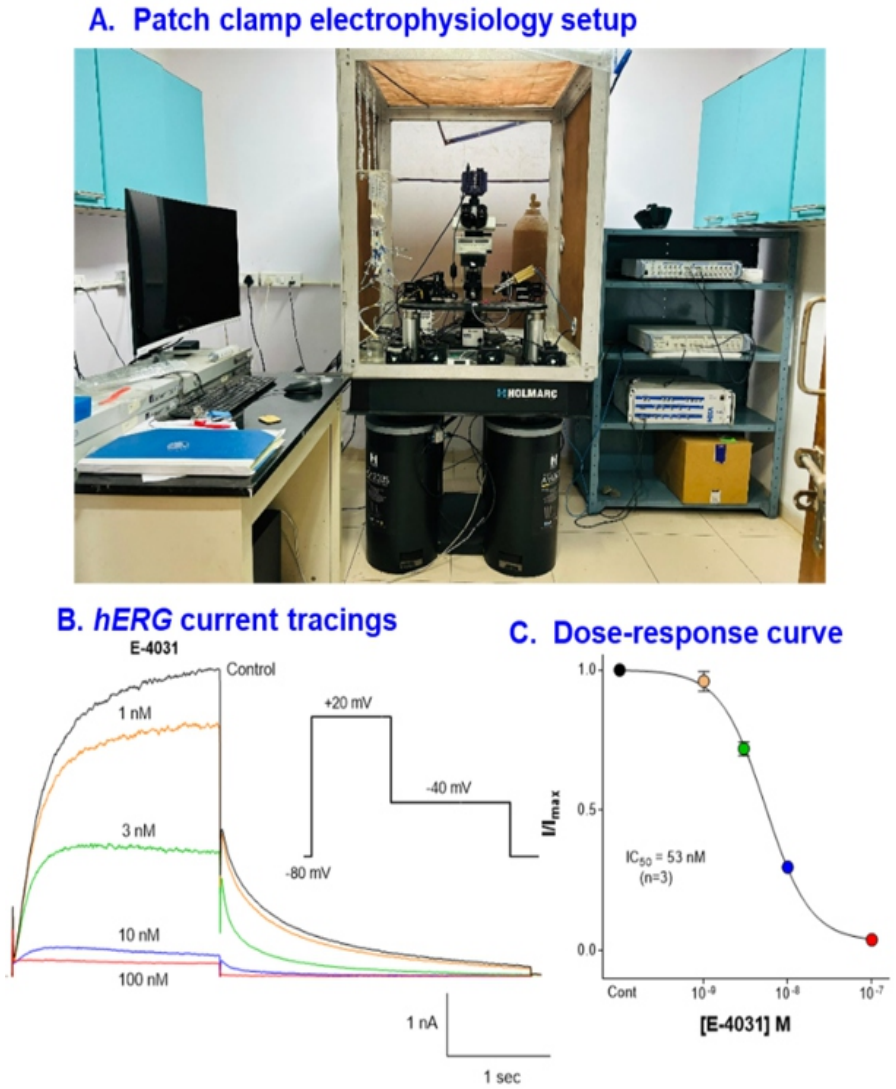



**Fig. 1:** State-of-the-art manual patch clamp electrophysiology facility at CDRI (**A**) Functional electrophysiology set up. (**B**) Typical current record from a dose response for 4 concentrations of the known hERG channel antagonist E-4031. Voltage protocol used is shown inset. (**C**) Mean normalized current amplitude ± SEM for each drug concentration is plotted where $IC_{50}$ of E-4031 was found to be 53± 2 nM.

*"We aspire to discover & develop therapeutics for the treatment of neuropathic pain, major depression, cerebral stroke, and cognitive impairments"*

***- Dr. Prem Narayan Yadav***
*Senior Principal Scientist & Area Coordinator*

*"The aim is to deliver functionally selective and high intrinsic efficacy small molecule modulators for CNS disorders"*

***- Dr. Prem Prakash Yadav***
*Senior Principal Scientist & Area Coordinator*

## 8.2 Drug Discovery & Development

### 8.2.1 GlP-CNS Safety Pharmacology Studies: Following Two Phytopharmaceutical and One Nce was Evaluated for CNS Safety in GlP Setup

i. NMITLI-118-AF1 sponsored by the CSIR-NMITLI project TLP0014

ii. NMITLI-PHPL sponsored by the CSIR-NMITLI project TLP0015.

iii. S016-1348, Sponsored by CSIR-PAN-Cancer mission

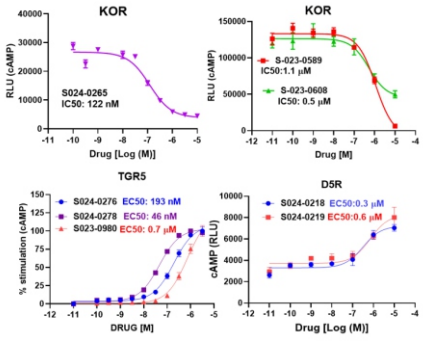
### 8.2.2. Discovery of Novel GPCRr Ligands for CNS Disorders

During last one year, total 488 compounds were submitted for screening against 5 GPCR targets (KOR, DRD5, CXCR3,5-HT2C and TGR5) and following 8 hits were found at various receptors. These hits (graphs are given below with $IC_{50}/EC_{50}$) are being pursued for selectivity, SAR and stability studies

I. Three compounds as agonist at kappa opioid receptor: S023-0589, S023-0608, S024-0265

II. Two agonist at dopamine D5 receptor: S024-0218 & S024-0219

III. Three agonists at TGR5 receptor: S023-0980, S024-0276 & S024-0276




### 8.2.3. Benzothiazine Derivatives as Antagonists of Hv1 Channels

Voltage gated proton channels (Hv1) are specifically expressed in the microglia of CNS and contribute to many key aspects of neuroinflammation. Despite the clinical importance of Hv1 channel-based therapeutics, no suitable inhibitor with good selectivity and *in vivo* pharmacokinetic profile has been identified. To address this research gap, we have developed a cell based fluorescent HTS assay and screened approximately 60 molecules belonging to benzimidazole, benzindazole, benzothiazine classes (**Fig.2 A**). Among these, S-023-0525 was identified to inhibit the channels with a reasonable potency ($IC_{50}$=2.5 µM) that is comparable to the known Hv1 channel inhibitor YHV-98-4. SAR analysis is being performed on this molecule to improve its potency on the target.

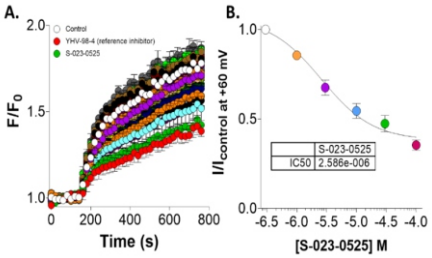


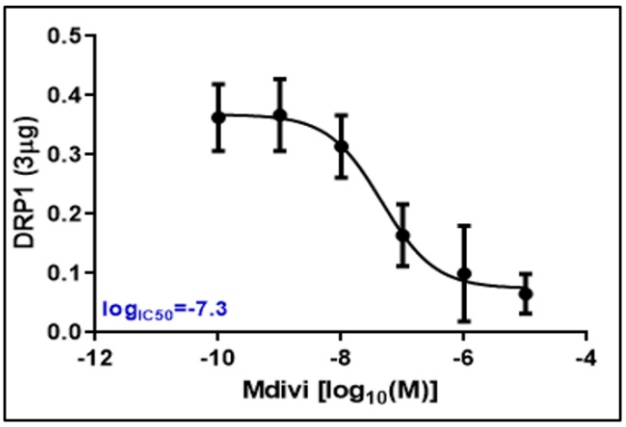

**Fig.2:** Effect of a benzothiazine derivatives on the inhibition of Hv1 channels in BV2 cells.

## 8.3 Screening of Novel Chemical Entities for Drp1 Inhibition Activity

DRP1, also known as Dynamin-Related Protein 1, is crucial for mitochondrial fission and vital for maintaining mitochondrial health, especially in energy-demanding cells like neurons. Dysregulation of mitochondrial dynamics, including excessive fission mediated by DRP1, is observed in neuroinflammatory and neurodegenerative conditions, leading to fragmented mitochondria, impaired function, and neuronal dysfunction or death. DRP1-mediated fission activates inflammatory pathways in Alzheimer's, Parkinson's, and multiple sclerosis, exacerbating neuronal damage. Excessive fission can trigger apoptosis in neurons, implicated in various neurodegenerative diseases. DRP1 modulation emerges as a potential therapeutic approach,

targeting mitochondrial dynamics and inflammation to mitigate neuronal damage and improve outcomes in these disorders.

We have developed a cell-free GTPase assay for the monitoring of free phosphate ions (Pi). This assay provides a simple and powerful system to monitor the GTPase activity of DRP1 protein through the hydrolysis of GTP into GDP, along with free phosphate ions. The protocol involves the expression and purification of His-tagged human DRP1. The purified protein (10 µg) is treated with test compounds for 30 minutes, followed by the addition of GTP for the next 15 minutes. The GTPase activity assay employs a single reagent solution, enabling accurate assessment of enzyme activity. The reagent, malachite green, forms a stable dark green color when it reacts with the liberated phosphate ions produced by the enzymes. This color change is measured within the range of 600–660 nm after incubation for 30 minutes. The intensity of the color is directly proportional to the enzyme activity. 10mM Mdivi-1, the reported DRP1 inhibitor, is used as a reference compound. During the last one year, a total of 90 compounds were submitted for screening against DRP1. However, no hits were found so far.




## 8.4 Fundamental Studies

### 8.4.1 Identification of a Fungal Metabolite as Trpa1 Channel Antagonist for Pain Relief

Chronic pain (CP) control is frequently ineffective and is associated with adverse side effects, and thus prompted a frantic search for new therapeutics and drug targets. Transient receptor potential (TRP) channels are key players in pain sensation and represent a valuable analgesic target for alleviating the pain. Among the TRP family of ion channels, TRPA1 channels are localized on the peripheral terminals of nociceptive afferent neurons and contributes to transduction of noxious stimuli as pain sensation. It is one of the few ion channels that is validated as a human pain target and a large body of preclinical evidence supports the therapeutic utility of TRPA1 antagonists for treating CP conditions. Despite their prominent role in CP, none of the small molecules against TRPA1 progressed through clinical trials due to their poor pharmacokinetic profile. We addressed this scientific gap by screening numerous natural products from medicinal plants and microbes and identified that Phialomustin B (PHL-B) obtained from an endophytic fungus inhibits TRPA1 channels with reasonable potency ($IC_{50}$= 0.5 µM). As shown in the figure below, treatment of cells with PHL-B significantly reduced the cinnamaldehyde (80 µM) evoked increase in the fluorescence. Using patch clamp electrophysiology technique, we further demonstrated that TRPA1 single channels were inhibited by PHL-B. The basal single channel activity (black traces) in the cell attached configuration at +60 and -60 mV was low and after the addition of AITC to the bath solution (orange traces), channel activity was clearly elevated. Exposure of the cells to PHL-B in the presence of AITC (green traces) substantially reduced the open probability of TRPA1 channels. PHL-B also alleviated the inflammatory and neuropathic pain in CFA model and CIPN mice models, respectively. Following the in-depth SAR studies and optimization of the lead, the derivatives of this compound will be patented and taken up for preclinical development.

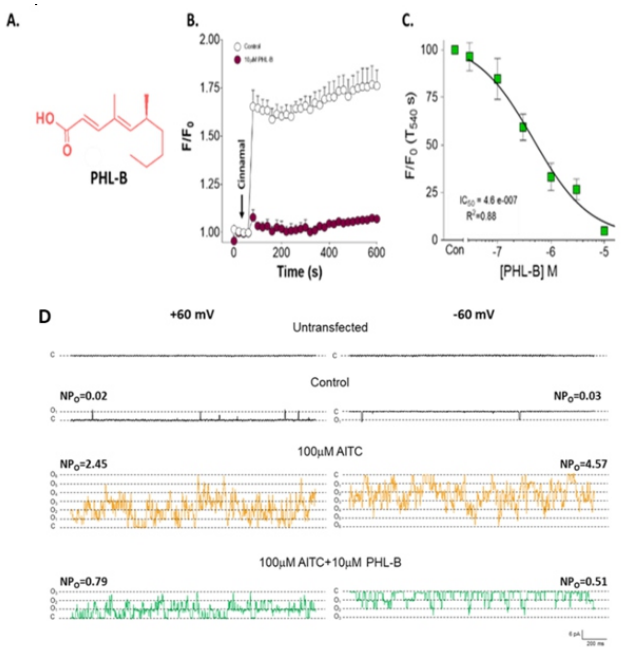



**Fig.3.** Effect of a Phialomustin B (PHL-B) on the inhibition of TRPA1 channels in BV2 cells.

### 8.4.2 Amyloidogenic Propensity of Metabolites in the Uric Acid Pathway and Urea Cycle Studied for their Impact on Etiology of Metabolic Disorders

The inborn errors of metabolism (IEMs), including gout, Lesch-Nyhan syndrome (LNS), xanthinuria, citrullinemia, and hyperornithinemia-hyperammonemia-homocitrullinuria (HHH) syndrome, are attributed to the dysfunction of the urea cycle and uric acid pathway. Novel insights into the etiology of these metabolic

disorders have recently been uncovered through the study of metabolite amyloids. Researchers at CDRI, in collaboration with teams at IIT Kanpur, Indrashil University and Shiv Nadar Institute of Eminence, endeavored to understand and mechanistically characterize the aggregative property exhibited by the principal metabolites of the urea cycle and uric acid pathway, specifically hypoxanthine, xanthine, citrulline, and ornithine. Employing scanning electron microscopy (SEM), transmission electron microscopy (TEM), and atomic force microscopy (AFM), they studied the aggregation profiles of the metabolites. Insights obtained through molecular dynamics (MD) simulation underscore the vital roles of π-π stacking and hydrogen bonding interactions in the self-assembly process, and thioflavin T (ThT) assays further corroborate the amyloid nature of these metabolites. The *in vitro* MTT assay revealed the cytotoxic trait of these assemblies, a finding that was substantiated by *in vivo* assays employing the *Caenorhabditis elegans* (*C. elegans*) model, which revealed that the toxic effects were more pronounced and dose-specific in the case of metabolites that had aged *via* longer preincubation. They hence report a compelling phenomenon wherein these metabolites not only aggregate but transform into a soft, ordered assembly over time, eventually crystallizing upon extended incubation, leading to pathological implications. The findings suggest that the amyloidogenic nature of the involved metabolites could be a common etiological link in IEMs, potentially providing a unified perspective to study their pathophysiology, thus offering exciting insights into the development of targeted interventions for these metabolic disorders. ***(ACS Chem Neurosci 2024 Mar 6;15(5):916-931)***.

### 8.4.3 Deciphering the Role of Tgr5 in Neural Stem Cell Homeostasis

G- protein coupled bile acid receptor 1, also known as Takeda G- protein coupled receptor TGR5 is a Gas Coupled GPCR discovered in 2002 by Maruyama. TGR5 is an endogenous bile acid receptor, which upon activation is known to initiate a number of signaling pathway modulating multiple physiological responses. TGR5 mRNA has been detected in many rodent and human brain tissues, including macrophages/monocytes, gallbladder, placenta, intestine, liver and brain. However, the precise role of TGR5 signaling in CNS is still not clear. Given that neural stem cell (NSC) homeostasis is considered paramount in healthy ageing and mood. We investigated the role and mechanism of TGR5 signaling in NSC homeostasis. Furthermore, NSC proliferation and adult neurogenesis has been shown to be significantly reduced during ageing and brain injury. We have found abundant expression of TGR5 in primary

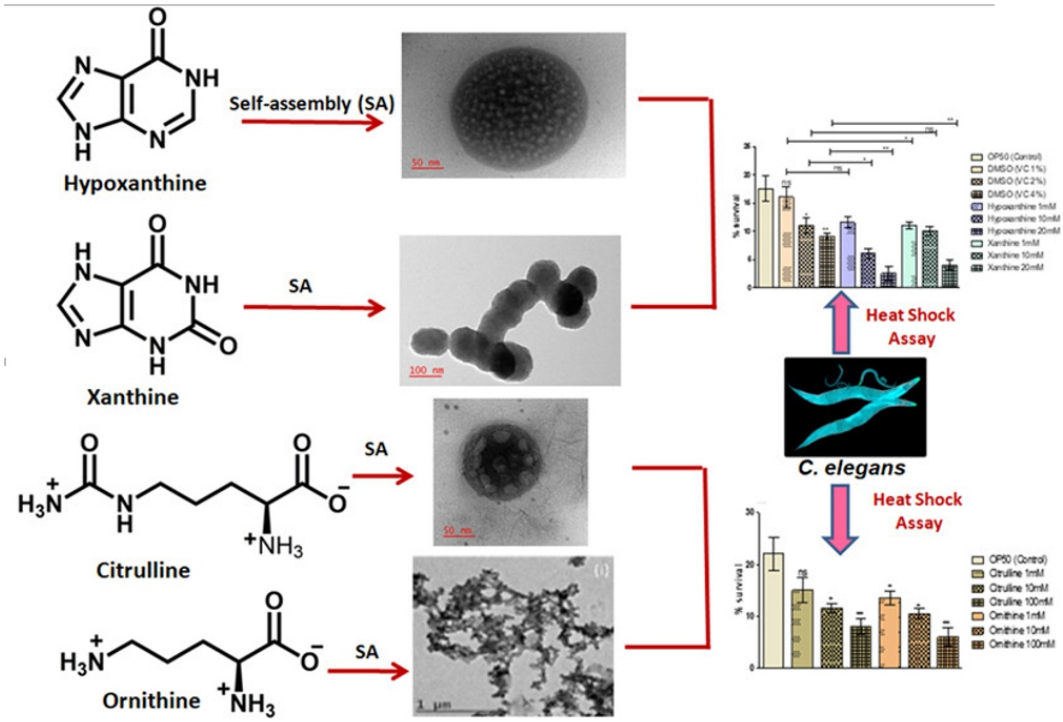



**Fig.4:** Effect of a Uric Acid and Urea Cycle metabolites on aggregation of β-Amyloids either in cell free system or in *Caenorhabditis elegans*.

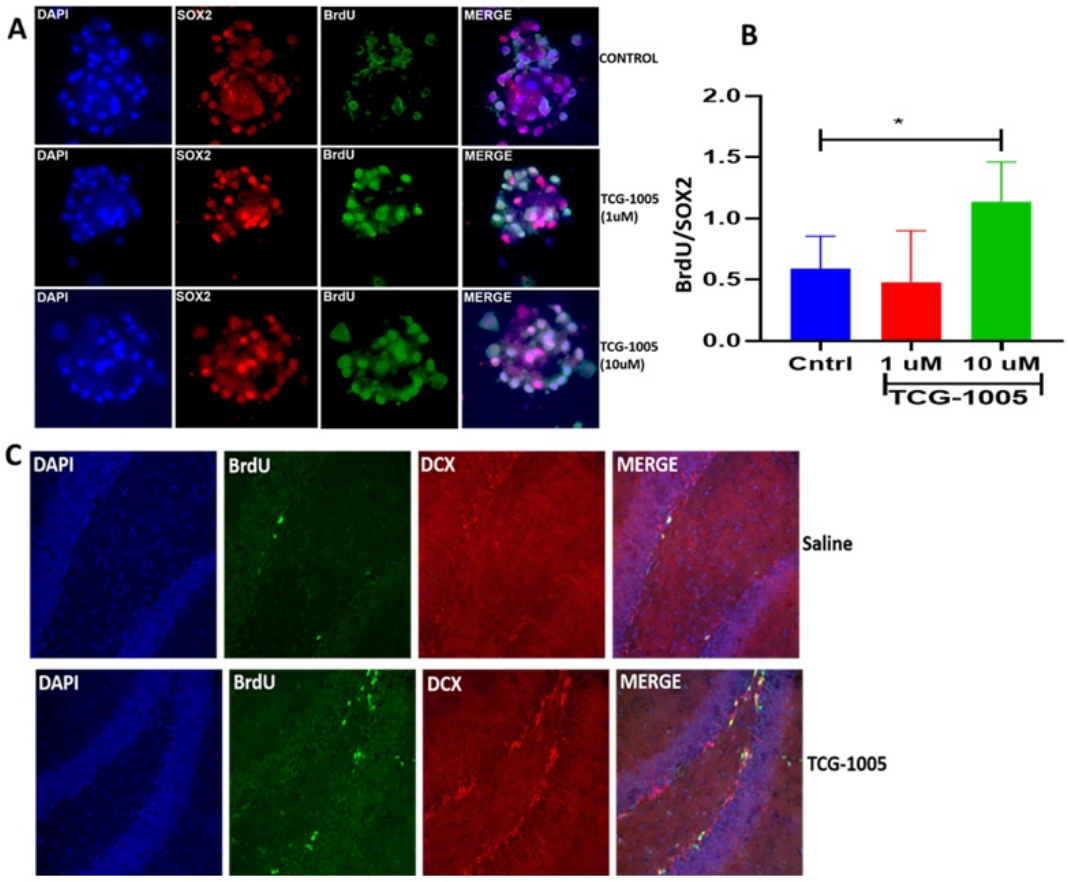



**Fig.5:** Effect of a TGR5 agonist TCG-1005 on the proliferation of NSC (**A, B**) and adult neurogenesis is in mice brain (**C**).

cultured neural stem cell from hippocampus, and in dentate gyrus region of mice. We have shown increased proliferation of NSC upon stimulation with TGR5 selective agonist TCG-1005. Although TGR5 agonism has been reported to cause itch upon activation by bile acids, however we found that synthetic agonist TCG-1005 did not induce itch in mice. Furthermore, administration of TGR5 agonist TCG-1005 significantly increased doublecortin (DCX) positive cells (a marker or immature neurons), indicating TGR5 role in NSC homeostasis and adult neurogenesis. More importantly, we also found that TGR5 activation led to increases in the quiescent neural stem cells in cultured NSC. These observations suggest that TGR5 might be a good target to ameliorate perturbed NSC homeostasis in various CNS disorders.

### 8.4.4 Unravelling the Shared Molecular Pathways in Parkinson's Disease: Insights from Dopaminergic Neuron Degeneration

Parkinson's Disease (PD) is a complex condition characterized by the deterioration of dopamine-producing neurons in the brain, leading to significant physical and neurological challenges. PD manifests in two primary forms: familial PD, a rarer type with a genetic basis, and the more common sporadic PD, thought to arise from a combination of genetic variations and environmental influences. This research highlights that both forms of PD, despite their different origins, may share common biological pathways leading to neuron degeneration.

Utilizing the Gene Expression Omnibus (GEO) database, this study analyzed gene expression in neurons with PD versus healthy controls. Data from three specific gene datasets were meticulously chosen for their relevance to PD, and with the aid of the GEO2R tool, significant differentially expressed genes (DEGs) were identified. These DEGs, common across datasets, were visualized and further examined within a Protein-Protein Interaction (PPI) network created using Cytoscape and the GeneMANIA plugin. This step was crucial for pinpointing hub genes and significant functional modules related to PD.

To validate the findings, experiments were conducted using the model organism *Caenorhabditis elegans,* focusing on the impact of gene knockdowns on the health of dopaminergic neurons and related behaviors. This work shed light on the potential roles of

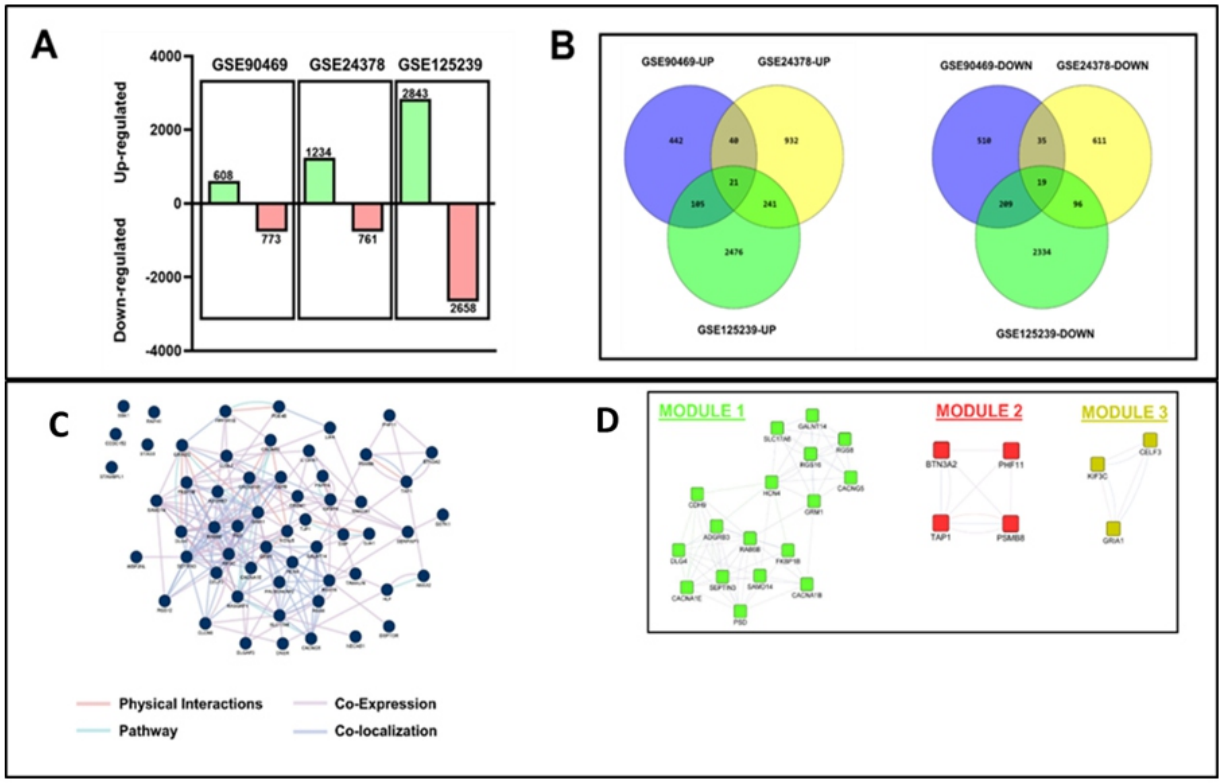



**Fig. 6.** High throughput gene expression analysis of the three selected datasets using GEO2R. (**A**) Bar graph of up- and downregulated genes in PD vs healthy DA neurons from each dataset. (**B**) In the 3 datasets, 21 DEGs were upregulated, and 19 DEGs were downregulated, as depicted in the Venn diagram. (**C**) The 40 cDEGs were filtered into the PPI network complex using GENEMANIA plugin in the Cytoscape software. The network nodes include proteins encoded by the cDEGs. The edges represent their functional associations. (**D**) The most significant modules were screened using the MCODE plugin in the Cytoscape software.

specific genes, such as raph1 and rgs8, in the degeneration process and their influence on PD-related symptoms. The results from this comprehensive approach not only deepen our understanding of the molecular mechanisms at play in PD but also open new avenues for targeted therapeutic interventions. By identifying shared genes and pathways implicated in the degeneration of dopaminergic neurons across both familial and sporadic PD, this research offers hope for the development of treatments that could mitigate the progression of this debilitating disease.

### 8.4.5 ACE2/ANG-(1-7)/Mas Receptor Axis Activation Prevents Inflammation and Improves Cognitive Functions in Sd Rats

Activation of the renin-angiotensin system (RAS), by Angiotensin converting enzyme/Angiotensin II/Angiotensin receptor-1 (ACE/Ang II/AT1 R) axis elicits amyloid deposition and cognitive impairment. Furthermore, ACE2 induced release of Ang(1-7) binds with the Mas receptor and autoinhibits ACE/Ang II/AT1 axis activation. Inhibition of ACE by perindopril has been reported to improve memory in preclinical settings. However, the functional significance and mechanism by which ACE2/Mas receptor regulate cognitive functions and amyloid pathology is not known. The present study is aimed to determine the role of ACE2/Ang-(1-7)/Mas receptor axis in STZ induced rat model of Alzheimer's disease (AD). We have used pharmacology, biochemical and behavioural approaches to identify the role of ACE2/Ang-(1-7)/Mas receptor axis activation on AD-like pathology in both *in vitro* and *in vivo* models. STZ treatment enhances ROS formation, inflammation markers and NFκβ/P65 levels which are associated with reduced ACE2/Mas receptor levels, acetylcholine activity and mitochondrial membrane potential in N2A cells. DIZE mediated ACE2/Ang-(1-7)/Mas receptor axis activation resulted in reduced ROS generation, astrogliosis, NFκβ level and inflammatory molecules and improved mitochondrial functions along with $Ca^{2+}$ influx in STZ treated N2A cells. Interestingly, DIZE induced activation of ACE2/Mas receptor significantly restored acetylcholine levels and reduced amyloid-beta and phospho-tau deposition in cortex and hippocampus that resulted in improved cognitive function in STZ induced rat model of AD-like phenotypes. Our data indicate that ACE2/Mas receptor activation is sufficient to prevented cognitive impairment and progression of amyloid pathology in STZ induced rat model of AD-like phenotypes. These findings suggest the potential role of ACE2/Ang-(1-7)/Mas axis in AD pathophysiology by regulating inflammation cognitive functions. (***Eur J Pharmacol. 2023 May 5; 946:175623***).

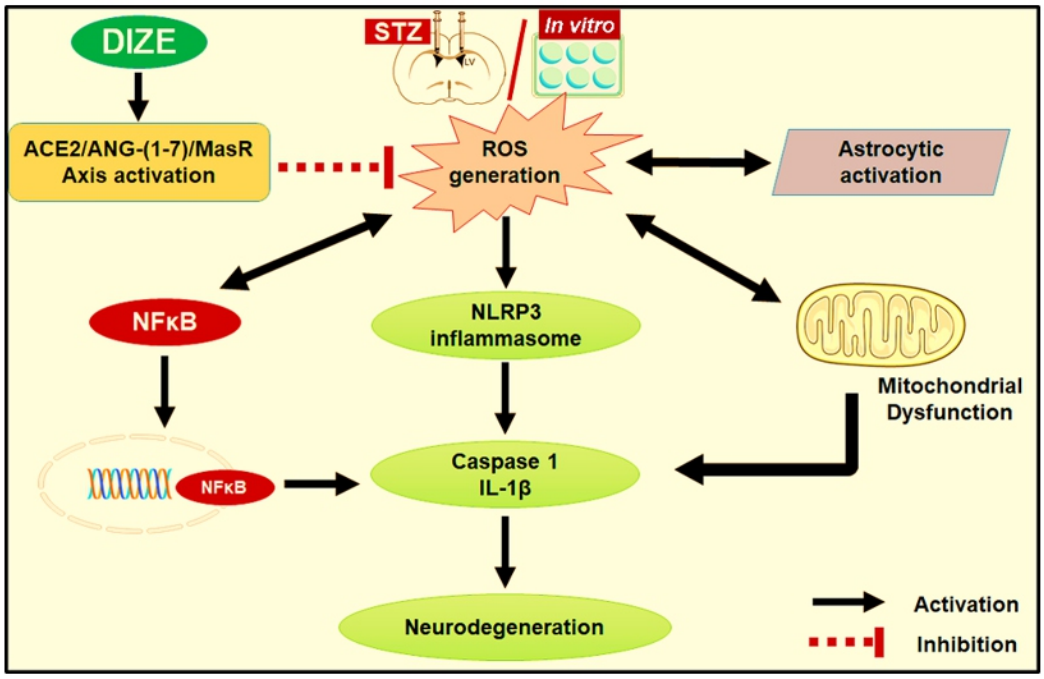



**Fig. 7.** Illustration showing the Angiotensin converting enzyme/Angiotensin II/Angiotensin receptor-1mechanisms and pathways involved in cognitive impairment and neurodegeneration

### 8.4.6 Pirh2 Modulates Amyloid-β Aggregation Through the Regulation of Glucose-Regulated Protein 78 and Chaperone-Mediated Signaling

Amyloid-β (Aβ) protein aggregation in the brain is a pathological hallmark of Alzheimer's disease (AD). However, the underlying molecular mechanisms regulating amyloid aggregation are not well understood. Here, we studied the propitious role of E3 ubiquitin ligase Pirh2 in Aβ protein aggregation in view of its regulatory ligase activity in the ubiquitin-proteasome system employing both cellular and sporadic rodent models of AD. Pirh2 protein abundance was significantly increased during Streptozotocin (STZ) induced AD conditions, and transient silencing of Pirh2 significantly inhibited the Aβ aggregation and modified the dendrite morphology along with the substantial decrease in choline level in the differentiated neurons. MALDI-TOF/TOF, coimmunoprecipitation, and UbcH7-linked *in vitro* ubiquitylation analysis confirmed the high interaction of Pirh2 with chaperone GRP78. Furthermore, Pirh2 silencing inhibits the STZ induced altered level of endoplasmic reticulum stress and intracellular $Ca^{2+}$ levels in neuronal N2a cells. Pirh2 silencing also inhibited the AD conditions related to the altered protein abundance of HSP90 and its co-chaperones which may collectively involve in the reduced burden of amyloid aggregates in neuronal cells. Pirh2 silencing further stabilized the nuclear translocation of phospho-Nrf2 and inhibited the altered level of autophagy factors. Taken together, our data indicated that Pirh2 is critically involved in STZ induced AD pathogenesis through its interaction with ER-chaperone GRP78, improves the neuronal connectivity, affects the altered level of chaperones, co-chaperones, & autophagic markers, and collectively inhibits the Aβ aggregation.

### 8.4.7 UBA52 Attunes VDAC1-Mediated Mitochondrial Dysfunction and Dopaminergic Neuronal DeathF

Mitochondrial homeostasis regulates energy metabolism, calcium buffering, cell function, and apoptosis. The present study has been conducted to investigate the implications of the ubiquitin-encoding gene UBA52 in mitochondrial physiology. Transient expression of Myc-UBA52 in neurons significantly inhibited the rotenone-induced increase in reactive oxygen species generation, nitrite level, and depleted glutathione level. Mass spectrometric and coimmunoprecipitation data suggested the profound interaction of UBA52 with mitochondrial outer membrane channel protein, VDAC1 in both the wild-type and Myc-α-synuclein overexpressed neuronal cells and in the Parkinson's disease (PD)-specific substantia nigra and striatal region of the rat brain. *In vitro* ubiquitylation assay revealed that UBA52 participates in the ubiquitylation of VDAC1 through E3 ligase CHIP. Myc-UBA52 overexpression in neurons further improved the mitochondrial functionality and cell viability by

preventing the alteration in mitochondrial membrane potential, mitochondrial complex I activity, and translocation of cytochrome *c* and p-Nrf2 along with the effect on intracellular calcium uptake, thus collectively inhibiting the opening of mitochondrial permeability transition pore. Additionally, Myc-UBA52 expression in neuronal cells offered protection against apoptotic and autophagic cell death. Altogether, our findings delineate a functional association between UBA52 and mitochondrial homeostasis, providing new insights into the deterrence of dopaminergic cell death during acute PD pathogenesis.

### 8.4.8 Neurotransmitter Pathways and Associated Metabolites Studied after Systemic Silencing of Gut Genes in *C. elegans;* Role in Neurodegeneration

The gut is now recognized as the "second brain" of the human body due to its integral role in neuronal health and functioning. Although we know that the gut communicates with the brain *via* immunological factors, microbial metabolites, and neurotransmitters, the interplay of these systems remains poorly understood. To investigate this interplay, we silenced 48 genes that are exclusively or primarily expressed in the *C. elegans* intestine. We studied the associated effects on various aspects of neurodegeneration, including proteotoxicity induced by α-Syn expression. We also assayed behaviours, such as mobility and cognition, that are governed by various neurotransmitters. We identified nine gut genes that significantly modulated these events. We further performed HR-MAS NMR-based metabolomics to recognize the metabolic variability induced by the respective RNAi conditions of *R07E3.1*, *C14A6.1*, *K09D9.2*, *ZK593.2*, *F41H10.8*, *M02D8.4*, *M88.1*, *C03G6.15* and *T01D3.6*. We found that key metabolites such as phenylalanine, tyrosine, inosine, and glutamine showed significant variation among the groups. Gut genes that demonstrated neuroprotective effects (*R07E3.1*, *C14A6.1*, *K09D9.2*, and *ZK593.2*) showed elevated levels of inosine, phenylalanine, and tyrosine; whereas, genes that aggravated neurotransmitter levels demonstrated decreased levels of the same metabolites. Our results shed light on the intricate roles of gut genes in the context of neurodegeneration and suggest a new perspective on the reciprocal interrelation of gut genes, neurotransmitters, and associated metabolites. Further studies are needed to decipher the intricate roles of these genes in the context of neurodegeneration in greater detail.

# 9 Reproductive Health

## Vision :

Addressing reproductive health issues by focusing on all major aspects, including the identification of new methods of diagnosis, the deciphering of the molecular mechanisms underlying disease etiology, and the identification of new methods of treatment

## Goal :

- Understanding of the causes of male and female infertility
- Investigate fundamental mechanisms operational in spermatogenesis, oogenesis, folliculogenesis
- Investigate molecular genetics causes of male infertility
- Investigate the role of sperm RNAs in fertility and transgenerational inheritance
- Dissecting the contribution of environmental factors as contributors to epigenetic changes in male infertility
- Deciphering the molecular alterations in female infertility (PCOS and endometriosis)

**(L to R):** Dr. Rajesh Jha, Dr. Narender T (Area Coordinator), Dr. Monika Sachdev, Dr. Radha Rangarajan, Dr. Rajender Singh (Area Coordinator), Dr. Koneni V Sashidhara and Dr. Durga Prasad Mishra

*"Deciphering underlying biology of reproductive health disorders"*

***- Dr. Rajender Singh***
*Senior Principal Scientist &*
*Area Coordinator*

## R & D Highlights

### 9.1 Investigation of New Genetic Causes of Male Infertility

Genetic causes are supposed to account for about 50% of the cases of male infertility. Excluding all known genetic and environmental causes, the etiology in more than 70% of infertility cases remains unknown. Genetic polymorphisms affect infertility risk depending on the gene, and location and nature of the polymorphism. In the present study, we selected 41 candidate gene for analysis in male infertility. A total of 52 single nucleotide polymorphisms spread across these genes were analyzed in 958 individuals, including 548 infertile cases and 410 fertile controls, using the iPLEX Gold assay for large-scale genotyping. The infertile group consisted of 548 subjects, including azoospermic (n=457) and asthenozoospermic (n=91) individuals. We analyzed genotype data in three ways: all cases versus all controls, azoospermic cases versus controls, and asthenozoospermic cases versus controls. Polymorphisms in the *TEX15* (rs323344), *CATSPERD* (rs2305925), *MAP2* (rs16843614), *MED10* (rs4592), *IRF5* (rs10954213), *APOC3* (rs5128), and *SYNGR4* (rs919804) genes showed associations with infertility. In sub-group analysis, polymorphisms in the *CATSPERD* (rs2305925), *SPEF2* (rs16902381), *IRF5* (rs10954213), *APOC3* (rs5128), and *SYNGR4* (rs919804) genes showed significant associations with azoospermic infertility, while polymorphisms in the *CCDC96* (rs871134), *DNAH8* (rs1537232), *DHH* (rs117527954), *PER3* (rs10462020), *MAP2* (rs16843614), *MED10* (rs4592), *SPEF2* (rs139580877), *DNAAF11* (rs2293979), *TCF3* (rs2074888), *KLC3* (rs13181), and *SYNG4* (rs919804) genes showed significant associations with asthenozoospermic male infertility. We conclude that genetic polymorphisms in the *TEX15* (rs323344), *CATSPERD* (rs2305925), *MAP2* (rs16843614), *MED10* (rs4592), *IRF5* (rs10954213), *APOC3* (rs5128), and *SYNGR4* (rs919804) genes significantly affect the risk of infertility. Identification of new genetic causes of male infertility will facilitate the development of genetic testing panels in the future. These panels can be used to offer tailored treatment and genetic counselling to the patients.

### 9.2 Identification of the SPEM1 Gene Mutation in a Teratozoospermic Infertile Men

We came across an interesting case of 33 years old teratozoosprmic men with coiled sperm tail. In the present study, we undertook whole exome sequencing to identify the genetic mutation responsible for teratozoospermic infertility. The study employed whole exome sequencing to investigate the genetic cause in a unique case of male infertility attributed to a coiled sperm tail defect. Exome sequencing data were filtered using the following criteria: MAF (<0.003), ALFA project (<0.001), 1000 Genomes (<0.003), Granthem (>50), Polyphen-2 (>0.70), SIFT (<0.03), PhyloP (>=0) scores. Shortlisted variants were looked at in the in-house 100 exomes data available with us, and the variants that affected conserved amino acid residues or led to insertion/deletion or protein-truncation with a Combined Annotation Dependent Depletion (CADD) score e"10 were shortlisted. The variants thus populated were prioritized according to their roles in spermiogenesis. The study identified a heterozygous mutation c.826C>T in the SPEM1 gene as a potential pathogenic variant that led to teratozoospermic infertility in the case under investigation. The mutation has a minor allele frequency of 0.00008176 in the gnomAd database and is absent in the Indian Genome Variations database.

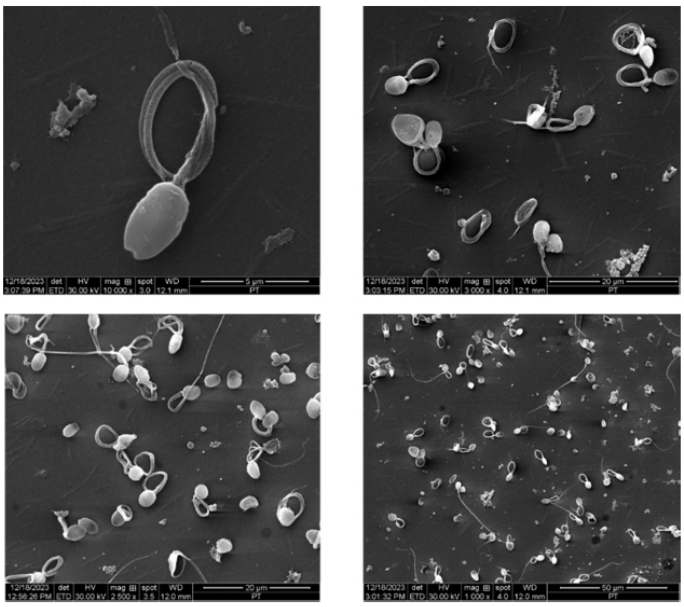


**Fig. 1.** Scanning electron microscopy images showing various morphological deformities observed in the sample. The study identified a c.826C>T mutation in the SPEM1 gene in a case of coiled sperm tail. This is the first human study reporting a mutation in the SPEM1 gene as a cause of coiled sperm tails.

### 9.3 Scientific Validation of *Putranjiva* Seeds to Promote Female Fertility

*Putranjiva roxburghii* is an evergreen tree growing up to 12 metres tall. The tree is harvested from the wild for local use as a medicine and source of beads, oil and wood. The name Putranjivaka signifies- which promotes or give life to progeny; hence, promotes fertility. The aqueous-ethanolic extract of *Putranjiva* seeds was prepared and used for the dosing of the animals. Identification and quantification of the marker compounds, detection of heavy metals and chromatographic finger printing of this extract is under progress.

Young adult Sprague-Dawley female rats (8-9 weeks old of proven fertility) were used to develop chemoablated infertile female models. After one week of model induction, treated group of animals received this seed extract orally as a daily dose of 60 mg/kg for four weeks. To assess the biological efficacy of *Putranjiva;* animals were sacrificed weekly after the initiation of the treatment and all the reproductive organs were collected for further analysis. Histological analysis of the ovarian tissues showed a significant decrease in follicular number of chemo-ablated animals as compared to the control group. Gradual recovery of follicles was quite evident in 14, 21 and 28 days of treatment with *Putranjiva* seed extract.

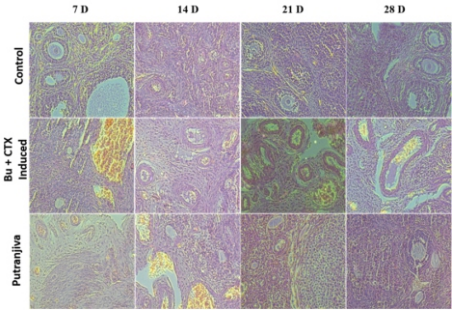


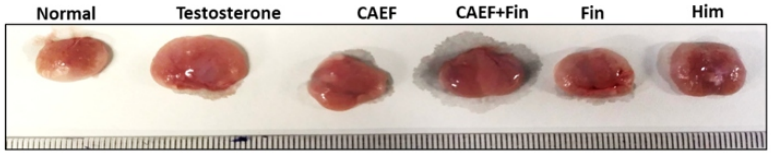

**Fig. 2.** Histological analysis of ovarian tissue

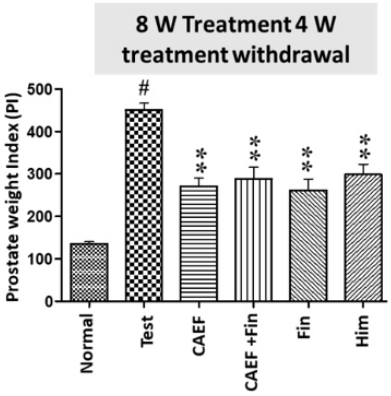
### 9.4 Therapeutic efficacy of Natural Compounds *vs* Commercial Drug Finasteride for the Management of BPH

Benign Prostatic Hyperplasia (BPH) is the most common benign neoplasm in older men as the prevalence of histological hyperplasia increases with age. Manifestations of BPH symptoms are not of a specific nature

*"Several Natural products served as drugs. We are working to develop natural products based drugs for BPH in men and PCOS in women"*

***- Dr. T Narender***
*Chief Scientist & Area Coordinator*



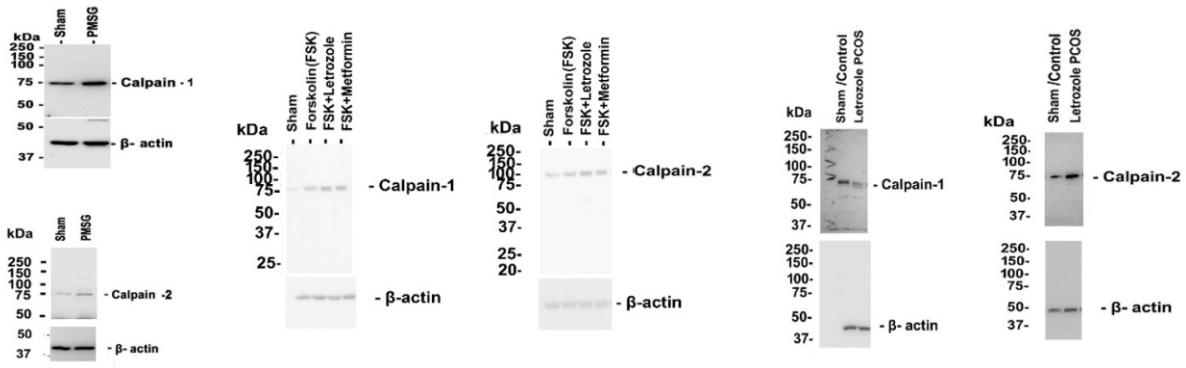

| Group | Prostate weight Index Recovery ( %) |
|---|---|
| Chebulinic acid enriched fraction (CAEF)100mg/kg | 40.0266 |
| Chebulinic acid enriched fraction (50mg/kg) + Finasteride (1.5 mg/kg) | 36.21454 |
| Finasteride (3 mg/kg) | 42.0656 |
| Himplasia (50 mg/kg) | 33.86525 |

**Fig. 3.** Effect of CAEF and Finasteride administration on prostate weight index (PI) in BPH- induced rats after 8 weeks treatment and 4 weeks withdrawal. Changes in prostate weight index was assessed for the Control, Testosterone- induced BPH, CAEF (100 mg/kg) treated group as well as Finasteride along with combination of CAEF and finasteride treated group. Himplasia was taken as an herbal drug control.

and vary diversely. Currently, there is widespread interest in developing nutraceuticals/ phytopharmaceuticals for the management of BPH due to the perception that they are safe, more cost-effective and less side effects as compared to their conventional alternatives (steroidal drugs). Through CSIR's mission mode project of natural compounds, we found beneficial role of Chebulinic Acid Enrich Fraction (CAEF), isolated from the fruits of *T. chebula* for the management of BPH in rat model. The efficacy of CAEF was found to be quite comparable with marketed steroidal drug Finasteride. Moreover, the process for preparation of CAEF is highly cost-effective, found safe in toxicity studies in rats and provides a good alternative from the natural resource. Our pharmacokinetic (PK) studies indicated that CAEF is quite stable even at room temperature and also viable in the circulatory system.

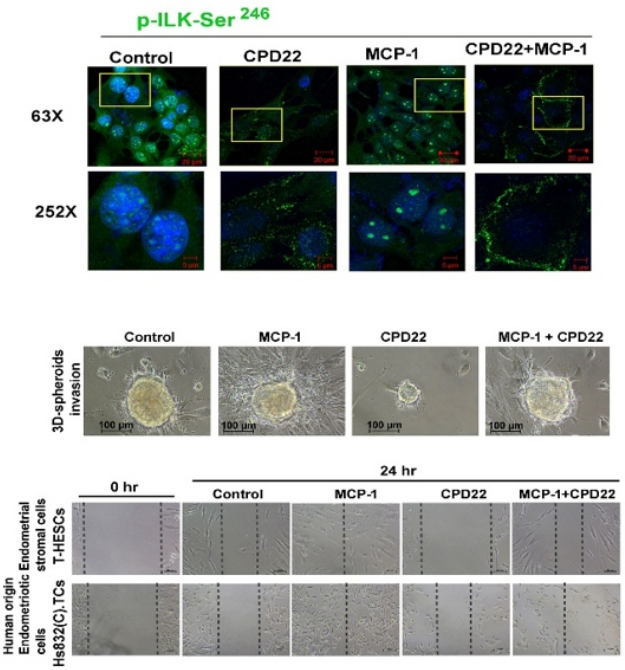
## 9.5 The Intra-Ovarian Calpain-1 is Associated With PCOS

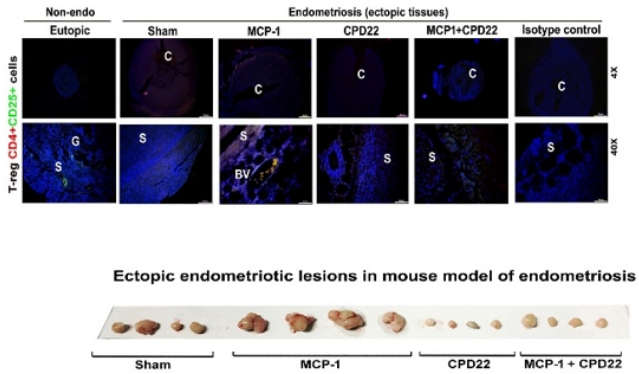
We are exploring intraovarian factors for PCOS etiologies. Calcium-dependent cysteine proteases, calpains participate in the cumulus cell-oocyte complexes and, corpus luteum. The studies showed calpains polymorphism association with PCOS cases. Therefore, we examined the intraovarian role of calpains-1 and -2 during folliculogenesis, follicle recruitment, ovulation, steroidogenesis and PCOS using the SD rat model and human-derived granulosa cells. We find that gonadotropin, pregnant mare gonadotropin (PMSG) induced calpain-1 expression level. During experimental steroidogenesis in the human-origin granulosa cells, we saw the increased expression of it in response to metformin and letrozole in the background of forskolin. Further, calpain -1 downregulation was seen during PCOS in the SD rat model, suggesting downregulation of calpain-1 and upregulation of calpain-2. In conclusion, calpain-1 is associated with follicular recruitment and it is lost during altered follicular recruitment in the SD rat model of PCOS. (***Reprod. Biol, 2024).***



## 9.6 MCP-1 Triggers the Inflammatory Response Through ILK Phosphorylation During Endometriosis Pathogenesis.

Endometriosis manifests with chronic inflammation, irregular menstruation, and infertility. Endometrial cells form an ectopic lesion in the pelvic cavity and exhibit enhanced migration, attachment, invasion, colonization and aggregation potentials. In endometriosis, MCP-1 is elevated in serum, peritoneal fluid and lesions, MCP-1 can activate ILK signalling in non-endometriotic cells. ILK functions in several cellular events (migration, adhesion, proliferation, and invasion). Therefore, we studied MCP-1-ILK signaling in human endometriotic cell migration, adhesion, colonization, aggregation and invasion, and macrophage differentiation along with inflammatory response during endometriosis pathogenesis in mouse models. We observed MCP-1 mediated ILK-Ser$^{246}$ phosphorylation induction in human-origin endometriotic cells (Hs832(C).TCs). To create a high level of MCP-1 environment, we treated the human origin endometriotic cells with it, which in turn accelerated the cell migration, adhesion, aggregation, invasion, and colonization via ILK activation. At the preclinical level, mouse model of endometriosis, MCP-1 mediates ILK activation in turn chronic inflammatory reaction and increased infiltration of residential and circulatory macrophages, and monocyte differentiation, and suppresses the anti-inflammatory reaction. The pharmacological inhibition of ILK reversed the MCP-1-mediated action by decreasing endometriotic cell migration, adhesion, aggregation, invasion, and colonization. Further, pharmacological inhibition of ILK, as a therapeutic intervention in a mouse model of endometriosis reduced the effects of MCP-1 mediated pro-inflammatory cytokines, but increased anti-inflammatory response along with T-regulatory and T-helper cell restoration. Collectively, targeting ILK reversed MCP-1 mediated inflammation in the peritoneum and endometrial tissues, and inhibits the aggressiveness of human endometriotic cells, and inflammatory response, and improves the T-regulatory and helper cells in the mouse model of endometriosis.



# Note

Section
II

# State of the Art Facilities, Knowledge & Infrastructure Management


6520 Q TOF LC MS/MS
HOLMARC

## DSIR Common Research and Technology Development Hub (CRTDH)

**R&D Scale Formulations Manufacturing Facility, Drug Testing Lab (DTL), and Bioanalytical Facility for Preclinical and Clinical Pharmacokinetics'**

The DSIR-CRTDH has been established in CSIR-CDRI with budgetary support from DSIR and CSIR. Formally inaugurated on 21 February 2021, the CRTDH facility is functioning with the following broad objectives:

a) Generation of chemical and pharmaceutical information on API and formulations physicochemical, analytical, and validation data.

b) Quality Assurance, Monograph, and Final/Batch Release Specifications including Stability Studies: Real-time and accelerated, per Schedule Y and ICH Q1A(R2) through Q1E.

c) *In vitro* pharmacokinetics and metabolism: Solubility, pKa, logP and stability in simulated biological fluids, PAMPA/CaCo2 permeation, plasma stability, and protein binding, whole blood partitioning; Rat S9 and human microsomal stability, CYP regulation/reaction phenotyping using recombinant human CYPs.

d) Preclinical pharmacokinetics, absorption, distribution, metabolism, and excretion: PK, metabolite identification, and toxicokinetics in blood using rodents, other efficacy models, canines or non-human primates; bio-distribution, allometric scaling, PK modeling and population PK.

e) Bioanalysis for clinical pharmacokinetics, including bioavailability and bioequivalence. Liaison with CSIR-CDRI's Clinical Pharmacology sites at KGMU, Lucknow; PGI, Chandigarh and KEM Hospital, Mumbai.

Since its establishment, the centre is providing assistance to MSME and Start-ups. The centre has GMP production capacity and capability—Pilot / R& D to Phase II Clinical Trial Batches (including placebos) under Form 29 License or Form CT-10 Permission. Across the board: from conventional oral and topical formulations to transdermal systems, pulmonary drug delivery, liposomes, nanoparticles (Sterile products will be added in the next phase). It also has a Form 37- Licensed, GLP-certified facility for pharmaceutical analysis, impurity profiling, accelerated and real-time stability and photo stability— almost all pharmacopoeial tests (except Schedule C and C1). The Bioanalysis capacity for preclinical pharmacokinetics and pharmacodynamics is equipped with LC-MS/MS, HPLC, ELISA, microplate-based assays and nucleic acid tests. The CRTDH has provided technical and/or consultancy services to 41 pharmaceutical companies to date.

**(Left to Right)** Dr. Kavita Singh, Mr. Dipak Sharma, Dr. Manish Kumar Chourasia, Dr. Vivek Vidyadhar Bhosale, Dr. Prabhat Ranjan Mishra, Dr. Amit Misra, Dr. Jiaur Rahaman Gayen, Dr. Rabi Sankar Bhatta, Ms. Mehzabeen Shaik and Mr. Narendra Kumar

# GLP Test Facilities for Pharmaceuticals

The GLP test facility of CSIR-CDRI is meant for development of pharmaceuticals for humans. It is a unique facility certified by NGCMA, Government of India. Since, October 2017, Regulatory safety pharmacology, mutagenicity, Chromosomal aberration, systemic toxicity and reproductive toxicity studies have been conducted regularly in the facility. The safety pharmacology and regulatory toxicity studies done at our center as per the requirements of the Drug Controller General of India, and we also follow ICH and OECD guidelines. Currently, more than 114 studies have been conducted at GLP-certified facility since its certification. We have successfully faced the Audit by NGCMA in October 2023 for re-certification for the next Cycle. The facility has one hundred forty-nine active standard operating procedures. Thirteen study Directors with the help of 18 study personnels execute the GLP studies. Three Quality assurance personnels strictly monitor the studies. The study reports are deposited at CADC for three Cycles (9 yrs). Document controllers, Archivists, Animal Facility, Engineers are supporting the smooth functioning of the GLP test facility.

Following are some of the important studies that were conducted and completed this year.

1. NMITLI-118 AF1: Evaluation of mutagenicity using Salmonella Reverse Mutation Assay
2. DIABEPRE 841: Single dose toxicity study in SD Rat by oral route
3. NMITLI-118 AF1: 28 Days Repeat Dose Toxicity Study in SD Rat by Oral Route with Reversal
4. NMITLI-PHPL: Single Dose Toxicity Study in SD Rat by Oral Route
5. NMITLI-PHPL: Single Dose Toxicity Study in Swiss Mice by Oral Route
6. S011-1793: 14-day repeat dose toxicity study in SD rat by oral route
7. CDRI 4655 EF: Single Dose Toxicity Study in Swiss Mice by Oral Route
8. CDRI 4655 EF: Single Dose Toxicity Study in SD Rat by Oral Route
9. CDRI S016-1348: 7-day DRF in SD rat by oral route
10. CDRI S016-1271: 10-day DRF in mice by I.V. route
11. NMITLI-PHPL: 10-day DRF in SD rat by oral route
12. NMITLI- 118 AF1: In vitro Chromosomal Aberration Assay
13. S011-1793: Evaluation of Genotoxicity by Micronucleus Test in Mouse Bone Marrow Cells

GOVERNMENT OF INDIA
Department of Science and Technology
National Good Laboratory Practice (GLP) Compliance Monitoring Authority (NGCMA)

Certificate of GLP Compliance

This is to certify that

**CSIR-Central Drug Research Institute**
**Sector 10, Jankipuram Extension**
**Sitapur Road, Lucknow- 226031 (Uttar Pradesh), India**

is a GLP certified test facility in compliance with the NGCMA's Document No. GLP-101 "Terms & Conditions of NGCMA for obtaining and maintaining GLP certification by a test facility" and OECD Principles of GLP.

The test facility conducts the below-mentioned tests/ studies:

- **Toxicity Studies**
- **Mutagenicity Studies**
- **Others**

The specific areas of expertise, test item and test systems are listed in the annexure overleaf.

14. S016-1348: Single Dose Toxicity Study in Swiss Mice by Oral Route
15. S016-1348: Single Dose Toxicity Study in SD Rat by Oral Route
16. NMITLI-PHPL: 28 Days Repeat Dose Toxicity Study in SD Rat by Oral Route with Reversal
17. NMITLI-PHPL: Evaluation of mutagenicity by Salmonella Reverse Mutation Assay (Ames Test)
18. Dhatri Lauha: Single Dose Toxicity Study in Swiss Mice by Oral Route
19. S017-622: Single Dose Toxicity Study in Rats by Oral Route
20. S016-1348:28 Days Repeat Dose Toxicity Study in SD Rat by Oral Route
21. Dhatri Lauha: Single Dose Toxicity Study in Rat by Oral Route
22. Dhatri Lauha: 28 Days Dose Range Finding Study in SD Rats by Oral Route

**(Top row; L to R)** Dr. Vivek Vidyadhar Bhosale, Dr. Rabi Sankar Bhatta, Dr. Ashish Awasthi, Mr. Anurag Srivastava, Mr. Anil Kumar Meena, Kul Bahadur Thapa, Mr. Deepak, Mr. Umesh Kumar, Mr. Navodayam Kalleti, Mr. Akhilesh, Mr. Ram Kumar, Mr. Narendra Kumar,

**(Mid row; L to R)** Mr. Sadan Kumar Pandey, Dr. Smrati Badhauria, Dr. Giaur R. Gayen, Dr. Manish K Chourasia, Dr. Madhav N Mugale, Dr. Vineetha Tripathi, Mr. Ramesh Chandra Yadav, Dr. Prem N Yadav, Dr. Virendrakumar Prajapathi, Dr. Agnihotri, Dr. Sheeba Saji Samuel, Dr. Sachin Kumar, Dr. C.P. Pandey, Ms. Smriti, Dr. Sonia Verma, Ms. Anupama, Dr. Shubha Shukla, Ms. Deepmala Umrao, Dr. Neha Topno, Er. Santosh Shukla, Dr. Shail Singh, Ms. Sachi Bharti, Dr. Baisaki Moharana, Dr. Richa Pandey

**(Front row; L to R)** Dr. Kashif Hanif, Dr. Rajdeep Guha, Dr. Manoj Barthwal, Dr. S.K Rath, Dr. Sharad Sharma, Dr. Aamir Nazir, Dr. Prabhat Ranjan Mishra, Dr. Sarika Singh and Dr. Anil N. Gaikwad

# Knowledge Resource Centre

The Knowledge Resource Centre (KRC) of the Institute provides information support to the scientific staff, students of the laboratory and visitors using both archival print resources and contemporary digital resources. It is situated in a beautiful building measuring 8000 sq. feet (approx.), fully air-conditioned building located in the main campus of CSIR-Central Drug Research Institute.

The primary objective of Knowledge Resource Centre (KRC) is to support the research and educational programs of the Institute by providing physical and online access to information, consistent with the present and the anticipated educational and research functions of the Institute. In accordance with the objectives of the Institute, over the years, KRC has been developing a comprehensive collection of peer-reviewed scholarly literature useful for the research community of the Institute. The secondary objective is to serve as a resource centre for the scholars and scientific community of the country. Besides this to promote Hindi, KRC procures Hindi books as well literature of common interest.

| Resource Type | Collection Size |
|---|---|
| Books | 23150 |
| Bound Volumes of Journals | 73969 |
| e-Journals | 4700 + |
| Reference Books/ Serials | 2863 + |
| CDRI Theses & Dissertations | 1887 |
| Hindi Books | 1029 + |

Knowledge Resource Centre is serving the mission and purpose of the Institute by providing the literary services with a collection of books, bound volumes of journals, thesis, annual reports of various scientific Institutions & many more e-version of resources. This facility is available to all the scientists, technical staff, students and guests. Resources received on gratis and donations are also housed in the KRC.

**Services**

- **Digital Library Access Zone:** This facility was inaugurated by Dr. Radha Rangarajan, Director, CSIR- CDRI, on 4th October 2023, on the occasion of the CSIR foundation day celebrations at CSIR-CDRI. Major resources available under the facility are EndNote; Biorender, GraphPad Prism and SnapGene *etc;* apart from access to digital library and databases in the area of biomedical research.
- **Online Catalogue** (OPAC: http://172.16.0.44/ (Intranet) Online Public Access Catalogue (OPAC) available for document search.
- **KRC Management** (through KOHA packages): The KRC/Library is fully computerized using Koha software for day-to-day operations. Web Online Public Access Catalogue (OPAC) is available on the Internet.
- **SciFinder:** This resource is widely used to Locate most relevant literature of research areas of Chemistry Search for organic/ inorganic/ biological substances/ metals etc. Conduct comprehensive patent searching Assess novelty of idea/ scaffold. Search by Bio-sequences (peptides and nucleotides).
- **Plagiarism Check and Similarity Reports Generation:** Similarity reports generated with the help of anti-plagiarism tool *i.e.* iThenticate of appoximate 905 number of thesis and publications.
- **Reference Management Tool:** KRC is providing facility of Endnote software for management of references to its users.

- **Grammar Checking Tool:** KRC provides a facility of research writing tool, Grammarly, to the scientific community of the institute.
- **Patent Information Database Orbit:** The facility of patent information can be accessed through Orbit database.
- **Major E-Resources:** KRC provides access to below mentioned several electronic journals through the web for students and faculty members of CSIR-CDRI. These electronic resources are hosted on the IPs of the Institute.

| Sl. No. | Name of Resource |
|---|---|
| 01 | ACS |
| 02 | Elsevier |
| 03 | RSC Gold |
| 04 | Wiley Online |
| 05 | Springer Nature (02 Sub. Collection) Life Sciences and Medicine |
| 06 | Nature Journals |
| 07 | Taylor & Francis |
| 08 | American Association for Cancer Research (AACR) |
| 09 | American Society for Microbiology (ASM) |
| 10 | American Society for Pharmacology and Experimental Therapeutics (ASPET) |
| 11 | Science Online and Science Translational Medicine (AAAS) |
| 12 | New England Journal of Medicine (NEJM) |
| 13 | JAMA Network |

- **Document Delivery Service:** Provided 305 document delivery services from our print & archival and subscribed resources as and when requested by the user *via* email, fax *etc*.
- **Scientometric Analysis:** Carried out citation analysis of publications of individual scientists and organization using scientometric tools such as Web of Science of Clarivate Analytics.
- **Reprographic Services:** The CDRI KRC offers photocopying services to all its members, and this service is available to all faculty members and students on nominal charges.
- **Archiving/ Institutional Repositories:** To provide better access to the recently published literature as pre-prints of publications and thesis are archived using D-Space Software.
- **Reference Service:** Reference service helps users to make full use of the resources available in the KRC. It guides the use of KRC resources and services, assists in accessing e-journals, e-books, databases, multimedia sources etc. KRC also maintains a collection of reference books consisting of encyclopedias, dictionaries, directories, technical reports, scientific reports, pharmacopoeia (s), current protocols, methods, and globes, etc.
- **Resource Orientation Programs:** The KRC takes an active part in the orientation program to familiarize users with various resources and services available for them and also whenever a new product or service is introduced. During the year below mentioned orientation programs were organized:
- **Trial Access:** The renowned publisher M/s Thieme graced the CDRI scientists with trial access to Pharmaceutical Substances from 2$^{nd}$ to 17$^{th}$ August 2023.
- **Apprenticeship Training**

  During the year, we engaged three graduate apprentice trainees in the area of Library and Information Science through the Board of Apprenticeship Training, Kanpur and trained them in the functioning of various areas of the KRC.

The membership of the KRC is available to all the scientists, technical staff, research students and the other CDRI staff. Only print resources are available for circulation against KRC membership. However, consultation of all resources is open to all, including reference material.

Research scholars, faculty, students of other universities/ organizations are also permitted to use the KRC on written request; or on a letter of recommendation from the concerned organization without membership.

| Sl. No. | Topic | Resource | Date |
|---|---|---|---|
| 01 | Training on Web of Science | Web of science | 01-06-2023 |
| 02 | CAS SciFinder Discovery Platform: A Career Planning Tool for Academics | CAS SciFinder In collaboration with NKRC | 21-07-2023 |
| 03 | Introduction to Patent Search Platform Orbit Intelligence | Questel | 24-07-2023 |
| 04 | CAS SciFinder: Literature Search | CAS SciFinder In collaboration with NKRC | 28-07-2023 |
| 05 | CAS SciFinder: Substance and Structure Searching | CAS SciFinder In collaboration with NKRC | 04-08-2023 |
| 06 | CAS SciFinder: Reaction Searching and Retrosynthesis Planner | CAS SciFinder In collaboration with NKRC | 11-08-2023 |
| 07 | CAS SciFinder: Advan ced searches and Tips & Hints | CAS SciFinder In collaboration with NKRC | 18-08-2023 |
| 08 | Workshop on Common Pitfalls in Scientific Writing and Science of Synthesis Orientation | Thieme Chemistry | 22-08-2023 |
| 09 | Books-based quiz competition for the staff and students | KRC | 23-08-2023 |
| 10 | Lecture on "Research Integrity and Publications Ethics." | Mr S.K. Mallik | 24-08-2023 |
| 11 | Improving Research Writing and Publications Output Using Grammarly | Grammarly | 25-08-2023 |
| 12 | MyLoft user training session | MyLoft, Eclat Engineering | 13-10-2023 |

**(Left to Right)** Mr. Pankaj Upreti, Dr. Anand P Kulkarni,Mr. Ramesh Chandra Gupta and Mr. Arbind Kumar

## National Laboratory Animal Facility

The Laboratory Animal Facility of CSIR-Central Drug Research Institute, Lucknow which is known as the National Laboratory Animal Center (NLAC), is a CCSEA-registered (Reg. no. 34/GO/ReRcBiBt-S/ReRc-L/ 99 CPCSEA) dated 22.09.2023, GLP certified test facility (No.: GLP/C-108/2017, DOI: 18.10.2017). The facility possesses approximately sixteen thousand animals of about 8 species with more than 25 strains of rodents and non-rodents which include mice, rats, hamsters, gerbils, mastomys, rabbits and guinea pigs. The facility has a state of the art primate research and rehabilitation unit for experimentation on non-human primates. NLAC also serves as national resource center for supply of experimental animals for research purposes to other CCSEA registered research institutions across the country.

The mandate of the center:

1. Breeding, production and supply of laboratory animals for IAEC approved in-house biomedical research programs.
2. Supply of healthy animal models to external CCSEA registered organizations.
3. Monitoring and maintaining animal health and quality parameters through genetic, microbial, viral, pathological, and parasitological screening of various animal colonies maintained in the facility.
4. Acting as referral center for scientific and technical advisory/consultancy services for developing and establishing research animal facility in accordance with the guidelines of the CCSEA.
5. Conducting human resource development programs including organizing symposium/workshop/seminar on various aspects of laboratory animal science.
6. Publication and dissemination of scientific literature on contemporary issues of laboratory animal science and animal experimentation.


**(Front Row, Left to Right)** Dr. Madhav N. Mugale, Mr. Rajakumar S, Dr. Dhananjoy Hansda, Dr. Rajdeep Guha, Dr. Chetan D. Meshram and Dr. Virendrakumar Prajapathi.

**(Top Row, Left to Right)** Mr. Dinesh Kumar, Mr. Narendra Kumar, Dr. Vijay Kumar Verma, Mr. Chandra Shekhar Yadav, Mr. Sanjeev Kumar Saxena, Dr. Zaheeb Rasheed Wani

**Experimental Animals Numbers:**

| Sl. No | Species | Strains | Opening stock (as on 01.04.2023) | Closing stock (as on 31.03.2024) |
|---|---|---|---|---|
| 1 | Mice | Outbred: Swiss<br>Inbred: C57BL/6, BALB/c<br>Transgenics: 10 strains | 11075 | 9377 |
| 2 | Rat | Outbred: SD, CF, DR,<br>Inbred: Wister, Lew, SHR | 3031 | 4272 |
| 3 | Hamster | Outbred: Golden Syrian | 1073 | 1354 |
| 4 | Gerbil | Outbred: Mongolian | 283 | 394 |
| 5 | Mastomys | Outbred: Coucha | 398 | 298 |
| 6 | Guinea pig | Outbred: Duncan Hartley | 184 | - |
| 7 | Rabbit | Outbred: NZW | 349 | 217 |
| 8 | Monkey | Rhesus | 60 | 59 |
| | | **TOTAL** | **16453** | **15971** |

**Experimental animals issued to IAEC approved in-house projects and supplies to other IAEC approved CCSEA registered organizations:**

| Animals | In-house Use (numbers) | External Supply | | Total animals |
|---|---|---|---|---|
| | | Nos. | ECF generated (Rs) | |
| Mouse | 12293 | 1593 | 559050 | 13886 |
| Rat | 5932 | 1663 | 951900 | 7395 |
| Hamster | 852 | 142 | 92300 | 994 |
| Mastomys | 215 | - | - | 215 |
| Gerbil | 128 | 120 | 78000 | 248 |
| Guinea Pig | - | - | - | - |
| Rabbit | 29 | 15 | 37500 | 44 |
| **Total** | **19449** | **3533** | **1718750** | **22782** |

**Experimentation on Non-Human Primates (NHPs):**

The primate facility is approved by the CCSEA for the purpose of research and experimentation on monkeys in the area of drug efficacy, regulatory toxicology and pharmacokinetics. The eco-friendly NHP rehabilitation unit has been developed according to the norms of the CCSEA to rehabilitate the monkeys surviving after termination of the experiments. Proper management and due veterinary care is extended to these animals round the clock. The experimental primate wing is highly upgraded to comply with the GLP and other regulatory guidelines enabling the institute to perform experiments on NHPs as per global standards.

**Status of animals in Non-Human Primate facility:**

| Number of Monkeys (as on 01.04.2023) | | | Number of Monkeys (as on 31.03.2024) | | | |
|---|---|---|---|---|---|---|
| Experimental Wing | Rehabilitation | Total | Experimental Wing | Rehabilitation | Death | Total |
| 20 | 40 | 60 | 20 | 39 | 01 | 59 |

**Animal Health Monitoring Programme**

The animal health and genetic monitoring is conducted as per standard SOPs and guidelines comprising of the following diagnostic techniques:

1. Routine clinical observation of animals
2. Examination of internal and external parasites
3. Necropsy and pathological monitoring of animals
4. Microbial monitoring of animals
5. ELISA based screening for virus infections
6. Screening for bacterial infections

**Genetic Monitoring Programme**

A panel of twenty SSLP markers was used as primary genetic screen to genetically monitor the common inbred mice strains and twenty markers were analyzed for Rats. The results confirmed the genetic integrity of the inbred and outbred strains of the animals and ruled out any chances of genetic cross contamination.

# Repository of Small Organic Compounds

The new drug design and discovery is a highly challenging, cost-intensive, and time-consuming research effort. Still, the problem of resistance to the present treatments or improvement of the present treatments to alleviate human suffering from different diseases and provide affordable healthcare underscores the need to continually discover new drugs. With a better understanding of molecular biology, genetic layouts, biochemical pathways, and protein science, new drug discovery and development now follow the paradigm of a target-driven approach rather than a hypothesis-driven. Various computational techniques including molecular docking, virtual screening, molecular simulations, and machine learning methods are employed to study the ligand-protein interactions and discover novel molecular entities with selective pharmacological activity. Such target-oriented approaches are commonly followed for discovering bioactive compounds for different lifestyle disorders and age-related diseases. Notably, the two distinct discovery approaches *viz*. hypothesis and target driven require a large pool of diverse chemical prototypes for *in silico*, biochemical or cell-based screening to identify hits. On the other hand, the paradigm of drug discovery *via* the repurposing of bioactive pursued globally also requires a large collection of compounds. Thus, this institute purchased and installed the Automated Chemical Stores in 2012, which was commissioned in October 2013. Since commissioning, all the compounds available with the institute were transferred and archived in the repository. Presently the CDRI Repository comprises approximately 90,000 small organic compounds and 215 natural compounds. The Repository at this institute is equipped with state of an art Liquid handling Platform that is effectively utilized for preparing stock solutions of compounds and their distribution for bioassays towards identifying bioactive under different disease areas being pursued at the institute.

The Automated Storage system from Brooks Automation (now Azenta) is equipped with options to store compounds in the 2.0 mL vial, 1.4 mL tube, or 96 well plate format at -20°C under nitrogen. The Repository has the Biomek Liquid Handling Station for preparing the stock solution of compounds for distribution to biologists for performing assays. The Repository has Analytical and Semi-Preparative HPLC systems for assessing the purity of the received samples and purifying compounds if required. The Nephelometer is used for evaluating the solubility of the compounds as and when required.

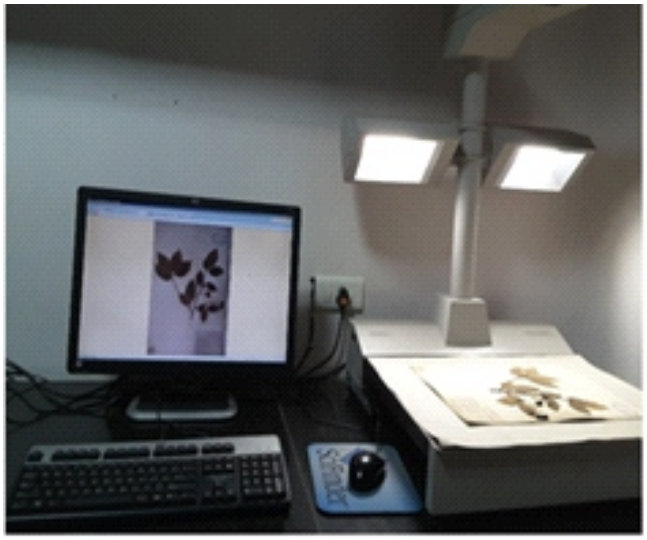
From the period of 1st April 2023 to 31st March 2024, 1208 synthetic compounds, 24 pure natural products and 7 natural product extracts were physically received in the repository. The purity check of all compounds were carried out, solutions were prepared and distributed for biological screening. Simultaneously the compounds (in house synthesized compounds and Maybridge library) which showed promise in the *in-silico* screening were distributed to biologists against their requisitions for confirming the bioactivity.

**(Left to Right)** Dr. Sanjay Batra, Dr. Bhawana Sharma and Dr. Anil Kumar K.S.

## Medicinal Plant Herbarium Facility

The Medicinal Plant Herbarium of CSIR-CDRI (Acronym CDRI) is one of the Indian Herbaria, indexed in 'Index Herbariorum' (https://sweetgum.nybg.org/science/ih/) of the W&L Steere Herbarium, New York Botanical Garden, USA. The Herbarium harbours more than 30,000 specimens in 896 pigeon holes of specially designed compactors. The specimens belong to ca 3,200 medicinal plant species under 1,800 genera and 210 families of vascular plants across the country. The digitization of this Herbarium started few years back and the data entry work of most of the sheets have been completed. Presently, checking and correction of entered data, nomenclature update of the species followed by rectification of scientific names in all the sheets are going on. During 2023-24, data of more than 2,600 herbarium sheets have been checked and corrected, of which nomenclature update of ca 190 species and rectification of scientific names of more than 700 concomitant specimens have been completed.

Students, scientists and faculties from different government and private institutes like CSIR-NBRI; IIT, Kanpur; CIS, Balaganj; CBG Ag. PG College, BKT; SSMV, Shahjahanpur; SNA PG College, Amethi; KV, IIT-KANPUR; CGHS, Unnao; KV No. 2, Bareilly Cantt; 59$^{th}$ Vahini SSB, Nanpara, Bahraich, IP PG College, Bulandshahar and NNM College of Pharmacy, Gonda have visited the Herbarium during this period for differrent purposes.



**(Left to Right)** Mr. Ram Chandra Mourya, Dr. Dipak Kumar Mishra, Dr. Vineeta Tripathi

## Sophisticated Analytical Instrument Facility (SAIF)

Sophisticated Analytical Instrument Facility is under the roof of the SAIF&R division at CSIR-Central Drug Research Institute, Lucknow. It is a more than 48-year-old facility, jointly set up by the Department of Science & Technology (DST), Govt. of India, and CSIR-CDRI, Lucknow, in the mid-seventies (1974-75). At present, facility partially supported by the Department of Science & Technology (DST) to provide chemistry-centric analytical services (https://saiflucknow.org). On the other hand, electron microscopy and other analytical facilities are supported by the CSIR-CDRI, Lucknow. These facilities are accessible to both internal and external facility users and support major R&D activities of the institute. The services are used by about 75 internal and 350 external users annually. More than 90% of the external users comprise researchers from universities and colleges in India. Researchers from national laboratories and industries constitute the rest. Besides providing analytical services, facility scientist groups are also involved in the R&D activity of the institute, with several ongoing projects. The development of analytical methods, ultrastructural characterization using TEM/SEM, and structural characterization of new chemical entities are the core areas of research in the SAIF&R division. Students also work for their Ph.D. degrees utilizing modern analytical equipment in SAIF.

**Facilities available at SAIF, Lucknow**

- Mass spectrometry
- NMR spectroscopy
- Electron Microscopy
- Elemental analysis
- IR spectroscopy
- UV-Vis spectroscopy
- Chromatography (HPLC)
- Circular dichroism (CD)
- Polarimetry

Sophisticated Analytical Instrument service provided during the year are as follows:

| Name of Facility | No. of external samples analyzed | No. of internal samples analyzed | No. of total samples analyzed |
|---|---|---|---|
| Mass Spectrometry | 1012 | 19983 | 20995 |
| NMR Spectroscopy | 1009 | 35864 | 36873 |
| Electron Microscopy | 130 | 1380 | 1510 |
| Other Analytical Facility | 819 | 2983 | 3802 |
| **Total No. of samples** | **2970** | **60210** | **63180** |

**(Left to Right)** Dr. Kalyan Mita, Dr. Sanjeev Kanojia, Dr. Koneni V. Sashidhara and Dr. Sanjeev K. Shukla

# Scientific Directorate

The Scientific Directorate is looking after three major portfolios Planning, Project Monitoring and Technical Information, apart from taking care of Institutional responsibilities like management of Auditorium complex, Art, Photo and Videography, organization of events, etc.

**Planning**

Under the domain of planning activities, the division extended support for the following Institutional activities:

- Revisit of Institute Vision 2030
- Formulation of new Mission, FTT, FBR, CSIR First Projects. A total of more than 60 proposals were vetted and evaluated technically for further consideration by the competent authority
- In-house projects management. Coordination of the entire process leading to the successful implementation of 34 In-house projects
- Vetting of proposals being submitted to external funding agencies, including government agencies, industries, Institutes, etc. A total of 192 project proposals were vetted and processed for approval of the competent authorities
- Budgetary planning for the FY 2023-24 and Budget estimates for FY 2024-25 for Chemicals, Consumables, Capital, Library, Furniture & fittings
- Procurement planning
- Number of proposals submitted under different categories
    - CSIR schemes (Mission, FTT, FBR, NCP, Seed Fund & CSIR First): 51
    - In-House Projects: 56
    - Grant in Aid Proposals (DST, SERB, DBT & ICMR): 127
    - Industry Sponsored Projects: 20

**Project Monitoring Activities:**

Under the domain of Project Monitoring, the PME unit is carrying out following activities

- Monitoring of procurements, expenditure of all ongoing projects (more than 250 projects)
- Processing of Indents with due diligence
- Monthly report generation on budget and expenditure
- Audit compliant records of all projects in softcopies and hardcopies (more than 250 numbers of project folders)
- Vetting expenditure statements, and utilization certificates for more than 200 projects and processing for approval of the competent authorities.
- Digitized information management
- Coordination with Audit
- Coordination of Project Monitoring Meetings
- Number of Projects Monitored:
    - CSIR Projects: 21
    - In-house: 34
    - Grant-in-Aid: 108
    - Sponsored: 11
    - Collaborative: 10

**Institutional Publications and Reports**

Scientific Directorate is engaged in preparation of various Institutional reports and documents. During the reporting period, following publications and reports were brought out.

- Preparation and publication of CSIR-CDRI Annual Report 2022-23
- Providing inputs for Annual Reports of CSIR and DSIR for the FY 2022-23
- Research Highlights and Executive Summary Document for Research Council meetings
- Preparation of Monthly reports
- Preparation of Quarterly Reports
- Response to queries from various corners (Govt./ non-Govt. agencies)
- Replies to Parliament Queries
- Communication within and outside the institute
- Management of database on projects, staff, budget, ECF, Awards, etc
- Brochures, Invitation Cards, Advertisements, etc.

**Institutional Photography and Design Work**

Scientific Directorate is the core of institutional art, videography and photography work. During the year, following activities were undertaken

- Making video films of staff who superannuated during the year
- Scientific Digital Photography for all publications, Scientific Journals and Research papers
- Designing of CSIR-CDRI Advertisements
- Photography coverage of all institutional events namely, seminars, symposiums, agreements, conferences, lectures, farewells, colloquiums, and many such events

- Designing of Institute publications including Invitation Cards, Posters, Banners, Certificate, Brochures, Mementos
- Allied services under photography and designing like Poster designing for conferences, computerized graphic diagrams, drawings and charts, editing and processing of digital images for publications, etc.
- Maintenance and update of central Institutional Digital Photo repository

**(Left to Right)** Mr. Ravindra Nath Londhe. Dr. Arbind Kumar, Dr. Shishir Gupta, Dr. Anand P Kulkarni, Dr. Shruthi R Raju, Ms. Farha Khan, Mr. Ashok Kumar

## Business Development & Intellectual Property Unit

Business Development & Intellectual Property Group aims to establish a stronger link between the Institute and Industry, Stakeholders, and Society. The overall objectives of the group:

- To promote the technologies developed at CSIR-CDRI and facilitate the R&D divisions of CSIR-CDRI to have a better interaction with industries to develop novel technologies
- Coordination of the technical services based on immense expertise available with CSIR-CDRI to various users
- Representing CSIR-CDRI in the exhibitions and expo to exhibit accomplishments of the Institute and opportunities available for industry, academia, and society to collaborate with CSIR-CDRI
- Management of Intellectual Property Rights of the Institute. Liaisoning with CSIR, sister CSIR laboratories, National Biodiversity Authorities, other Government agencies
- Conducting IP awareness programs
- Coordination of the International S&T Affairs activities at CSIR-CDRI including foreigners visiting the institute and deputation of staff to foreign countries. Liaisoning with MEA, IHCs etc.
- Carrying out biological activity studies of compounds against various diseases as requested by Academia and Industry sources. Generation of ECF for the institute
- Active participation towards Translation of Research outcomes

During the reporting period, the Business Development group continued to explore business development opportunities by establishing liaisons with national and international organizations and industries in order to have more public-private partnerships at an early stage of the development and to have collaborations for new leads. Several new contracts/assignments were signed/undertaken by the Institute during the reporting period.

**Number of Agreements Signed (Details given in the Research Output Section)**

- Licensing of Technology 02
- Demonstration of Technology (Know-how) 02
- Grant Agreement 01
- Sponsored Project Agreements 07
- Consultancy Project 01
- Memorandum of Cooperation 04
- Memorandum of Understanding 15
- Collaborative Research Agreement 01
- Agreement 01
- Secrecy Agreements 31
- Clinical Trial Agreement 06
- Memorandum of Agreements 05
- IP Expense Sharing Agreement 03
- Material Transfer Agreements 09

**Number of Patents Processed: (Details given in the Research Output Section)**

- Patents Filed in India 06
- Patents Granted in India 06
- Patents Filed Abroad 10

**Other Activities**

- Number of foreigners visited the institute during the reporting period: 20
- Number of foreign students under CV Raman International Fellowship for African Researchers visited the institute during the reporting period: 01
- Number of CSIR-CDRI staff went on deputation abroad during the reporting period: 07
- Number of Academia and Industry sources that have benefited out of Biological Screening programme at CSIR-CDRI: 38
- The amount of ECF that had been generated during the reporting period is approx. ₹ 5,38,970.00

**(Left to Right)** Ms. Shraddha Jain, Er. Jai Prakash Dwivedi, Dr. Kaushik Bhattacharjee, Dr. Naseem Ahmed Siddiqui, Dr. Sripathi R. Kulkarni and Ms. Neelima Srivastava

# Human Resource Development

Human Resource Development (HRD) is a framework for development of skills, knowledge, and abilities. Accordingly, HRD group of CSIR-CDRI is making efforts to nurture the skills to Acquire capabilities required to perform various functions relating to present and future roles of students as well as employees. The composition of CDRI's HRD group includes, (i) Academic Affairs Unit, (ii) Skill Development Program (NWP0100)-PG Training Unit, (iii) Jigyasa (HCP0101), (iv) Deputation Abroad/International Trainings, (v) Placement and Alumni Cell, (vi) Students Hostel and (vii) Continuing Education programs, Awards, Recognitions, Fellowships, Conference, Symposia and Workshop for staff members.

**(i) Academic Affairs Unit**

Coordination of the academic activities related to PhD Programs of Academy of Scientific and Innovative Research (AcSIR), Ghaziabad and Jawaharlal Nehru University (JNU) New Delhi starting from admission, organization of course works, seminars, comprehensive, Research/Doctoral Advisory Committee (RAC/DAC) Meetings to Thesis submission, Viva-voce examination and finally award of Doctoral Degree.

**Academic Related Activities:**

- Coordination of admission process of PhD positions in reporting period under CSIR-CDRI PhD Program (JNU & AcSIR) Coordination of Pre-PhD Course work of CSIR-CDRI PhD Programs
- Orientation program for students registered in AcSIR/JNU
- Coordination with Doctoral/Research Advisory Committee (DAC/RAC) for CSIR-CDRI PhD Programs along with all the documents related to thesis & viva voce, scanned & send to JNU and AcSIR
- Coordination for conducting Viva-voce Examination
- Issue of Transcripts and certificates and verifications thereof
- Formalities regarding other financial remittance to JNU/AcSIR according to commitments
- Coordination and organization of Academic Council (Institutional, JNU & AcSIR)/ JNU Scrutiny committee meetings
- Initiative taken towards connecting stakeholders (Research /Academic Institutes/ University/Medical Colleges) for enriching the academic environment and knowledge sharing

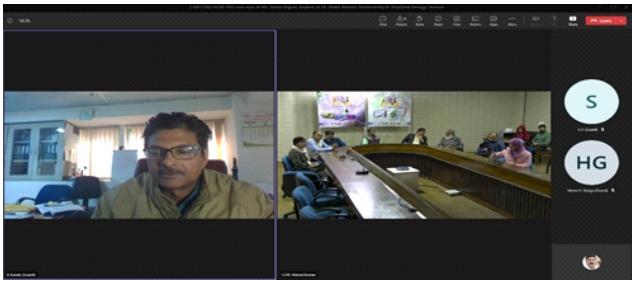
**Human Resource Related Activities:**

- Processing of applications for attending the conference/ seminar/ workshop/symposium
- Processing of application for SRF, RA and Women Scientists to various agencies

**First Row (L to R):** Dr. Sanjeev Yadav, Mr. Shailendra Mohan, Dr. Anand P Kulkarni, Dr. S.K. Rath, Dr. Sanjeev Shukla, Dr. Ritu Trivedi, Dr. Rajdeep Guha, Ms. Shraddha Jain, Dr. Shruthi R. Raju
**Second Row (L to R):** Ms. Harshita Maheshwari, Mr. Ashok Kumar, Er. Jai Prakash Dwivedi, Dr. Sripathi R Kulkarni, Dr. Naseem A. Siddiqui, Dr. Anil Kumar

**Science Communication and Dissemination Activities:**

- Science Communication and Dissemination through Vigyan Prasar & SCDD, CSIR-HQ
- Science Communication and Dissemination through Print and Electronic Media
- Science Communication and Dissemination through Social Media (Twitter & Facebook)
- Activities under the aegis of Scientific Social Responsibility (SSR) of the Institute
- CSIR-800 Program (Health Awareness and Outreach Projects by PhD Students)
- Other Societal programs




**(i) Skill Development Program (NWP0100)-Post Graduate Training Unit**

Skill India is an initiative launched to empower the youth of our country with skill sets which make them more employable and productive in their work environment. Skill shortage remains one of the major constraints to the continued growth of the Indian economy. We wish to address this knowledge-gap by professionally trained youth of India. The courses have been designed to meet the aspirations of students, young researchers and industry-sponsored personnel looking for training. We offer seven certificate courses under the CSIR-CDRI Skill Development Program. These courses provide an opportunity for skill development and hands-on experience in the area of healthcare and life science. During this period 87 aspirants from more than 60 colleges/institutes of different part of country have participated.

**Skill Development Program for Postgraduate Students**

The course meets the aspirations of students/young researchers looking for training and hands-on experience in the chosen area. Students pursuing their post-graduation course from universities/ colleges in any of the relevant areas can develop skills through these courses. Candidates have taken training for a duration of 04 months to 01 year depending upon the recommendations from their HOD. During this period 206 post graduate students from more than 120 colleges of different part of country received training.

**Advance Training Program for the research scholars and employees of R&D Institutions/Univ./ Industry etc.**

Institute conducts different kinds of training of short duration in various disciplines against payment. These courses comprise both lectures and practicals by our experienced scientists with emphasis on practical R & D aspects in a particular domain. During the period of report 12 aspirants received training.

**Training for Scholarship Awardees**

Under this category candidates getting scholarships/selected/ nominated from some of the prestigious institutions of India are provided training. The training comprises of both lectures and practical by our scientists and technical staff.

A. Indian Academy of Sciences, INSA-IASc-NASI Summer Research Fellowship

B. INSPIRE Fellowship

C. UPCST Fellowship

D. AcSIR - Dr. APJ Abdul Kalam Summer Training Program

During the period of report 13 aspirants received training.

**(iii) Deputation Abroad/ International Training**

Over the years, CSIR CDRI has invited several foreign researchers visiting under fellowships such as TWAS, RTF-DCS etc. In this regard, interested candidates approach the scientist of this institute based on their domain of expertise and obtain consent towards the conduct of the proposed research at his/her laboratory. In the reporting period, one student, Ms. Natacha Paule Marie Nelzie joined under the C V Raman International Fellowship for the period of six months.

**(iv) Placement and Alumni Cell**

The placement cell has been created to facilitate the job opportunities for the Ph.D. scholars who wish to pursue their carrier in Industries. The unit carries out two major activities viz., (i) Collating the data related to the PhD scholars, including their PhD duration, date of thesis submission and viva-voce, thesis title, publications and contact details, to facilitate placement assistance and networking opportunities and (ii) Sharing job opportunities, fellowship openings, and postdoctoral positions relevant to the PhD scholars in the placement WhatsApp group.

During the reporting period the placement cell also organized the talk on "Bridging the gap between academia and corporate by Ms. Aakanksha Pathak, Lead-Learning, Talent Management in Aurigene Oncology Limited, Bengaluru on 30th May 2023, more than 110 students attended the talk and

participated in the interaction. This program helped them in their CV writing and for attending future job interview. The placement cell reached out to nearly 25 industries for placement of scholars.

**Alumni Related Activities:**

- Maintaining a database of alumni contact information and career updates to facilitate communication and networking opportunities
- Connecting all alumni through a WhatsApp platform to facilitate ongoing communication, networking, and collaboration.
- Recognizing and celebrating alumni achievements and milestones through awards, accolades, and alumni spotlights.
- Serving as a liaison between alumni and the university administration, faculty, and students to facilitate communication, collaboration, and mutual support


**(v) Student Hostel**

Augmentation of Hostel rooms: This year We have revamped the Hostel facility for the students on both campuses so that our regular Ph.D. scholars, trainees, and students for skill development can have a pleasant stay and devote more time to their research and learning activities. We procured tables, Chairs, Beds mattresses, Almirahs to augment the new rooms and replaced the old furniture in the rooms where the furniture was worn out. A fully automatic RO+UV water purification system (50 Lit) is also installed at the Hostel Mess. The serving tables of hostel mess were also replaced by new steel tables. New utensil washing base has also been installed to evade the choking and maintaining the Kitchen environment. Sanitary napkin Dispensers along with small incinerators were installed in girl's common wash rooms to make the Hygienic environment well maintained.

# Information Technology Services

The Computer centre of the Institute is engaged in the development and management of Information Technology Services. Activities carried out during the reporting period are as follows:

**A) Software Development & Maintenance:**

- CDRI Website and intranet.
- Compound Submission and Bio-Assay Reporting. (CBRS) System and its enhancement for natural compounds.
- Dispensary automation software Human Resource Management Software system for students
- Management of latest DSPACE software
- Upgradation of Instrument online pre-booking system
- Laboratory Animal Issue Software
- Management & hosting of https://plantmetabolome.cdri.res.in Plant Metabolites database and Tandem Mass Spectrum https://tmsdatabase.cdri.res.in Database
- Online Budget Monitoring System
- Online Electrical/Civil/Refrigeration/Other Lab Services Job cards
- Online Gate Pass application for visitors
- Online Request / Reporting for Small Molecule X-ray Diffraction Facility
- Online Sample Submission/Analysis and Equipment Booking software for SAIF
- Online Skill Development Program (SDP) registration for CSIR-CDRI Courses
- Requisition for Bio-evaluation of compounds from CDRI Repository
- Software for applications for recruitment of PA posts
- Software for Wireless Controller log
- Upgradation of Store & Purchase Software for goods and services procurement management as per new purchase procedure
- Migration of Old SnP (Store and Purchase Software) from Java to .Net technologies
- Development of portal for Bill Gates Melinda Foundation (BMGF)
- Development of portal for Translational Research Group TRG
- Development of portal for CTDDR-2025
- Implementation of Face based attendance system for Students using python and MS SQL database
- Application for display and print of Salary slip
- Development of new CSIR-CDRI website (Under development)
- Development of new intranet (Under development)
- Co-operative Society Database
- Database for GPF Statement
- Digital Herbarium

**B) ICT Infrastructure Management and Services**

- Operation and Management of LAN/WAN System comprising of 1500 wired nodes and campus-wide Wireless network and NKN link of 1 Gbps bandwidth
- Operation and Management of servers and Storage systems
- Comprehensive IT support to institute-wide users comprising approximately 1000 clients
- Web hosting services for several publicly accessible websites including the institute's internet website (www.cdri.res.in)
- Support provided for the implementation of the e-procurement System
- Provisioning for NIC e-mail services
- Maintenance of PCs as per Standard Operation Procedure(SOP) for Protection and validation of Hardware and Software under GLP
- Routine backup for GLP-related data and management of GLP IT infrastructure
- Hosting of CDRI tenders, advertisements, events etc on the website Portal
- Online meeting platform facilities
- ICT support for Audiovisual arrangements
- ICT support for the adoption of e-office, AEBAS attendance and GeM portal
- Secondary NKN link using NKN link of AKTU and extended similar redundancy to AKTU
- Helped in implementation of NCCC Server and Firewall at CSIR-CDRI in support with CERT-In and CDAC for security of Institutional LAN

**(Left to Right)** Mr. Mukesh Kumar, Er. Kural, Er. Ajay K. Mourya and Er. Santosh Shukla

## Centralized Utility Services

Environmental Health & Safety carries utmost importance in the research laboratory. Compliances of various statutory and government agencies i.e. Ministry of Environment & Forest, UP Pollution Control Board, and Good Laboratory Practice for rigorous monitoring of the experimental and environmental parameters have been followed by the CSIR-CDRI. Our lab core facilities at CSIR-CDRI provide very important services in terms of operation and maintaining various centralized gas supplies i.e. LPG, Nitrogen, Compressed air, vacuum, and pharmaceutical Millipore grade water (Grade-I) to the workbench in chemical and biological research labs. CUS unit also maintain the operation and up keeping of generation of Liquid Nitrogen at CSIR-CDRI. The centralized services optimize the recurring expenditure and maintenance cost of the institute where the quality at a centralized point can be assessed /analysed. Presently following services are effectively functional and maintained under Institute Centralised Utility Services at the CSIR-CDRI, Lucknow.

**Centralized Gas Supply/ Utility services**

1. Operation & maintenance of nitrogen generation and supply in $N_2$ gas in all labs (approx. 116 no's labs and 600 work bench points)
2. Operation and maintenance of LPG, Compressed air, vacuum supply in all R&D labs
3. Operation & Maintenance of pharmaceutical grade (ASTM D1193 Grade-III) specification water supply at work bench
4. In house production of liquid nitrogen through LN2 plant of capacity 10LPH
5. Monitoring the environmental Health and safety compliances of GLP environmental parameters
6. Eco-campus Initative for campus environment, waste management, awareness among the residents under "Swachhata Pakhwada"

**(Left to Right)** Mr. Shivram Mishra, Dr. Sanjay Batra and Dr. Ranvir Singh

7. Preparation & compliances of SOP's for various technical services supervised and monitored by CUS

**Environmental, Health & Safety Services:**

1. Housekeeping services specialized cleaning in Animal care lab, environmental & Waste management as per statuary /Good Laboratory Practices (GLP) guidelines
2. Operation and maintenance of Effluent Treatment Plant (ETP), Sewage Treatment Plant (STP) and Biomedical Waste Incinerator *etc.*
3. Pest & rodent control, fogging for mosquito removal, termite control *etc.*
4. Operation and up keeping of fire alarm, fire-fighting, fire hydrant system and public announcement (PA) system and Safety stations
5. Cleaning & maintenance of drinking water purification system & maintenance of common facilities
6. Miscellaneous work on waste solvent /chemical recycle; preparation of new lawns, plantation, shramdaan, Mission LiFE program.
7. Member of team constituted by CSIR HQ on policy on Disaster Management Program

Various student interaction programs, visit to labs, delivering lecture of lab safety, environmental health & plantation drive under induction program

# Auditorium Management

The Auditorium Management Unit under the Scientific Directorate looks after the audio-visual and related facilities of the auditorium and meeting rooms/halls for institutional scientific lectures, conferences, seminars, workshops, project meetings, selection committee meetings, RC meetings, Virtual Video Conferencing, and other general events.

The major activities of this unit are:

- Operation and maintenance of high-end audio and visual systems to ensure smooth functioning during events
- Operation and Management of the Auditorium Complex
- Coordination with other facilities/sections for smooth organization of events
- Preventive maintenance of display systems, projectors, video switchers, streamers, amplifier switchers, feedback suppressers, microphones, portable sound systems, speakers, and projection systems
- Upgradation of the audio and visual system to make it compatible with available latest technology
- Virtual Conferencing through Skype, MS Team, Zoom, Google Meet etc.
- Live Broadcast Facility for Social Media websites like YouTube, Facebook, & Local LAN
- ICT Support for Seminars, Symposium, and Virtual Conference meetings
- Audiovisual support for Online Interviews, Assessments, and Recruitments

**(Left to Right)** Dr. Anand P. Kulkarni, Mr. Arbind Kumar, Mr. Sumit Kichi

# Instrumentation, Common Equipment and Facility Management Unit

GLP facility & NABL facility at our institute are being used for externally funded and In-house GLP studies. These facilities accreditation have been given by NGCMA, DST New Delhi and NABL Gurugram, Haryana after Audit. These agencies also carry out periodic audit of our GLP & NABL facilities. Instrumentation unit is responsible to establish & maintain the Equipment and Lab Environment Conditions as per OECD & ISO standard.

**1) Management of Good Laboratory Practice (GLP) Facility**

Instrumentation unit maintaining the Institutional GLP Facility as per the OECD Guidelines to comply the statutory requirements of NGCMA, DST-New Delhi. For that Instrumentation unit has been carried out following activities during last year

- Technical specification preparation, verification, installation and commissioning of new GLP instrument
- Calibration/validation of 113 nos. of GLP equipment as per OECD guidelines
- Performance check/preventive maintenance and report preparation of 92 nos. of GLP equipment on quarterly basis
- Environmental conditions (Lux, Sound Level, Relative Humidity and Temperature) monitoring & control in in experimental rooms, TICO, CADC, Geno-toxicology & Histopathology lab and generate monthly analyzed RH-Temp. data reports for each GLP study
- Daily monitoring of negative differential pressure in all experimental rooms
- Revised and Implemented Standard Operating Procedure (SOP) 7 nos. related to GLP equipment and environmental parameters control
- Preparing and tagging the unique identification tag to all GLP equipment (134 Nos)
- Updating log books of GLP equipment with calibration certificate and other relevant details
- Troubleshooting/repair of sophisticated GLP equipment
- Providing training to user on GLP equipment use and performance check
- Updating and maintaining following controlled GLP documents
- Mater equipment List (126 Nos. of GLP equipment)
- Calibration/Validation record (113 Nos. of GLP equipment)
- Minor equipment List ((8 Nos. of GLP equipment)
- Withdrawn/Replaced equipment list (24 Nos. of GLP equipment)
- Unique Identity Tag (134 Nos. of GLP equipment)
- Total 17 nos. of GLP study has been completed during last year and provided analyzed environmental parameters reports for each study to study director also maintained the environmental parameters in experimental rooms and instruments for experiments

**2) Management of NABL (Basic Composite Medical Laboratory) Facility**

SAIF Division Implementing and maintaining NABL, QCI India guidelines for lab equipment and lab environment to maintain NABL accreditation for Basic Composite Medical Laboratory

- Technical specification preparation, verification, Installation & Commissioning of new NABL Lab equipment
- Calibration of equipment (10 nos.) as per NABL guidelines
- Monitoring & maintaining the lab environment conditions (Relative Humidity & Temperature) and preparing monthly environmental reports of analysed data
- Conducting quarterly preventive maintenance/ performance check of NABL equipment (10 nos.) and report preparation
- Economical repair and maintenance of sophisticated NABL equipment
- Prepared following controlled NABL documents
  - o Standard Operating Procedure (SOP) related to NABL equipment and environmental parameters control (2 nos.)
  - o Mater equipment/Calibration List (14 Nos. of NABL equipment)
  - o Unique Identity Tag (14 Nos. of equipment)

**3) Management of Instruments**

Instrumentation unit provides efficient and economical repair, maintenance and upkeep of different sophisticated Analytical, Biomedical, Electronics and Laboratory equipment to all labs of CSIR-CDRI. Due to non-availability of imported components/spares, indigenous substitute was used to ensure the smooth functioning of equipment.

- Technical specification verification was carried out for the procurement of state of the art new equipment
- Unit helped the user scientists to prepare broad based technical specification and to choose right equipment to suit their application
- To identify the instruments either for their retention or disposal OFF.

During the year, Instrumentation unit carried out special drive throughout the year for inspection of about 1200 nos. of nonfunctional equipment of different labs, Director CSIR-CDRI constituted Repair/Condemnation committee (Er. Manoj Kr. Rawat, Chairperson, Er. Sanjay Kumar, Er. Jeevan Pandey and Er. K. B. Thapa). The actions taken by the committee are as follows.

- The committee completed inspection of about 1200 nos. of non-functional equipment from 79 nos. of different labs
- Committee in-house repaired about 410 nos. of non-functional equipment without involving any extra cost
- Committee given discard reports for about 395 nos. of non-functional equipment after thorough inspection

- Committee given reports to repair from company for about 183 nos. of specialized non-functional equipment
- Committee refers about 212 nos. of non-functional equipment to concerned section for repair

**4) Facility Management**

- As common facility management coordinating maintenance/repair of drinking water purification systems (30 nos.) installed at common places and other common facility of the Institute

**(Top row; Left to Right)** Mr. Ram Karan, Mr. Sanjay Kumar, Mr. Kul Bahadur Thapa, Mr. Kamlesh Singh

**(Front row; Left to Right)** Er. Manoj Kumar Rawat and Dr. Koneni V. Sashidhara

## Engineering Services

The Laboratory Engineering Services Division of CSIR-CDRI comprises three sections - Civil, Electrical, and Refrigeration & Air-conditioning. The division's primary objective is to maintain the existing infrastructure and develop new facilities.

CSIR-CDRI has four campuses, each with its own unique features. Here's a brief overview of each of them:

1. The new campus of CSIR-CDRI covers an area of 248395.56 square meters and comprises six R&D blocks (with 144 labs), an animal house for experimentation, a library building, an administrative block, a building for purchase and engineering services, a reception building, an electric substation, an A.C. plant, and a pump house. The campus also has a guest house, hostels for research students (both boys and girls), staff quarters, a club, a dispensary, a cafeteria, a gym, and a crèche. Most of the buildings on the campus are ten years old.
2. CSIR-CDRI's old campus spans 22784.72 square meters and is primarily used for breeding animals, with supporting facilities. Most of the structures on the campus are 70 years old.
3. The CSIR-Scientist Apartment is located in the Aliganj area of Lucknow and covers an area of 42219.00 square meters. The campus mainly consists of temporary housing for employees and students, including a Guest House in the city center. The majority of the buildings on the campus are over 35 years old.
4. The CSIR-Dispensary, located in Nirala Nagar, Lucknow, covers an area of 1513.12 square meters. The campus provides essential medical facilities to the staff and pensioners of the CSIR labs in Lucknow and is conveniently located in the city's central area.

**(Left to Right)** Er. Mohit K. Shukla, Mr. Madhukar Saroj, Mr. Brahma Singh, Er. Kamal Jain and Mr. Sidho Hembrom

The Engineering Services Division is responsible for maintaining, renovating, and constructing buildings on all the above campuses. Here's a list of the major works completed by the division in the year 2023-2024:

- Installation and commissioning of a new 200 TR HVAC chiller to cater to the Animal House facility located at the Old campus
- Processed the proposal to install an additional SPV generation capacity of 800 KWp under the RESCO model
- Installation of LED lights and BLDC fans throughout the new campus to achieve better energy efficiency
- Electrical renovation of the Breeding Unit at the Animal House facility, Old campus
- Renovation of electrical wiring at the Scientist Apartments, Sector-K, Aliganj
- Installation and commissioning of a new 630 KVA transformer at the Old campus substation
- Miscellaneous jobs were carried out on campus, given the proposed visit of the Honorable Minister
- S & T in the Plaza area, Hall No. 2, the Auditorium and main porch, *etc.*
- Renovation works for wardrobes and cupboards in the Residential colony of the New campus
- Repairs work on the façade of the administration building.
- Upgradation work of Radioactive Facility
- Miscellaneous jobs carried out on the campus through Running Annual item rate contract

Administration front upgradation and decoration

The new 200 TR HVAC chiller at the Old campus

# Note

Section
III

# Research Output

Redox Biology
Volume 65, September 2023, 102833

# Loss of PERK function promotes ferroptosis by downregulating SLC7A11 (Syster colorectal cancer

Krishan Kumar Saini [a, b], Priyank Chaturvedi [a], Abhipsa Sinha [a], Manish Prat
Khan [a], Ayushi Verma [a], Mushtaq Ahmad Nengroo [a], Saumya R
Sameer Srivastava [c], Jayanta Sarkar [a, b],

# Musashi-2 causes cardiac hypertrophy and he mitochondrial dysfunction through destabiliz mRNA

Sandhya Singh [1] · Aakash Gaur [1,2] · Rakesh Kumar Sharma [2,3] · Renu K
Ayushi Devendrasingh Chaudhary [1,2] · Pankaj Prasun [1] · Priyanka Par
Kumaravelu Jagavelu [1,2] · Pragya Bharati [1,2] · Kashif Hanif [1,2] · Pragya
Shashi Kumar Gupta [1,2]

International Journal of Biological Macromolecules
Volume 253, Part 7, 31 December 2023, 127541

# The *Saccharomyces cerevisiae* SR protein Npl3 interacts with hyperphosphorylated CTD of RNA Polymerase II

Adity Gupta [a, b], Ashutosh Kumar [c, 1], Neha Singh [a], Nikita Sudarshan [a, b],
Kam Y.J. Zhang [c, 2], Md. Sohail Akhtar [a, b]

From the journal:
Green Chemistry

## A scalable and eco-friendly total synthesis of poly(A Olaparib† ‡

Check for updates

Indranil Chatterjee [a], Deblina Roy [a] and Gautam Panda [*ab]

## dium-Catalyzed Enantioselective Allylic Substitution of Vinylcyclopropan

t Singh Adhikari, Soumen Pandit, Ruchir Kant, and Nilanjana Majumdar*

ite this: *ACS Catal.* 2023, 13, 9, 6261−6267
April 21, 2023

Article Views 3451 | Altmetric 14 | Citations 2

LEARN ABOUT THESE METRICS

From the journal:
Journal of Materials Chemistry B

## A new class of teraryl-based AIEgen for highly selective imaging of intracellular lipid droplets and its detection in advanced-stage human cervical cancer tissues†

CHEMISTRY AN ASIAN JOURNAL
ACES Asian Chemical Editorial Society
Research Article

# Metal-free $sp^2$-C7–H Borylation of Tryptophan Containing Peptides and Late-stage Modification

Rachana Meena, Shashank Shekhar, Shabina B. A
Dr. Damodara N. Reddy

Ravi Prakash Vats [ac] Sakshi P

promising antiplasmo inflammatory agents

Alka Raj Pandey [a, f], Suriya Pratap Singh [a], Princ
Smriti Srivastava [c], Kanchan Yadav [b, f], Ramesh
Sristi Agrawal [d, f], Sachin Nashik Sanap [d, f], Rabi
Manoj Kumar Barthwal [c, f], Koneni V. Sashidhara

European Journal of Medicinal Chemistry
Volume 261, 5 December 2023, 115863

Research paper

# Design, synthesis, and biological evaluation of quinoline-piperazine/pyrrolidine derivatives as possible antileishmanial agents

Sarita Katiyar [a, e, 1], Karthik Ramalingam [b, 1], Abhishek Kumar [a], Alisha Ansari [a, e],
Amol Chhatrapati Bisen [c, e], Garvita Mishra [f], Sachin Nashik Sanap [c, e], Rabi Sankar Bhatta [c],
Neeraj Goyal [b], Koneni V. Sashidhara [a, d, e]

International Journal of Biological Macromolecules
Volume 252, 1 December 2023, 126459

# *Mycobacterium tuberculosis* Rv2324 is a multifunctional feast/famine regulatory protein involved in growth, DNA replica and damage control

Shikha Dubey [a, c], Rahul Kumar Maurya [b], Sonal Shree [a, d, 1], Sanjay Kumar [a, c], Farheen Ja
Manju Yasoda Krishnan [b], Ravishankar Ramachandran [a, c]

# 1 Publications

**LIST OF PUBLICATIONS (2022)**

*(Not included in the previous year Annual Report due to incomplete Citation)*

1. Kushavah U, Panigrahi L, Ahmed S and Siddiqi MI. Ligand-Based *In Silico* Identification and Biological Evaluation of Potential Inhibitors of Nicotinamide N-methyltransferase. **Molecular Diversity 27(3), 1255-1269.**
2. Manhas RS, Tiwari H, Noor M, Ahmed A, Vishwakarma J, Tripathi RBM, Ramachandran R, Madishetti S, Mukherjee D, Chaubey A and Nargotra A. Setomimycin as a Potential Molecule for COVID-19 Target: *In Silico* Approach and *In Vitro* Validation. **Molecular Diversity 27(2), 619-633.**
3. Parwez S, Panigrahi L, Ahmed S and Siddiqi MI. Machine Learning-Based Predictive Modeling, Virtual Screening and Biological Evaluation Studies for Identification of Potential Inhibitors of MMP-13. **Journal of Biomolecular Structure & Dynamics 41(15), 7190-7203.**
4. Sahoo SK, Ommi O, Maddipatla S, Singh P, Ahmad MN, Kaul G, Nanduri S, Dasgupta A, Chopra S and Yaddanapudi VM. Isoxazole Carboxylic Acid Methyl Ester-Based Urea and Thiourea Derivatives as Promising Antitubercular Agents. **Molecular Diversity 27(5), 2037-2052.**
5. Shukla V, Bajpai V, Singh P, Rai P, Khandelwal N, Gaikwad AN, Singh B and Kumar B. Identification and Quantification of Phytochemicals of *Chamaecostus cuspidatus* (Nees & Mart.) Cdspecht & Dwstev and *Cheilocostus speciosus* (J. Koenig) Cdspecht by LC-MS Techniques and their *In-Vitro* Anti-Adipogenic Screening. **Natural Product Research 37(14), 2461-2465.**
6. Singh P, Ishteyaque S, Prajapati R, Yadav KS, Singh R, Kumar A, Sharma S, Narender T and Mugale MN. Assessment of Antidiabetic Effect of 4-HIL in Type 2 Diabetic and Healthy Sprague Dawley Rats. **Human & Experimental Toxicology 41**
7. Tiwari D, Srivastava G, Indari O, Tripathi V, Siddiqi MI and Jha HC. An *In-Silico* Insight into The Predictive Interaction of Apolipoprotein-E with Epstein-Barr Virus Proteins and Their Probable Role in Mediating Alzheimer's Disease. **Journal of Biomolecular Structure & Dynamics 41(18), 8918-8926.**

**LIST OF PUBLICATIONS (2023)**

| | |
|---|---|
| Total Number | 275 |
| Average Impact Factor | 4.80 |
| Publications with >10 Impact Factor | 9 |
| Publications with >5 Impact Factor | 102 |

1. Abdulkareem AO, Tiwari P, Lone ZR, Iqbal H, Gupta S, Jha RK, Chanda D, Jagavelu K and Hanif K. Ormeloxifene, A Selective Estrogen Receptor Modulator, Protects Against Pulmonary Hypertension. **European Journal of Pharmacology 943, 17555**
2. Acharya TK, Pal S, Ghosh A, Kumar S, Kumar S, Chattopadhyay N and Goswami C. TRPV4 Regulates Osteoblast Differentiation and Mitochondrial Function That are Relevant for Channelopathy. **Frontiers in Cell and Developmental Biology 11, 1066788.**
3. Adhikari AS and Majumdar N. Unconventional Reactivity of a Grubbs Catalyst: Hydroalkylation Overriding Metathesis. **Organic Letters 25, 8611.**
4. Adhikari AS, Pandit S, Kant R and Majumdar N. Iridium-Catalyzed Enantioselective Allylic Substitution of Vinylcyclopropanes by Carboxylic Acids. **ACS Catalysis 13(9), 6261-6267.**
5. Aggarwal C, Ramasamy V, Garg A, Shukla R and Khanna N. Cellular T-Cell Immune Response Profiling by Tetravalent Dengue Subunit Vaccine (DSV4) Candidate in Mice. **Frontiers in Immunology 14, 1128784.**
6. Agrawal S, Bisen AC, Biswas A, Jaiswal S, Choudhury AD, Gupta S, Narender T and Bhatta RS. UHPLC Method for Quantification of Bioactive Components in Fenugreek Herbal Preparations. **Revista Brasileira De Farmacognosia-Brazilian Journal of Pharmacognosy 33, 1031.**
7. Agrawal S, Bisen AC, Biswas A, Sanap SN, Verma SK, Kumar M, Jaiswal S, Kumar A, Narender T and Bhatta RS. Simultaneous Pharmacokinetic Assessment of Phytopharmaceuticals in Fenugreek Extract using LC-MS/MS in Sprague-Dawley Rats. **Biomedical Chromatography 37, (5), e5600.**
8. Agrawal S, Bisen AC, Sanap SN, Biswas A, Choudhury AD, Verma SK and Bhatta RS. LC-MS/MS based Quantification of Steroidal Biomarkers in Polycystic Ovary Syndrome Induced Rats. **Journal of Pharmaceutical and Biomedical Analysis 234, 115484.**
9. Agrawal S, Sanap SN, Bisen AC, Biswas A, Choudhury AD, Verma SK, Jaiswal S, Narender T and Bhatta RS. Preclinical Pharmacokinetics of 4-Hydroxy Isoleucine using LC-MS/MS: A Potential Polycystic Ovary Syndrome Phytopharmaceutical Therapeutics. **Bioanalysis 15 (13), 711-725.**
10. Ahmad MN, Dasgupta A and Chopra S. Monobactam Treatment of Multidrug-Resistant Enterobacteriaceae

Infections. **Drugs of the Future 48(2), 81-91.**

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14. Ali K and Panda G. Transition-Metal-Free Multicomponent Approach to the Regioselective Synthesis of Highly Substituted N-Alkylpyrazoles. **Chemistry-An Asian Journal 18(4), e202201129.**

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20. Ansari SB, Kamboj S, Ramalingam K, Meena R, Lal J, Kant R, Shukla SK, Goyal N and Reddy DN. Design and Synthesis of N-Acyl and Dimeric N-Arylpiperazine Derivatives as Potential Antileishmanial Agents. **Bioorganic Chemistry 137, 106593.**

21. Antonouli S, Di VN, Messini C, Daponte A, Rajender S and Anifandis G. A Comprehensive Review and Update on Human Fertility Cryopreservation Methods and Tools. **Frontiers in Veterinary Science 10, 1151254.**

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**Neuropharmacology 21(4), 867-889.**

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Biofilm of Methicillin Resistant *S. aureus*. **Bioorganic Chemistry 134, 106440.**

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# 2 Patents

## 2.1 Patent Applications Filed in India

**Patent Application No.** 202311028947 **Date of Filing:** 20-Apr-23

**Title: NOVEL SUBSTITUTED AMINOPYRIDINES AS 5-HYDROXYTRYPTAMINE RECEPTOR MODULATORS AND USES THEREOF**

**Inventors:** ATUL GOEL, PREM NARAYAN YADAV, PARIMAL MISRA, SHACHI MISHRA, JAGRITI SINGH, SAJIYA PARVEEN, ANKITA MISHRA, ANNU YADAV, WAHAJUDDIN, SWATI CHATURVEDI

**Patent Application No.** 202311053048 **Date of Filing:** 07-Aug-23

**Title: LIVE GENETICALLY ATTENUATED PARASITE AS MALARIA VACCINE**

**Inventors:** SATISH MISHRA, SUNIL KUMAR NARWAL, ANKIT GHOSH, AKANCHA MISHRA

**Patent Application No.** 202411004626 **Date of Filing:** 23-Jan-24

**Title: SMALL MOLECULES TARGETING PCSK9-MEDIATED DYSLIPIDEMIA**

**Inventors:** AJAY KUMAR SRIVASTAVA, MANOJ KUMAR BARTHWAL, IMRAN SIDDIQI, MOHAMMAD WAHAJUDDIN, MANISH KUMAR CHOURASIA, SRIKANTA KUMAR RATH, MANJU, ANAMIKA YADAV, AMIT KUMAR, HEENA AGARWAL, GAURAV SHARMA, NIDHI RAJPUT, SMRITI, SAHAHUDDIN AHMAD, SHAGUN KRISHNA, SANDEEP KUMAR SINGH, DEEPAK SHARMA

**Patent Application No.** 202411007892 **Date of Filing:** 05-Feb-24

**Title: QUINOLINE-TRIAZOLE DERIVATIVES AS POTENTIAL ANTI-FILARIAL AGENTS**

**Inventors:** KONENI VENKATA SASHIDHARA, MRIGANK SRIVASTAVA, PRABHAT RANJAN MISHRA, SARITA KATIYAR, SHIKHA MISHRA, ABHISHEK KUMAR, AVIJIT KUMAR BAKSHI, RUCHI JHA

**Patent Application No.** 202411019816 **Date of Filing:** 15-Mar-24

**Title: AMINO ACIDS BASED POLY(ADP-RIBOSE) POLYMERASE (PARP) INHIBITORS, PROCESS FOR PREPARATION AND USE THEREOF**

**Inventors:** GAUTAM PANDA, SAUMYA RANJAN SATRUSAL, INDRANIL CHATTERJEE, SOUVIK BARMAN, KASIM ALI, SACHIN KUMAR, SUPRIYA SINHA, SANJEEV MEENA, JIAUR R GAYEN, AAMIR NAZIR, SMRATI BHADAURIA, DIPAK DATTA

**Patent Application No.** 202411022451 **Date of Filing:** 22-Mar-24

**Title: ASYMMETRIC RING OPENING OF VINYL AZIRIDINES BY CARBOXYLIC ACIDS**

**Inventors:** NILANJANA MAJUMDAR, SURESH KUMAR, SOUMEN PANDIT, AMIT SINGH ADHIKARI

## 2.2 Patents Granted in India

**Patent No.** 432040 **Date of Grant:** 17-May-23

**Title: A FORMULATION USEFUL FOR DELIVERY OF NEURO PROTECTING AGENT**

**Inventors:** ANIL KUMAR DWIVEDI, HAFSA AHMAD, KIRAN KHANDELWAL, RAJENDER SINGH SANGWAN, NEELAM SINGH SANGWAN, JIAUR RAHAMAN GAYEN, SARIKA, SMRATI BHADUARIA, SPS GAUR, VIVEK V BHOSALE, SRIKANTA KUMAR RATH, SHARAD SHARMA, RAKESH SHUKLA

**Patent No.** 436391 **Date of Grant:** 30-Jun-23

**Title: PYRANONE FUSED AZA-HETEROCYCLIC FLUORESCENT DYES USEFUL FLUORESCENT PROBES.**

**Inventors:** ATUL GOEL, ASHUTOSH RAGHUVANSHI, AJAY KUMAR JHA, SHALINI DOGRA, PREM NARAYAN YADAV, ANANT JAISWAL, MANOJ KUMAR BARTHWAL

**Patent No.** 440383 **Date of Grant:** 25-Jul-23

**Title: NOVEL COMBINATION KIT FOR TREATMENT OF MALARIA**

**Inventors:** RENU TRIPATHI, PRABHAT RANJAN MISHRA, PANKAJ DWIVEDI, HEMLATA DWIVEDI, SUNIL KUMAR SINGH, SUNIL KUMAR PURI, ANIL KUMAR DWIVEDI

**Patent No.** 452004 **Date of Grant:** 15-Sep-23

**Title: A SHORT CATIONIC PEPTIDE WITH BROAD-SPECTRUM ACTIVITY AS A POTENT ANTIBACTERIAL AND AS AN ADJUVANT FOR CONVENTIONAL ANTIBIOTICS AND THEREOF**

**Inventors:** SANDEEP VERMA, SIDHARTH CHOPRA, APURVA PANJLA, GRACE KAUL, MANJULIKA SHUKLA

**Patent No.** 493976 **Date of Grant:** 03-Jan-24

**Title: RECOMBINANT PROTEIN FOR CANCER DETECTION**

**Inventors:** MONIKA SACHDEV, PARMITA KAR, SAURABH KUMAR, DEEPSHIKHA TEWARI, MADAN LAL BHATT, REKHA SACHAN

**Patent No.** 516610 **Date of Grant:** 28-Feb-24

**Title: PHARMACEUTICAL COMPOSITION FOR THE PREVENTION AND/OR TREATMENT OF BONE RELATED DISORDERS**

**Inventors:** RITU TRIVEDI, PRABHAT RANJAN MISHRA, SULEKHA ADHIKARY, NASEER AHMAD, DHARMENDRA CHOUDHARY, NARESH MITTAPELLY, SUDHIR KUMAR, KAPIL DEV, RAKESH MAURYA

## 2.3 Patent Applications Filed in Foreign Countries

**US Patent Application No**. 18/267643 **Date of Filing**: 15-Jun-23

**Title: SMAC MIMETICS FOR TREATMENT OF CANCER AND PROCESS FOR PREPARATION THEREOF**

**Inventors:** WAHAJUL HAQ, RAFAT ALI, AKHILESH SINGH, MUSHTAQ AHMAD NENGROO, ROSHAN KATEKAR, GAJENDRA SINGH, JAYANTI VAISHNAV, MOHAMMAD AFSAR, MANOHAR SINGH, SRIKANTA KUMAR RATH, DIPANKAR KOLEY, DURGA PRASAD MISHRA, RAVISHANKAR RAMACHANDRAN, RAVI SANKAR AMPAPATHI, JIAUR RAHAMAN GAYEN, DIPAK DATTA

**Canada Patent Application No**. 3205456 **Date of Filing:** 15-Jun-23

**Title: SMAC MIMETICS FOR TREATMENT OF CANCER AND PROCESS FOR PREPARATION THEREOF**

**Inventors:** WAHAJUL HAQ, RAFAT ALI, AKHILESH SINGH, MUSHTAQ AHMAD NENGROO, ROSHAN KATEKAR, GAJENDRA SINGH, JAYANTI VAISHNAV, MOHAMMAD AFSAR, MANOHAR SINGH, SRIKANTA KUMAR RATH, DIPANKAR KOLEY, DURGA PRASAD MISHRA, RAVISHANKAR RAMACHANDRAN, RAVI SANKAR AMPAPATHI, JIAUR RAHAMAN GAYEN, DIPAK DATTA

**Japan Patent Application No**. 2023-536845 **Date of Filing:** 16-Jun-23

**Title: SMAC MIMETICS FOR TREATMENT OF CANCER AND PROCESS FOR PREPARATION THEREOF**

**Inventors:** WAHAJUL HAQ, RAFAT ALI, AKHILESH SINGH, MUSHTAQ AHMAD NENGROO, ROSHAN KATEKAR, GAJENDRA SINGH, JAYANTI VAISHNAV, MOHAMMAD AFSAR, MANOHAR SINGH, SRIKANTA KUMAR RATH, DIPANKAR KOLEY, DURGA PRASAD MISHRA, RAVISHANKAR RAMACHANDRAN, RAVI SANKAR AMPAPATHI, JIAUR RAHAMAN GAYEN, DIPAK DATTA

**Brazil Patent Application No**. 1120230121108 **Date of Filing:** 16-Jun-23

**Title: SMAC MIMETICS FOR TREATMENT OF CANCER AND PROCESS FOR PREPARATION THEREOF**

**Inventors:** WAHAJUL HAQ, RAFAT ALI, AKHILESH SINGH, MUSHTAQ AHMAD NENGROO, ROSHAN KATEKAR, GAJENDRA SINGH, JAYANTI VAISHNAV, MOHAMMAD AFSAR, MANOHAR SINGH, SRIKANTA KUMAR RATH, DIPANKAR KOLEY, DURGA PRASAD MISHRA, RAVISHANKAR RAMACHANDRAN, RAVI SANKAR AMPAPATHI, JIAUR RAHAMAN GAYEN, DIPAK DATTA

**Patent Application No.** PCT/IN2023/050611 **Date of Filing:** 24-Jun-23

**Title: BETA CARBOLINE ANALOGUES AS SELECTIVE AND BIASED KAPPA OPIOID RECEPTORS AGONISTS FOR TREATING VARIOUS ASSOCIATED PATHOPHYSIOLOGICAL CONDITIONS**

**Inventors:** SANJAY BATRA, PREM NARAYAN YADAV, VEENA YADAV, LALAN KUMAR, SHALINI DOGRA, POONAM KUMARI, AJEET KUMAR, ADILAKSHMI VUTLA

**Australia Patent Application No.** 2021399292 **Date of Filing:** 26-Jun-23

**Title: SMAC MIMETICS FOR TREATMENT OF CANCER AND PROCESS FOR PREPARATION THEREOF**

**Inventors:** WAHAJUL HAQ, RAFAT ALI, AKHILESH SINGH, MUSHTAQ AHMAD NENGROO, ROSHAN KATEKAR, GAJENDRA SINGH, JAYANTI VAISHNAV, MOHAMMAD AFSAR, MANOHAR SINGH, SRIKANTA KUMAR RATH, DIPANKAR KOLEY, DURGA PRASAD MISHRA, RAVISHANKAR RAMACHANDRAN, RAVI SANKAR AMPAPATHI, JIAUR RAHAMAN GAYEN, DIPAK DATTA

**Patent Application No.** PCT/IN2023/050682 **Date of Filing:** 12-Jul-23

**Title: SUBSTITUTED 3-METHYLBENZO[D]THIAZOL-3-IUM COMPOUNDS AND USE THEREOF**

**Inventors:** ATUL GOEL, SAJIYA PARVEEN, KUNDAN SINGH RAWAT, SHRADHA GOENKA

**European Patent Application No**: 21906012.6 **Date of Filing:** 13-Jul-23

**Title: SMAC MIMETICS FOR TREATMENT OF CANCER AND PROCESS FOR PREPARATION THEREOF**

**Inventors:** WAHAJUL HAQ, RAFAT ALI, AKHILESH SINGH, MUSHTAQ AHMAD NENGROO, ROSHAN KATEKAR, GAJENDRA SINGH, JAYANTI VAISHNAV, MOHAMMAD AFSAR, MANOHAR SINGH, SRIKANTA KUMAR RATH, DIPANKAR KOLEY, DURGA PRASAD MISHRA, RAVISHANKAR RAMACHANDRAN, RAVI SANKAR AMPAPATHI, JIAUR RAHAMAN GAYEN, DIPAK DATTA

**US Patent Application No.** 18/565911 **Date of Filing:** 30-Nov-23

**Title: SMALL MOLECULE MODULATOR TARGETING A RARE HISTONE MODIFICATION, REGULATION OF ADIPOGENESIS AND PHARMACEUTICAL FORMULATION THEREOF**

**Inventors:** TAPAS KUMAR KUNDU, ADITYA BHATTACHARYA, SOURAV CHATTERJEE, SASHIDHARA KONENI VENKATA, SURIYA PRATAP SINGH, PRABHAT RANJAN MISHRA, AAMIR NAZIR, RAJDEEP GUHA

**European Patent Application No**: 22815524.8 **Date of Filing:** 02-Jan-24

**Title: SMALL MOLECULE MODULATOR TARGETING A RARE HISTONE MODIFICATION, REGULATION OF ADIPOGENESIS AND PHARMACEUTICAL FORMULATION THEREOF**

**Inventors:** TAPAS KUMAR KUNDU, ADITYA BHATTACHARYA, SOURAV CHATTERJEE, SASHIDHARA KONENI VENKATA, SURIYA PRATAP SINGH, PRABHAT RANJAN MISHRA, AAMIR NAZIR, RAJDEEP GUHA

# 3 Papers Presented in Scientific Conventions

**Preclinical Animal Models and Available Alternatives, CSIR-CDRI, Lucknow, April 24, 2023**

- Preparation and Optimisation of Dry Powder of *M. abscessus* for Aerosol Challenge via Inhalation for Developing Non-Tubercular Lung Disease Model. *Verma K, Garg T, Roy T, Reddy DVS, Shafi H, Ahmed N, Raman SK, Dasgupta A, Amit Misra*

**Global Indian Young Scientists Research and Innovation Conference, New Delhi, May 31- June 1, 2023**

- Bone Fracture-Healing Property of Purified Flavonoid Enriched Fraction from *Oxystelma esculentum* with their Phytochemical Investigation using Ultra-Performance Liquid Chromatography-Mass Spectrometry. *A P, Sharma K, Singh Y, Mishra DK, Singh D, Sanjeev Kanojiya*

**11th India Alliance Annual Conclave, July 15, 2023**

- Strengthening Research Management in Academic Institutions. *Bhawana George, Raju SR, Kulkarni AP*

**Indo-French Workshop on Infectious Diseases ICGEB, New Delhi, August 24, 2023**

- A Large Low Complexity Region Confers Unique Functional Attributes to a Diverged *Plasmodium falciparum* Apicoplast Targeted Exonuclease/Flap Endonuclease. *Chatterjee T, Tiwari A, Gupta R, Saman Habib*

**National Symposium on "Cross Talk Between Animal research and Alternatives', CSIR-NEIST, Jorhat, September 8, 2023**

- *In-vitro* and *In-vivo* Study: Nrf2 and NF-□B Signaling Axis Plays a Pivotal Role in the Promotion and Progression of Liver Carcinogenesis in an Experimentally Induced Rat Model. *Verma S, Ishteyaquea S, Yadav KS, Madhav Nilakanth Mugale*

**34th Molecular Parasitology Meeting hosted by Marine Biological Laboratories (MBL) in Woods Hole, Massachusetts (MA), USA, September 17-21, 2023**

- Unique Functional Properties Are Conferred to a *Plasmodium falciparum* Apicoplast Targeted Exonuclease/Flap Endonuclease by its Large Internal Lowcomplexity Region. *Chatterjee T, Tiwari A, Gupta R, Saman Habib*
- Mitochondrial Multidrug Resistant Transporter (Mdr6) Links Isc Pathway to Cia Pathway for Fe-S Cluster Biogenesis in Cytosol in the Malaria Parasite. *Shrivastava D, Ramachandra JP, Jha A, Mitra K, Saman Habib*

**NIPER PHARMACON 2023; International Conference on New Horizons in Drugs, Devices, and Diagnostics, Hyderabad, September 14-16, 2023**

- Celastrol-Loaded Polymeric Mixed Micelles Shows Improved Antitumor Efficacy in 4T1 Bearing Xenograft Mouse Model Through Spatial Targeting. *Shalini G, Prabhat Ranjan Mishra*
- Exosome Coated Quantum Dots to Target and Deliver the Anticancer Drug for Treatment of Breast Tumor. *Tiwari P, Prabhat Ranjan Mishra*

**Manipal Pharmaceutics Conference (MPCON)-2023, Manipal Karnataka, September 28-30, 2023**

- Surface Modified Eudragit Nano-Therapeutic Bearing Doxorubicin and Rutin Synergistically Improves Therapeutic Outcomes in Breast Cancer Bone Metastasis**.** *Agarwal N, Prabhat Ranjan Mishra*

**XLI Meeting of Indian Academy of Neurosciences, by Jiwaji University, Gwalior, Madhya Pradesh, October 4-6, 2023**

- Role of Tgr5 in Neural Stem Cell Homeostasis. *Kaushik D, Prem N. Yadav*

**Immunocon-2023, AIIMS, New Delhi, October 5-8, 2023**

- Mechanism of Sir2 (Deacetylase Enzyme) Mediated Epigenetic Regulation of G6PDH in Manipulating Amb-Induced Oxidative Stress in Amb Unresponsive Clinical Isolates of *Leishmania donovani*. *Garvita Mishra, Riya Arora and Bidyut Purkait*
- Targeting RNA Editing Ligase-1 (Ldrel1) of *Leishmania donovani* for The Development of Novel Anti-Leishmanial Agent. *Mishra G, Siddiqui M.I, Bidyut Purkait*
- Dendritic Cell Response in Patients Exposed to SARS-Cov-2 Infection. *Rao D, Rakshit A, Roy R, Tiwari S, Pandey S, Mrigank Srivastava*
- Understanding the Role of Host and Parasite-Derived Extracellular Vesicles During Filarial Manifestation of Tropical Pulmonary Eosinophilia. *Tiwari S, Roy R, Rao D, Rakshit A, Pandey S, Mrigank Srivastava*
- Deciphering The Cross-Talk Between Innate Lymphoid Cells-Type 2 (ILC2) and Eosinophils During Tropical Pulmonary Eosinophilia. *Roy R, Tiwari S, Rao D, Rakshit A, Pandey S, Mrigank Srivastava*
- Partners in Crime: Role of Eosinophils and Migratory Dendritic Cells in the Pathogenesis of Tropical Pulmonary Eosinophilia. *Ganga L, Sharma P, Tiwari S, Satoeya N, Jha R, Mrigank Srivastava*

**XVIII J-NOST Conference for Young Researchers 2023, IISER, Pune, Maharashtra, October 10-12, 2023**

- Manganese Catalyzed Site-Selective Hydroxymethylation to 2-Pyridines and Isoquinolones via C-H Activation. *Rastogi A,*

*Dipankar Koley*

**7th International Conference on Translational Research, AIIMS, New Delhi, October 16-18, 2023**

- Triphala Ethanolic Extract Exhibits Anti-Osteoporotic Effect by Ameliorating Bone Microarchitecture in Ovariectomized SD Rats. *Singh D.P, Divya Singh*
- Identification of Novel Pyrimidine Derivative as Bone Anabolic and Fracture Healing Agent Promoting Osteogenesis via Canonical Wnt/β-Catenin Signalling. *Khanka S, Divya Singh*
- Immunomodulating Action of IL-33: Prevents Age Related Bone Loss and Memory Impairment in D-Galactose Accelerated Aging Mice Model. Kaushal S.K, *Divya Singh*
- Investigating the Resistance Mechanism for Immune Checkpoint Blockade Therapy in Breast Cancer. *Srivastava S, Kumar V, Ramakant P, Qayoom S, Dibyendu Banerjee.*
- Exosome Coated Quantum Dots to Target and Deliver the Anticancer Drug for Treatment of Breast Tumor. *Tiwari P, Prabhat Ranjan Mishra*
- Brain targeting Exosome Concocted Nanoparticles: Revolutionizing Neurological Treatment. *Rana R, Manish K. Chourasia*

**TCS 2023: 15th The Cytometry Society (TCS) Annual Conference and Workshops, AIIMS, New Delhi, October 26-29, 2023**

- Immunophenotypic and Functional Characterization of Eosinophil and Migratory Dendritic Cell Subsets during Filarial Manifestation of Tropical Pulmonary Eosinophilia. *Ganga L, Sharma P, Tiwari S, Satoeya N, Jha R, Mrigank Srivastava*

**Asian Federation of Pharmaceutical Sciences biennial meeting (Theme: Collaboration for Breakthroughs in Pharmaceutical Sciences), 2023, Hanoi, Vietnam, November 8-10, 2023**

- Dry Powder Inhalation of Lytic Mycobacteriophages in Pulmonary Tuberculosis. *Raman SK, Roy T, Verma K, Amit Misra*
- Transcriptional Induction of Suppressors of Cytokine Signaling Isoforms in Macrophages During Infection with *Mycobacterium tuberculosis* as an Immune Evasion Strategy: Scope of Intervention Via Host-Directed Therapy. *Roy T, Seth A, Raman SK, Amit Misra*

**International Conference, CD4,2023, by Institute of Pharmaceutical Science, University of Lucknow, Lucknow, Uttar Pradesh, November 21-22, 2023**

- Session chaired. *Sarika Singh*
- Multifunctional Polymeric Mixed Micelles Exhibit Enhanced Anticancer Activity in a 4T1 Xenograft Model of Mouse Through CD44 Targeting. *Shalini G, Prabhat Ranjan Mishra*
- Brain Targeted Biomimetic System Traversing Blood Brain Barrier to Treat Neurological Diseases. *Rana R, Manish K. Chourasia*
- Validated Analytical and Bioanalytical Method Development to Simultaneously Estimate Donepezil and Rutin. *Tripathi S, Rana R, Manish K. Chourasia*
- Development and Validation of a Rapid HPLC Method for Co-Esimation of Doxorubicin and Baiclaein Loaded Liposomes. *Yadav P, Manish K. Chourasia*
- Analytical UPLC Method Development and Validation for Simultaneous Quantification of Erlotinib and Quercetin: Application in Dual Drug Loaded. *Kothuri N, Manish K. Chourasia*
- Co-Delivery of Oxaliplatin and Baicalein by Folic Acid Surface-Modified Nanostructured Lipid Carrier for Effective Breast Cancer Management. *Chakradhar JVUS, Manish K. Chourasia*
- Validated Analytical UPLC Method for Simultaneous Estimation of Gefitinib and Metformin: Application in Formulation Development. *Verma S, Manish K. Chourasia*
- Metal-Free Sp2-C7-H-Borylation of Tryptophan Peptide and Stage Modification. *Meena R, Shekhar S, Ansari S B, Tiwari A, Lal J, Damodar reddy*

**Microcon 2023: Parasitology Workshop in KGMU, Lucknow, UP, November 23, 2023**

- Coordinated the workshop**.** *Niti Kumar and Saman Habib*

**4th National Biomedical Research Competition (NBR COM), 2023, by Society of Young Biomedical Scientists (SYBS), ESIC Medical College and Hospital, Alwar, Rajasthan, November 25-26, 2023**

- Musashi-2 Causes Cardiac Hypertrophy and Heart Failure by Inducing Mitochondrial Dysfunction through Destabilizing Cluh and Smyd1 mRNA. *Singh S, Gaur A, Sharma RK, Kumari R, Prakash S, Kumari S, Singh AD, Hanif K, Mitra K, Shashi Kumar Gupta*
- Longitudinal Assessment of Bleomycin-Induced Pulmonary Fibrosis by Evaluating TGF-β1/Smad2, Nrf2 Signaling and Metabolomics Analysis in Mice. *Washimkar KR, Tomar MS, Kulkarni C, Verma S, Shrivastav A, Chattopadhyay N, Madhav Nilakanth Mugale*
- Quaking Knockdown Leads to Cardiac Cachexia and Heart Failure in Mice by Altering Morf4l2 Alternative Splicing. *Kumari S, Shashi Kumar Gupta*

**Society of Young Biomedical Scientists (SYBS INDIA) – NBRCOM-2023, Rajasthan, December 9-10, 2023**

- Dry Powder Inhalation of *M. abscessus* as Inoculum for Preclinical Mouse Model of Non-Tubercular Mycobacterial Lung Disease. *Verma K, Garg T, Roy T, DVS Reddy, Shafi H, Ahmed N, Raman SK, Dasgupta A, Amit Misra*

**Indo-French Seminar on "Catalysis for Sustainability" 2023, by IISER Thiruvananthapuram, Kerala, December 10-13, 2023**

- Copper-Catalyzed Stitching of 2-Carbonyl-Anilines with 1,3-Butadienes: An Access to Pyrrolo[2,3-B] Quinoline and Its

Photophysical Studies. *Choudhary S, Gayyur, Kant R, Nayan Ghosh*

**92nd Annual meet of the Society of Biological Chemist, BITS Pilani KK Birla Goa Campus, Goa, December 18-20, 2023**

- NOD1 Activation in 3T3-L1 Adipocytes Confers Lipid Accumulation in Hepg2 Cells. *Gulzar F, Ahmad S, Singh S, Kumar P, Sharma A, Tamrakar AK*
- High Glucose Induced Expression of PRMT4 Contributes to Skeletal Muscle Atrophy in L6 Myotubes. *Kumar P, Gulzar F, Chhikara N, Ahmad S, Tamrakar AK*
- Targeting Pattern Recognition Receptor-Mediated Inflammation by Small Molecules. *Chhikara N, Gulzar F, Sashidhara KV, Tamrakar AK*
- Functional Characterization of Rv2635, A Mycobacterial Hypothetical Protein, and Its Implications in Bacterial Survival and Pathogenesis. *Chandra G, Sharma R, Ghosal D, Venugopal U, Manju Yasoda Krishnan*
- Evolutionary Indications of Antimicrobial Resistance Genes in Marine Bacteria. *Gupta P, Kishan J, Kishore R, Telang V, Arockiaraj J, Mukesh Pasupuleti*

**Novel Paradigms in Controlled Drug Delivery to Strengthen Innovation and Translation in Pharmaceutical Formulations, Lucknow, December 22, 2023**

- Mucoadhesive Gastroretentive Controlled Release Ferrous Sulphate Tablets for Addressing Iron Deficiency Anemia. *Yadav C, Negi-Sah A, Amit Misra*
- siRNA Knockdown of Suppressors of Cytokine Signaling-Host Directed Therapy of Tuberculosis. *Roy T, Seth A, Raman SK, Amit Misra*

**6th Prof. V.V. Modi Memorial lecture and Two Day International Conference on "Microbial Odyssey: Converging Biotechnology and Industry", Baroda, December 28-29, 2023**

- Synthetic Peptide Analogs against ESKAPE Pathogens: Design, Development and Evaluation. *Telang V, Latha M, Gupta P, Kishan J, Kishore R, Arockiaraj J, Mukesh Pasupuleti*

**45th World Conference on Applied Science, Engineering and Technology, Goa, December 29, 2023**

- Surface-Modified Lyotropic Crystalline Nanoconstructs Bearing Doxorubicin and Buparvaquone Target Sigma Receptors through pH-Sensitive Charge Conversion to Improve Breast Cancer Therapy. *Marwaha D, Prabhat Ranjan Mishra*
- Supramolecular Acetal-Functionalized Ph-Responsive Nanocarriers for the Targeted Delivery of Pemetrexed to Tumor Microenvironment. *Marwaha D, Prabhat Ranjan Mishra*

**National Conference on Recent Trends in Polymer & Chemical Sciences, 2023 by Mohanlal Sukhadia University, Udaipur, Rajasthan, January 5-6, 2024**

- Synthesis of Highly Substituted Isoquinolines/ Isoquinolones by Ruthenium(II)-Catalyzed Reaction of Benzyl/β-Methyl Benzyl/Benzoyl Isocyanates with Diaryl Alkynes. *Jaiswal S, Kumar A, Narender T*

**28th ISCB International Conference (ISCBC-2024), Marwadi University, Rajkot, January 8-10, 2024**

- Mir-539-3p Impairs Osteogenesis by Suppressing Wnt Interaction with LRP-6 Co-Receptor & Subsequent Inhibition of Akap-3 Signaling Pathway. *Singh D.P, Divya Singh*
- Identification of Novel Pyrimidine Derivative as Bone Anabolic and Fracture Healing Agent Promoting Osteogenesis via BMP2/SMAD1 Signalling. *Khanka S, Divya Singh*
- Immunomodulating Osteoprotective Effect of IL-33 in D-Galactose Accelerated Aging Bone Loss Condition. Kaushal S.K, *Divya Singh*

**46th All India Cell Biology Conference, Mumbai, January 10-12, 2024**

- Session Chaired by *Bhupendra N Singh*
- Session Chaired by *Raj Kamal Tripathi*
- *Plasmodium* EDP is Required for Efficient Transition from Sporozoite to Blood-Stage Infection. *Nandi R, Satish Mishra*
- Targeted Disruption of the *Plasmodium berghei* IMP4 Gene Reveals Its Critical Role in Parasite Transmission in The Mosquito. *Mehra P, Satish Mishra*

**IACR 2024, by IISER Pune, Maharashtra, January 19-22, 2024**

- Acyl-Coa Synthetase 4 (ACSL4)-Driven Modulation of Histone Acetylation Dynamics Orchestrates Triple Negative Breast Cancer Metastasis. *Sinha A, Dipak Datta*

**32nd CRSI National Symposium in Chemistry (CRSI-NSC-32), Pilani, Rajasthan, February 2-4, 2024**

- Development of Fluorescent Dyes and Quenchers for Diagnostic Applications in Patient Clinical Samples. *Gupta S, Sharma CP, Vyas A, Pandey P, Atul Goel*

**7th Nirma Institute of Pharmacy International Conference (NIPiCON 2024), Ahmedabad, February 7-9, 2024**

- Development and Optimization of Mitomycin C (MMC)-Complex Nanostructured Lipid Carriers by Quality-By Design Approach. *Rai N, Prabhat Ranjan Mishra*
- Development and Validation of a Simultaneous Analytical Method for the Estimation of the Gefitinib and Piperine in the Polymeric Microparticle Formulation. *Verma S, Manish K. Chourasia*

**Global Immunology Summit 2024, THSTI Faridabad New Delhi, NCR, February 15-17, 2024**

- IL-33 Prevents Age Related Bone Loss and Memory Impairment: Evidence in D-Galactose Accelerated Aging Mice Model. Kaushal S.K, *Divya Singh*

**International Conference on Traditional Medicine & Phytopharmaceuticals (ICTMP) & International Congress of**

**Society for Ethnopharmacology (SFEC 2024), February 16-18, 2024**

- Herbal Raw Material Authentication Based on Mass Spectrum Fingerprints Utilizing a Digital Library of Indian Medicinal Plants and their Metabolites. *Kumar A, Mishra DK, Sanjeev Kanojiya*
- Tandem Mass Spectrum Database: An Open Access MS/MS Library of Naturally Occurring Bioactive Compounds (Utility and Its Applications). *Ali M, Shukla S, Sanjeev kanojiya*
- Osteogenic Activity of Justicia Adhatoda Leaves. *Yadav S, Verma R, Richhariya M, Lakra AD, Kaushal SK, Singh D, Tripathi V, Richa Pandey*

**2nd Annual Meeting of International Society for Heart Research (Indian Section) International Academy of Cardiovascular Sciences (Indian Section), 2023, by Department of Cardiology, AIIMS, Jodhpur, Rajasthan, February 16-18, 2024**

- Identification of Novel Signaling Molecules Involved in Cardiac Remodeling and Regeneration. *Prakash S, Shashi Kumar Gupta*
- Modulation of Innate Immune Response Ameliorates Angiotension II Induced Cardiac Hypertrophy and Fibrosis. *Jaiswal S, Manoj Kumar Barthwal*

**International Conference on Bio-Technological Intervention for Health, Agriculture and Circular Economy in BioSangam, 2024, at MNNIT, Prayagraj, Uttar Pradesh, February, 23-25, 2024**

- *E. coli* as a Chasis for Lycopene Bio-Production: A Synthetic Biology Infused Whole Cell Catalysis Platform. *Prajapathi G, Kinshuk Raj Srivastava*

**One Day Seminar-Cum-Workshop on Emerging Trends in Computer Aided Drug Design, CDRI, Lucknow, February 26, 2024**

- *In silico* Approach to Deduce the Structural and Functional Characteristics of the Rv1457c, An ABC Transporter Family Protein of *Mycobacterium tuberculosis*. *Gunjan and Bhupendra N. Singh*

**National Conference on 'Recent Trends in Chemical Sciences (RETICS-2024), Sambalpur, Odisha, March, 1-3, 2024**

- New Insights into Influenza Viral Fusion. *Saurav Haldar*

**International Conference of Integrative Chemistry, Biology & Translational Medicine, Udaipur, Rajasthan, March 8-10, 2024**

- The Multifunctional Autophagy Pathway as a Potential Drug target for Malaria. *Mishra A, Varshney A, Srivastava PN, Ali SH, Satish Mishra*
- Neddylation is Essential for Malaria Transmission in *Plasmodium berghei*. *Paul P, Nayak B, Satish Mishra*
- Elucidating the Role of Base Excision Repair Enzymes LLn Organellar Genome Maintenance in The Malaria Parasite. *Shukla H, Satish Mishra*
- An Immunoinformatic Approach to Design a Multi-Epitope Vaccine Candidate for *Plasmodium falciparum* Secretory Proteins. *Nirdosh, Satish Mishra*
- Modulation of Host Response by *Plasmodium* During Liver Stage Development: A Strategy to Survive. *Chakraborty I, Paul P, Satish Mishra*
- Functional Expansion and Diversification of HSP40s in Human Malaria Parasite. *Vidyarthi S, Noorie S.N, Niti Kumar*

**International Conference on Luminescent Materials: From Fundamentals to Applications" (IcImfa-2024), Amritsar, Punjab, March 15-16, 2024**

- Development of New Fluorescent Probes for Detection of Cancer and Viral Infections. *Jaiswal SP, Sharma CP, Pandey P, Atul Goel*
- Development of New Fluorescent Dyes for Hypochlorite Ion-Sensing and Staining of Dsdna. *Gupta N, Parveen S, Atul Goel*
- Synthesis of Natural Pterocarpans and their Fluorescent Tagging for Monitoring Biological Pathways. *Pal S, Awasthi P, Atul Goel*

**8th World Cancer Congress, JNU Convention Centre, New Delhi, March 18-20, 2024**

- Exploring beyond PD-1/PD-L1: Unveiling Alternate Checkpoint Ligands in Resistant Cancer Cells. *Srivastava S, Kumar V, Ramakant P, Qayoom S, Dibyendu Banerjee.*

**3rd International Conference on "Antimicrobial Resistance, Novel Drug Discovery and Vaccine Development: Challenges and Opportunities", New Delhi, March 18-20, 2024**

- Cryptic Antimicrobial Peptides from Venom as Next Generation Novel Biotherapeutics Against WHO Priority Pathogen. *Kishore R, Telang V, Latha M, Gupta P, Kishan J, Arockiaraj J, Mukesh Pasupuleti*

# 4 Invited Lectures Delivered by Institute Scientists

**Dr. Radha Rangarajan**

- "Future of pharmaceutical innovation" in 146th Forum, entitle, 'Future of Pharmaceutical Innovation (Tailwinds and Headwinds)' organized by, Synergia Foundation, 14th April, 2023
- "Bridging ideation to translation: Solutions for antimicrobial resistance (AMR) as a paradigm" organized by, BioCyTIH, BITS, Pilani, 18th May, 2023
- "Developing drugs in India, for the world" in ASET Colloquium by, TIFR, Mumbai, 30th June, 2023
- "Transforming drug discovery and development using Artificial Intelligence" in Yusuf Hameid Workshop by, National Science Academy, New Delhi, 25th July, 2023
- "Translational research: Understanding the continuum from bench to bedside" in India Biosciences Regional Young Investigators Meeting, by CSIR-CDRI, Lucknow, UP, 14th September, 2023
- "Role of women scientists in S&T based entrepreneurship development" organized jointly by NASI, Allahabad and IHBT Palampur, 18th September, 2023
- "Traditional knowledge inspired contemporary research for affordable healthcare" in Science Summit at the 78th United Nations General Assembly, 28th September, 2023
- "Drug discovery and development: Perspectives from a publicly funded Indian organization" organized by Bill and Melinda Gates Foundation, Dakar, Senegal, West Africa, 10th October, 2023
- "The role of AI in healthcare research" organized by, UP Medical Tourism and Pharma Expo, Lucknow, 27th October, 2023
- "Addressing India's needs for new drugs" organized by, IISER, Kolkata, 3rd November, 2023
- "Nanomaterial based therapies for combating multidrug resistant infections" in International Conference on Nanomaterials in Biology, organized by IIT, Gandhinagar, 19th November, 2023
- "Drug discovery and development: an urgent need for India" in 16th Foundation day of IPC (Indian Pharmacopeia Commission), by CDSCO, Ghaziabad, 17th January, 2024
- "Drug discovery and development in India" in Indian Biophysical Society Conference, jointly organized by, University of Hyderabad and TIFR, Hyderabad, 16th March, 2023
- "Navigating the intersection of gender and science" in International Women's Day function by, CSIR-CSMCRI, Bhavnagar, 18th March, 2023

**Dr. Saman Habib**

- Panel Discussion on "Time to deliver zero malaria: invest, innovate, implement—Indian context" in ICMR-MERA Inception Day, World Malaria Day by ICMR Headquarters, New Delhi, 28th April, 2023
- "PfMDR6 as the interface between mitochondrial ISC and cytosolic CIA pathways of [Fe-S] biogenesis in the malaria parasite" in CSIR-Pasteur Institute Workshop, by CSIR-CCMB, Hyderabad, 14th -16th June, 2023
- "A tale of two transporters: [Fe-S] transport and zinc flux in organelles of the malaria parasite" in Indo-French Workshop on Infectious Diseases, by ICGEB, New Delhi, 24th August, 2023
- Invited Lecture to celebrate 50 years of the Department of Botany, Miranda House, by Delhi University, 6th October, 2023
- Workshop resource faculty, in 46th Annual Conference of Indian Association of Medical Microbiologists, by KGMU (Microcon-2023), Lucknow, 23rdNovember, 2023
- "Low complexity regions and unique functionalities in *Plasmodium falciparum* proteins" in National Centre for Biological Sciences, Bangalore, 15th December, 2023
- "Biological chemistry: Opportunities, challenges and the way forward", in 92nd Annual Meeting of the Society of Biological Chemists, From 18th -20th December, 2023

**Dr. S.K Rath**

- "Development of a phytopharmaceutical: My experience" by Biotechnology Department, Utkal University, Vanivihar, 24th July, 2023
- "Challenges in the development of a phytopharmaceutical" by Institute of Pharmaceutical Sciences, Lucknow University, Lucknow, 22nd November, 2023
- "How drugs are developed" in Science Day event by Lucknow Christian College, 28th February, 2024
- "Alternative models used in drug discovery and development" in International Conference on Alternative to Animal Experiments" by, AMITY University, Lucknow, 1st -3rd November, 2023

**Dr. Sanjay Batra**

- "Development of biased KOR agonist for managing chronic pain", in International Symposium on Global Trends in Health, Technology and Management (GTHTM-2024), 15th -17th March, 2024
- "Serendipitous discoveries with Iodine-mediated reactions" in International Conference on Catalysis (IC²), IACS, Kolkata, 11th -13th March, 2024

- "Harnessing diverse drug discovery paradigms for identification of novel bioactives" in National Conference on Recent Trends in Polymer & Chemical Sciences, by Mohanlal Sukhadia University, Udaipur, Rajasthan, 5th -6th January, 2024
- "Tips and tricks towards successful grant applications and funding opportunities" in India Biosciences Regional Young Investigators Meeting, by CSIR-CDRI, Lucknow, UP, 14th September, 2023

**Dr. Amit Misra**

- "Orally-inhaled dry powders for treatment of TB: Centinhale, second-line drugs and host-directed therapies" in 'Towards End TB: Achievements, Challenges and Future Directions', by Translational Health Sciences and Technology Institute, Faridabad, 23rd March, 2023
- "Lung macrophage-targeted host-directed therapies for TB: Small molecules, micronutrients and cytokines heal the host, but do they kill the bug?" by CSIR-Centre for Cellular and Molecular Biology, Hyderabad, 8th August, 2023
- "Host-pathogen dialectics and 'host-directed therapy' in tuberculosis", by National Centre for Cell Sciences, Bangalore, 9th September, 2023
- "Comparing and contrasting dry powder inhalations for use in COVID-19 and tuberculosis" in Conference 2023: 'Collaboration for Breakthroughs in Pharmaceutical Sciences', by Asian Federation for Pharmaceutical Sciences, Hanoi, Vietnam, 8th November, 2023
- "Dry powder inhalation for treating airborne infections: COVID-19 and tuberculosis" in 21st International Symposium on Advances in Technology and Business Potential of New Drug Delivery Systems, organized by Controlled Release Society Indian Chapter, 24th December, 2023

**Dr. Atul Goel**

- "Development of indigenous fluorescent probes for diagnostics and biomedical applications", in Institute of Advanced Molecular Genetics & Infectious Diseases (IAMGID), Lucknow University, Lucknow, 19th March, 2024
- "Development of donor-acceptor based fluorescent probes for biomedical applications" in The National Academy of Sciences, India, Mumbai Chapter, BKBC, Kalyan, Mumbai, 15th July, 2023.

**Dr. Prabhat Ranjan Mishra**

- "Challenges and prospects in the realm of precision nanomedicines", in Conference on Drug Development & Drug Delivery: An International conference (CD4), Lucknow, 21st November, 2023
- "Bridging gaps in AYUSH-based drug development through integrated approaches" in High End Workshop on the Nanotechnology in Nutraceutical Delivery, by CSIR-IHBT, Palampur, 23rd July, 2023

**Dr. Gautam Panda**

- "Chiron amino acids derived privileged scaffolds and natural products: Design, synthesis and bio evaluation towards therapeutic agents", in Institute Science lecture Series organized by NEIST Jorhat, 2nd November, 2023
- "Amino acids towards heterocycles and natural products: Ray of hope as therapeutic agents", organized by Utkal University, Bhuvneshwar, 23rd August, 2023

**Dr. T. Narender**

- Development of phytopharmaceuticals from the Indian medicinal plants" in 'Seminar on Challenges and Opportunities in the Development of Plant based Medicinal products' by NIPER, Ahmadabad, 18th July, 2023
- "Development of phytopharmaceuticals from the Indian medicinal plants" in International Conference on 'New Horizons in Drugs, Devices & Diagnostics (NIPER-PHARMACON 2023)' by NIPER, Hyderabad, 14th November, 2023
- "Recent developments in science based phytopharmaceutical drugs from Indian medicinal plants" in International Conference on 'Climate Change and Natural Resources Management for Sustainable Development (ICNS-2024), by Mizoram University, 13th March, 2024
- "Developments in phytopharmaceutical drug discovery from Indian medicinal plants" in Indian Pharmacopeia Commission, Ghaziabad, 28th March, 2024

**Dr. Manish K. Chourasia**

- "Perspectives of *nano*-sized formulations bearing chemotherapeutic agents intended for modulated therapeutic outcome" in Nano- Based Drug Delivery Systems: Recent Developments and Future Prospects by Nirmala College of Pharmacy, Kochi, Kerala, 7th October, 2023
- "Discovery and drug development" in PPDS program on 'Hands on Practice with advance techniques and instruments for nanotechnology based drug delivery system" by, Department of Pharmaceuticals, NIPER, Hyderabad, 10th January, 2024
- "Design and characterization of nanomaterials" in Certificate course and hands-on training on "Design and Characterization of Nanomaterials, by NIPER, Raibareily, 21st July, 2023

**Dr. Divya Singh**

- "Journey of a nature-inspired small molecule in bone regeneration and repair" in Women in Academia, Research and Management of Toxicology and Health-

Wellness (WARM-TH) program, organized by IITR, Lucknow, 6th - 8th March, 2024

- "Mending the bones with nature inspired sources" in International Conference on Recent Trends in Engineering and Scineces-2024, by BIT MESRA, Ranchi, 29th -30th March, 2024

**Dr. Arun Kumar Trivedi**

- "Mechanisms underlying functional inactivation of C/EBP alpha leading to differentiation arrest in acute myeloid leukemia" in 4th Annual Research Day, by SGPGI, Lucknow, 13th December, 2023
- "Overview and application of mammalian cell cultures" in Workshop on Cell Culture, by ICAR-National Bureau of Fish Genetic Resources, Lucknow, 30th October - 8th November, 2023

**Dr. Aamir Nazir**

- "Studies on neuronal development, degeneration and repair employing transgenic *C. elegans* model" in 10th Annual Meeting of Chemical Biology Society (India), KIIT, Bhubaneswar, 24th March, 2023
- "Rethinking animal models: *C. elegans* as an ethical and effective model in biomedical research" in National Symposium on Cross Talk Between Animal research and Alternatives, by CSIR-NEIST, Jorhat, 8th September, 2023
- "Understanding neurological resilience employing *C. elegans* model: The role of glia-enriched PTR-10 in neuronal health" in Indo-German Workshop on Enabling Methodologies for Rational Design of Complex Systems, by University of Wurzburg, Germany, 12th October, 2023
- *"Caenorhabditis elegans* as an efficient model system in biomedical research" in Pre-conference workshop of 46th Annual Conference of Indian Association of Medical Microbiologists, by King George's Medical University, Lucknow, 22nd November, 2023

**Dr. Sanjeev Kanojia**

- "Digital library of Indian medicinal plants and their metabolites" (A mass spectrometry-based bioinformatics tool) organized by UGC-Human Resource Development Centre, NEHU, Shillong, 9th November, 2023

**Dr. Naseem A. Siddiqui**

- "Entrepreneurial journey: dare to dream" in World Entrepreneurs Day, organized by NIPER, Rae-Bareli, 21st August, 2023
- "Carrier opportunity for pharmacy professional" in Conference on Drug Development and Drug Delivery *i.e.* CD4-2023, by Institute of Pharmaceutical Sciences, University of Lucknow, 22nd November, 2023

**Dr. Sanjeev K Shukla**

- "Structure elucidation of natural products" in training on "Instrumentation (Data Analysis and Interpretation - LCMS & NMR), as a part of ICFRE-HRD program by Forest Research Institute (FRI), Dehradun, 14th June, 2023
- "Basics and applications of NMR spectroscopy" in Refresher Course in Chemistry (Core), organized by, Devi Ahilya University, Indore, 17th July, 2023
- "Applications of NMR based metabolomics" in International Conference on "Recent Advances in Biological, Chemical, and Pharmaceutical Sciences for Innovation in Healthcare", by Marwadi University, Rajkot, 8th January, 2024
- "Applications of NMR spectroscopy in drug discovery" in International Conference on "Paradigm Shift Towards Sustainable Growth in Chemical and Biological Sciences" by Bhakta Kavi Narsinh Mehta University, Malanka, 11th January, 2024

**Dr. Sripathi Rao Kulkarni**

- "Protection and management of intellectual property rights (IPRs)" in One Day Awareness Workshop on "INTELLECTUAL PROPERTY RIGHTS(IPR)" organized by Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur, U.P, 2nd March, 2024
- "Inventions: protection and management" in Sensitization Workshop, organized by ICAR – IISR ITMU, Lucknow, 19th February, 2024
- "Intellectual property rights (IPRs) and its role in propelling the growth of MSME sector" in "National IP Yatra -Two Days Workshop organized by ASSOCHAM, 5th -6th December, 2023
- "Understanding 'Bouddhik Sampada' and its protection" in "Rashtriya Boudhik Sampada Mahotsav (RBSM)", organized by HYGIA College of Pharmacy, Lucknow, U.P, 19th July 2023
- "Understanding 'Bouddhik Sampada' in 'Rashtriya Boudhik Sampada Mahotsav (RBSM)' organized by CSIR CIMAP and SRM University, Barabanki, U.P, 18th July, 2023
- "Intellectual property rights: National & global perspectives" in 'WORLD IP DAY 2023', organized by Institution's Innovation Council & School of Life Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow, 26th April, 2023

**Dr. Mukesh Pasupuleti**

- "Antimicrobial peptide; a component of innate immune system" organized by School of Biological Sciences, Madurain Kamaraj University, Chennai, Tamil Nadu, 20th December,2023
- "Searching the innate immune system to fight emerging new pathogenic infections" organized by Department of

Microbial Technology, Madurai Kamaraj University, on 27th November, 2023

**Dr. Satish Mishra**

- "The multifunctional autophagy pathway as a potential drug target for malaria" organized by Pacific University, Udaipur, Rajasthan, 9th March, 2024

**Dr. Vivek Vidyadhar Bhosale**

- "HIPPA-new, requirement to clinical study process, pharmacovigilance, safety monitoring in clinical trials" organized by Era College of Pharmacy, Era University, Lucknow, 6th February, 2024

**Dr. Tejender Thakur**

- "Computational screening of conformers for multicomponent crystal development" in 3rd Conference of Nanomechanics for Pharmaceutical Applications (NPA 2023) Lemon Tree Premier, Hitec City, Hyderabad, 16-17th December, 2023

**Dr. Niti Kumar**

- "To Fold or degrade? handholding between two machineries for proteostasis balance in the malaria parasite" in 92nd Annual meeting of Society of Biological Chemist, 18th December, 2023

**Dr. Rajdeep Guha**

- "Designing and execution of animal experiments" in the National Symposium and Workshop on Crosstalk Between Animal Research and Alternatives by CSIR-North East Institute of Science and Technology, Jorhat, Assam, 7th -9th September, 2023

**Dr. Ashish Awasthi**

- "Myths *vs* realities in statistics and epidemiology" in International Symposium on Advances in Health Sciences organized by Deshbandhu College, University of Delhi, 12th Feb 2024

**Dr. Rahul Shukla**

- "Do SARS-CoV-2 antibodies enhance dengue virus pathogenesis?" organized by, International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi,17th June, 2023
- "Antibody-dependent enhancement (ADE): The dark side of dengue vaccine development" organized by General Sir John Kotelawala Defence University Kandawala Rd, Ratmalana, 10390, Sri Lanka, 7th September, 2023

**Dr. Sourav Haldar**

- "New insights into influenza virus biology: from single particle fusion to novel antiviral strategies" by CCMB Hyderabad,18th March, 2024

**Dr. Arun Kumar Trivedi**

- "Mechanisms underlying functional inactivation of C/EBPalpha leading to differentiation arrest in acute myeloid leukemia" in 4th Annual Research Day, by SGPGI, Lucknow,13th December, 2023

**Dr. Dibyendu Banerjee**

- "Overcoming antifungal drug resistance in the human pathogenic fungus *Candida albicans*" in the National Seminar RABB 2024, by the Department of Biochemistry, University of Lucknow, 16th March, 2024
- "Targeting the transcriptional activator of CDR genes (TAC1) of the human pathogenic fungus *Candida albicans*" Invited talk in BSB Divisional lecture, by IIT-K, Kanpur, 21st February, 2024

**Dr. Kumaravelu J**

- "Myocardial infarction induced hypoxia regulates cardiac lymphangiogenesis" in International Conference titled "Global Disease Biology: Perspective Biotechnology, by University of Burdwan, Burdwan, West Bengal, 15th -17th March, 2024

**Dr. Madhav Nilakanth Mugale**

- "New chemical entity (NCE): Pre-clinical and regulatory toxicity studies in drug development" in Veterinary Pathology Congress - 2023 XXXX Annual Conference of the Indian Association of Veterinary Pathologists XIV Annual Meeting of the Indian College of Veterinary Pathologists National Symposium "Advances in veterinary pathology for diagnosis and control of emerging diseases of livestock and poultry" by IVRI, Bareilly, Uttar Pradesh, 20th - 22nd December, 2023
- "Review and interpretation of animal pharmacology, vaccine and recombinant products safety studies/ toxicology data" in The Brain Storming Session series "Reverse Pharmacology" by Department of Veterinary Pharmacology & Toxicology Mathura veterinary college, Mathura, UP, 13th February, 2024
- "Exploring the hepatoprotective and neuroprotective potential of natural compounds" in National Conference by Mahayogi Gorakhnath University, Gorakhpur, Uttar Pradesh, 15th December, 2023

**Dr. Damodar N Reddy**

- **"**Drug development process: Efforts towards combating multidrug resistance bacterial pathogens using drug editing technology" in an invited talk organized by Chemistry Department, St. Joseph's University, Bangalore, 23rd January, 2024

**Dr. Nilanjana Majumdar**

- "Unactivated carboxylic acids in catalytic asymmetric ring opening reactions" in ICOC, Goa (International Conference on Organometallics and Catalysis), 30th October to 2nd November, 2023

- "Iridium catalyst in enantioselective ring opening reactions" in IFSC (Indo-French Seminar on Catalysis) for Sustainability, by, IISER-Thiruvananthapuram,10th -13th December, 2023
- "Unactivated carboxylic acids in catalytic asymmetric ring opening reactions" in FCSB (Indo-French Seminar on Fostering Catalysis for Societal Benefit, by School of Chemistry, University of Hyderabad, 15th -17th January, 2024
- "Unactivated carboxylic acids in catalytic asymmetric ring opening reactions" in ETCS-2024 (Emerging Trends in Catalysis & Synthesis, by IIT Kharagpur (IIT KGP), 7th -9th March, 2024

**Dr. Chetan Meshram**

- "Reverse genetics approaches for the development of antiviral interventions" in VII Annual Convention and International Symposium of the Society of Veterinary Biochemists and Biotechnologists of India (SVBBI), by IVRI, Izatnagar, 14th December, 2023

**Dr. Sonia Verma**

- Invited speaker in Women in Academia, Research and Management of Toxicology & amp; Health-Wellness (WARM-TH 2024), by CSIR-IITR, 6th- 8thMarch, 2024

# 5 Networks & Inter Agency Linkages

**Projects completed / ongoing / initiated during 2023-24**

## 5.1 CSIR Mission / Thematic Projects

| Title of the Project | PI | Project Start Date | Completion Date |
|---|---|---|---|
| **Mission Mode projects (MMP)** | | | |
| PAN CSIR CANCER RESEARCH PROGRAM: Making Cancer Care Affordable | Dr. Dipak Datta | 29-06-2021 | 31-03-2025 |
| CSIR Phytopharmaceutical Mission (Phase-2) | Dr T Narender | 24-06-2021 | 31-03-2024 |
| Active Pharmaceutical Ingredients for Affordable Health Care [API-AHC] | Dr. Gautam Panda | 03-07-2023 | 31-03-2025 |
| Development of Millet Beverages/Curd with Probiotics for Healthy Ageing, Indoleamine for Anti-Anxiety /Stress and Spice Nutraceuticals, Flavours with Enhanced Protein and Micronutrient Bioavailability | Dr P N Yadav | 10-07-2023 | 31-03-2025 |
| Antiviral Mission CSIR: Discovery & Pre-clinical Development of Antivirals for COVID-19 & Other Diseases | Dr. R. Ravishankar | 08-11-2021 | 31-03-2024 |
| Progressing CSIR Molecules for Filing Investigational New Drug (IND) Application | Dr. Sanjay Batra | 09-06-2021 | 31-03-2024 |
| CSIR Jigyasa 2.0 Programme with the Concept Virtual Laboratory Integration Project (CJVL) | Dr Sanjeev Yadav | 17-08-2022 | 31-03-2026 |
| Phenome India-CSIR Health Cohort Knowledgebase | Dr. Amit Lahri | 03-08-2022 | 02-08-2027 |
| **CSIR-FIRST Scheme** | | | |
| Looking Beyond Eosinophils: Exploring the Nexus Between Migratory Dendritic Cells (migDCs) and Eosinophils in the Chaos, Complexity and Conundrum of Filarial Manifestation of Tropical Pulmonary Eosinophilia | Dr. Mrigank Srivastava | 30-12-2021 | 31-03-2024 |
| Understanding the Role Of Wat1, a Wd Repeat Protein in Regulating the Function of Pikk Family Proteins in Fission Yeast *S.Pombe* | Dr. Shakil Ahmed | 30-12-2021 | 31-03-2024 |
| **Fast Track Translation Project (FTT)** | | | |
| Subsequent New Drug Application (SNDA) Enabling Studies for Sustained for Released Corneal Targeted Anti Fungal Formulation | Dr. R S Bhatta | 14-10-2022 | 30-09-2024 |
| **Niche Creating High Science/ High Technology Projects** | | | |
| Chemical Biology Approaches Towards Dissecting Non-Canonical Protein Functions and Novel Targets in Malaria, Leishmania and Filaria Parasites | Dr. Saman Habib | 05-08-2020 | 31-03-2025 |
| Discovery of Selective KOR Ligands for the Treatment Resistant Depression and Neuropathic Pain | Dr. Prem Prakash Yadav | 05-08-2020 | 31-03-2025 |
| Multipronged Studies on Persistence and Drug Resistance in Mycobacteria | Dr. B.N. Singh | 05-08-2020 | 31-03-2025 |
| Novel and Integrative Approaches Towards Discovery of Small Molecule Therapeutics for Healthy Ageing (NISTHA) | Dr. Atul Kumar | 05-08-2020 | 31-03-2025 |
| Understanding the Mechanism of Osteopenia and Aberrant Bone Formation, and Discovery of New Targets for Skeletal Medicine (Osteo Target) | Dr. Naibedya Chattopadhyay | 05-08-2020 | 31-03-2025 |
| Modern Innovative Solutions for Environmental/ Occupational Lung Health Challenges | Dr. Kashif Hanif | 15-07-2020 | 31-03-2025 |
| **New Millennium Indian Technology Leadership Initiative Projects** | | | |
| Development of Novel Anti Stroke Phytopharmaceutical Formulation from the Roots of a Ashwagandha Variety, NMITLI-118 | Dr. Srikanta Kumar Rath | 02-11-2020 | 31-03-2024 |
| Industrially Scalable Ashwagandha (*Withania somnifera*) Charged Formulation for Better Bone Health | Dr Ritu Trivedi | 09-06-2021 | 31-03-2024 |
| **COVID** | | | |
| CSIR Multi-Centric Long Term T Cell Immune Monitoring for COVID-19 (PoV-Cov) | Dr. Amit Lahiri | 23-12-2021 | 31-03-2024 |

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|---|---|---|---|
| **Network Projects** | | | |
| CSIR Integrated Skill Initiative" Programme Phase-II | Dr Sanjeev Shukla | 16-10-2020 | 31-03-2025 |
| **CSIR-Young Scientist Award Scheme** | | | |
| Studies on the Functional Characterization of RNA Editing Ligase 1 (REL1) of *Leishmania donovani* as Drug Target | Dr. Bidyut Purkait | 02—08-2021 | 01-08-2026 |

## 5.2 CSIR-CDRI In-house Projects

| Title of the Project | PI | Project Start Date | Completion Date |
|---|---|---|---|
| Functional Characterization of Inflammatory Bowel Disease Associated Variants: Delineating Functions of Novel Genetic Loci and New Therapeutic Disease Targeting | Dr. Amit Lahiri | 11-10-2021 | 31-03-2024 |
| Identification of Natural Product Inhibitors of TRPA1 Channels to Combat Chronic Pain | Dr. Aravind Kshatri | 06-07-2023 | 31-03-2024 |
| Optimization of Novel TGR5 Selective Agonist for Post-Ischemic Cerebral Stroke Recovery | Dr. Prem N. Yadav | 06-07-2023 | 31-03-2024 |
| Identification and Characterization of Skeletal Muscle Anabolic and Anti-Muscular Atrophy and Hits Leads with GLP-IR of AdipoR Agonist Activities | Dr. Sabyasachi Sanyal | 06-07-2023 | 31-03-2025 |
| Small Molecule and Peptide Inhibitors of Sclerostin Signalling: A Promising Therapy for CKD-Induced Osteoporosis | Dr. Divya Singh | 06-07-2023 | 31-03-2025 |
| Identification of Gut Microbiome Signature in the Inflammatory Bowel Disease patients | Dr. Amit Lahiri | 06-07-2023 | 31-03-2024 |
| White to Brown Adipocyte Trans-Differentiation: Hit to Lead Optimization for Novel Specific Beta 3 Adrenergic Agonists | Dr. Anil N. Gaikwad | 06-07-2023 | 30-09-2024 |
| Killing Two Birds with One Stone: A Novel Hypoxia Mimetic for Ischemic Cerebral Stroke therapy | Dr. D. P. Mishra | 06-07-2023 | 31-03-2024 |
| Non-Invasive Early Detection of Cervical Cancer Through Immuno-Sensing of Cancer-Biomarker and HPV From Sera & Urine Samples | Dr. Monika Sachdev | 06-07-2023 | 31-03-2025 |
| Desing, Synthesis, and Evaluation of Novel Inhibitors of *Brugia malayi* Treholose 6- Phosphate Phosphatase (Bm-T6pp) As Potent Anti-Filarial Agents for the Elimination of Lymphatic Filariasis | Dr. Mrigank Srivastava | 06-07-2023 | 31-03-2024 |
| Therapeutic Targeting of Plasmodium Autophagy; Mechanistic Studies and Optimization of Identified Hits | Dr. Satish Mishra | 06-07-2023 | 31-03-2025 |
| Exploring Non-Canonical Secondary Structures (G-quadruplexes) as Alternative Targets for Malaria Intervention | Dr. Namrata Rastogi | 06-07-2023 | 30-09-2024 |
| Targeting *De Novo* Pyrimidine Biosynthesis Enzyme SHMT for the Discovery of Novel Antimalarials | Dr. Prem Prakash Yadav | 06-07-2023 | 31-03-2025 |
| Optimization of Malaria Libre hit MMV023227 for the Discovery of New Antimalarials | Dr. Prem Prakash Yadav | 06-07-2023 | 31-03-2025 |
| Design and Testing of Bacterial Peptidyl-tRNA Hydrolase Inhibitors as Broad-Spectrum Antimicrobial Agents | Dr. Ashish Arora | 06-07-2023 | 31-03-2025 |
| Generation of Well-Defined Microbial Repository To Support Drug Discovery Programs at CDRI | Dr. Mukesh Pasupuleti | 06-07-2023 | 30-09-2024 |
| Multi- Pronged Approach to Identify NDM-1 Inhibitors | Dr. Sidharth Chopra | 06-07-2023 | 31-03-2025 |
| Mucosal Drug Delivery Systems for Bacterial Vaginosis and Vulvovaginal Candidiasis | Dr. Amit Misra | 06-07-2023 | 31-03-2025 |
| Investigation on the Therapeutic Potential of Short Novel Designer Antimicrobial Peptides | Dr. Jimut kanti Ghosh | 06-07-2023 | 31-03-2025 |
| *In vitro* Screening of Small Molecule(s) Against All Four Dengue Virus Serotypes (DENV-1,-2, -3 and -4) | Dr. Rahul Shukla | 21-07-2023 | 31-03-2025 |
| Preclinical Pharmaceutics and Pharmacokinetic Studies of CDRI Candidate Drugs, Formulations and Phytopharmaceuticals | Dr. P. R. Mishra | 26-07-2023 | 31-03-2025 |

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|---|---|---|---|
| Targeting the Loop Region of Flavivirus RDRP: A Structure Based Drug Development Approach | Dr. R.K Tripathi | 08-09-2023 | 31-03-2025 |
| Development of Small Molecule Inhibitors of Chikungunya Virus | Dr. Chetan D. Meshram | 08-09-2023 | 31-03-2024 |
| Quest for Inhibitors Against Mtb KasA and DprE1 | Dr. Gautam Panda | 08-09-2023 | 31-03-2025 |
| Design and Development of Pyrazoloindole Derivatives as Novel Potential Drug Candidates for Treatment of Dengue Infection | Dr. Rahul Shukla | 08-09-2023 | 31-03-2025 |
| Development of Isoleucine Dioxygenase Mediated Fermentation Process for Production of 4-Hydroxyleucine and its Pre-Clinical Development for the Management of Polycystic Ovary Syndrome and Associated Anovulation | Dr. Kinshuk R. Srivastava | 08-09-2023 | 31-03-2024 |
| Development of Novel PDE-4 Inhibitors and Therapeutic Exploration in COPD | Dr. Baisakhi Moharana | 08-09-2023 | 31-03-2024 |
| Discovery of Hits and Leads Against Musculoskeletal Disorder | Dr. Divya Singh | 08-09-2023 | 31-03-2025 |
| Development of Assay and Screening Method for ClpP Activators | Dr. Kumaravelu Jagavelu | 08-09-2023 | 31-03-2025 |
| Discovery of Hits and Leads Against Parasitic Disease | Dr. Satish Mishra | 08-09-2023 | 31-03-2025 |
| Creation of DSIR – Common Research and Technology Development Hub (CRTDH) in the Area of Affordable Health under DSIR-CRTDH Programme Support by CSIR-CDRI | Dr. Amit Misra | 01-04-2020 | 31-03-2025 |

| Title of the Project | PI | Project Start Date | Completion Date |
|---|---|---|---|
| **Science & Engineering Research Board, Government of India** | | | |
| **Core Research Grant Scheme (CRG)** | | | |
| Elucidation of Class III CoA- Transferases Rv3272 in Virulence of *Mycobacterium tuberculosis* | Dr. J. Venkatesh Pratap | 27-02-2020 | 26-05-2023 |
| Development of Glycoconjugates Based Site Directed Fluorescent Sensor for the Detection of Bacteria | Dr. Ajay Kumar Srivastava | 26-02-2020 | 22-06-2023 |
| Organo-Photoredox Catalysis for Visible Light-Driven Synthesis of Natural/ Synthetic Medicinal Molecules | Dr. Namrata Rastogi | 03-12-2020 | 02-12-2023 |
| Structural and Functional Studies on Signaling System Associated with Bacitracin Sensing and Resistance in Multi-Drug Resistant *Staphylococcus aureus* | Dr. J. Venkatesh Pratap | 11-03-2021 | 10-03-2024 |
| Exosomes as Innate Immune Effectors: Understanding the Intricate Art of Immunomodulation by Parasite and Host Cell Released Exosomes During Filarial Manifestation of Tropical Pulmonary Eosinophilia | Dr. Mrigank Srivastava | 20-03-2021 | 19-03-2024 |
| Elucidating the Mechanism of Biogenesis and Secretion of Exosomes from Host During Visceral Leishmaniasis and their Role in Immune Evasion | Dr. Susanta Kar | 25-03-2021 | 24-03-2024 |
| Investigation on the Role of a Novel, Secreted Small Deoxyribonuclease of *Mycobacterium tuberculosis* in Pathogenesis and Immune Modulation | Dr. Y.K. Manju | 03-04-2021 | 02-04-2024 |
| Metal-Free Direct Oefination Employing Hypervalent Iodine Reagents for Rapid Access to Fluorinated Building Blocks | Dr. Kishor Mohanan | 20-12-2021 | 19-12-2024 |
| Molecular Editing, Late Stage Modification and Bio-Conjugation of Novel Antimicrobial Peptides and Antibiotics | Dr. Damodara Reddy N | 17-12-2021 | 16-12-2024 |
| The Identification of Atypical RNA Polymerase II CTD Phosphatases and their Role in mRNA Transcription | Dr. Sohail Akhtar | 31-12-2021 | 30-12-2024 |
| Targeting Nucleolin for Refining anti-neoplastic chemo- immunotherapy and Immunomodulation in B-Cell Lymphoma | Dr. Neeraj Jain | 28-01-2022 | 27-01-2025 |
| Elucidation of the Structures, Role in Survival, and Targets of the PadR family Transcriptional Factors of *Mycobacterium tuberculosis* H37Rv | Dr. Ashish Arora | 10-02-2022 | 09-02-2025 |
| Design and Synthesis of Biased Kappa Opioid Receptor Agonists for Treating Chronic Pain | Dr. Sanjay Batra | 19-03-2022 | 18-03-2025 |
| Merging Electrochemistry and Metal Catalysis: Development Towards Sustainable and Scalable Catalytic Processes | Dr. Valmik Shankar Shinde | 26-12-2022 | 25-12-2025 |

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| Development fo Asymmetric Isocyanide-Based Multi-Component Reactions (Aimcr) Towards Alkal Oid-Mimicking Scaffolds and Drugs | Dr. Ajay Kumar Srivastava | 27-12-2022 | 26-12-2025 |
| Leveraging Vinyl Azides and in Situ Generated Iminium Intermediates for the Synthesis of Cyclic/Acyclic Amines under Redox-Neutral Conditions | Dr. Nayan Ghosh | 02-01-2023 | 01-01-2026 |
| Development of Organocatalytic Photochemical Reactions and their Enantioselective Variants | Dr. Chandra Bhushan Tripathi | 09-01-2023 | 08-01-2026 |
| Investigations on the Diverse Mechanisms Involved in the Distinct Types of Neutrophil Death and their Clearance In Impacting Immune Tolerance or Inflammatory Outcome | Dr. Sachin Kumar | 11-07-2023 | 10-07-2026 |
| Deciphering the Role of Protein Neddylation in Malaria Parasite and its Targeting to Block Transmission | Dr. Satish Mishra | 11-07-2023 | 10-07-2026 |
| Rational Design, Development and Anti-Microbial Activity Evaluation of a New Class of Inhibitors of Bacterial Peptidyl-tRNA Hydrolase for Tackling AMR | Dr. Ashish Arora | 11-07-2023 | 10-07-2026 |
| Immunomodulatory Properties of Cryptic Host Defense Peptides Against Brain Residing Microglia Cells and their Potential Implications in Neurodegenerative Diseases | Dr. Mukesh Pasupuleti | 29-09-2023 | 28-09-2024 |
| Exploration of Cyclic Diaryliodonium Salts as Biarylating Agents to Generate Medicinally Relevant Biaryl Scaffolds | Dr. Malleswara Rao Kuram | 30-01-2024 | 29-01-2027 |
| Stereoselective Synthesis of Diverse Sp3-Rich Polycyclic Scaffolds: Generation of High Valued New Molecular Entities (Nmes) for GPCR Modulators | Dr. Ravindra Kumar | 23-02-2024 | 22-02-2027 |
| Investigating the Effect of Adiponectin Repetor 2 (AdipoR2) Agonism on Non Alcoholic Fatty Liver Disease (NAFLD); A PoC Study for Assessing the Potential for AdipoR2 as a Novel Therapeutic Target | Dr. Sabyasachi Sanyal | 04-03-2024 | 03-03-2027 |
| Transition Metal-Catalyzed Fluorine Insertion In Small Organic Molecules | Dr. Nilanjana Majumdar | 15-03-2024 | 14-03-2027 |
| Design and Implementation of Enzyme Like Small Scaffold as a Bifunctional Catalyst for Stereoselective Glycosylation | Dr. Pintu Kumar Mandal | 02-01-2023 | 01-01-2026 |
| **Women Excellence Award Scheme** | | | |
| A Multi-Pronged Approach to Understand the Functional Diversity of HSP40s in Human Malaria Parasite and Explore Small-Molecule Based Pharmacological Targeting | Dr. Niti Kumar | 27-03-2020 | 26-09-2023 |
| **Teachers Associate for Research Excellence Scheme (TARE)** | | | |
| Mechanistic Studies of Bacteriophage-Derived Lysins to Combat Multidrug Resistant Bacterial Pathogens | Dr. Aditi Singh | 05-11-2019 | 04-07-2023 |
| Exploring the Role of Metabolic Gene Variants in Myositis | Dr. Somali Sanyal | 22-03-2023 | 21-03-2026 |
| To Study the Role of Phytoestrogen in Modulating Gut Permeability and Bone Health: The Gut-Bones Axis | Dr. Sapna Sharma | 29-01-2027 | 28-01-2027 |
| Synthesis and *In-Vitro* Assessment of Broad Spectrum Antiviral Activities of Nucleoside Analogues | Dr. Maneesh Kumar Gupta | 08-02-2024 | 07-02-2027 |
| **Scientific and Useful Profound Research Advancement Scheme (SUPRA)** | | | |
| Anti-Gerogenic Therapy to Augment Lifespan and Health Span by Bioactive Peptides from Rasayana Herbs: Generation of PoC for the First-In-Class Ayurveda-Based Peptide Therapeutics | Dr. N. Chattopadhyay | 28-08-2020 | 18-11-2023 |
| **Science and Technology Award for Research Scheme (STAR)** | | | |
| Innate Lymphod Cells and Eosinophils: Exploring the Mystery Between a "Player " and an "Effector Cell" During the Pathogenesis of Filarial Manifestation of Tropical Pulmonary Eosinophilia | Dr. Mrigank Srivastava | 27-12-2021 | 26-12-2024 |
| **Start-up Research Grant (SRG)** | | | |
| Development of High Throughput Assay Systems for Screening of Antiviral Compounds Against Dengue and Japanese Encephalitis Viruses | Dr. Rahul Shukla | 01-11-2022 | 31-10-2024 |
| Development of *In-Vitro* and *In-Vivo* Drug Screening Platforms Against the Chikungunya Virus | Dr. Chetan Dewaji Meshram | 23-01-2024 | 22-01-2026 |
| Identification and Functional Characterization of Novel Hv1 Channel Inhibitors for Neuroprotection | Dr. Aravind Singh Kshatri | 17-02-2024 | 16-02-2026 |

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| **SERB POWER GRANT (SPG)** | | | |
| Decoding the Role of Pirh2 in Dementia of Alzheimer's Type (DAT) Related Neurodegenerative Signaling Mechanisms | Dr. Sarika Singh | 17-08-2022 | 16-08-2025 |
| Role of Nuclear mTOR: An Autonomous Modulator of Gene Expression | Dr. Smrati Bhadauria | 16-08-2022 | 15-08-2025 |
| Characterization of Key Enzymes Involved in Wedelolactone Biosynthesis from *Eclipta prostrata L.* to Enhance Secondary Metabolite Contents | Dr. Vineeta Triapthi | 10-10-2022 | 09-10-2025 |
| Transition Metal-Catalyzed Enantioselective C-X Bond Formation | Dr. Nilanjana Majumdar | 21-08-2023 | 20-08-2026 |
| **Promoting Opportunities For Women in Exploratory Research (POWER)** | | | |
| Role of Mitochondrial Sirtuins 4/5 in Aging Induced Bone Loss Conditions | Dr. Divya Singh | 27-12-2022 | 26-12-2025 |
| **Swarna Jayanti Fellowship (SJF)** | | | |
| Understanding the Role of Dynamin-Related Proteins (DRPs) in Mitochondrial Remodeling and Organelle Communication in Human Malaria Parasite | Dr. Niti Kumar | 09-02-2022 | 08-02-2027 |
| **National Post-Doctoral Fellwoship (N-PDF)** | | | |
| Bronsted-Acid Catalysed 1,3-Alkyl Migration: A Step- and Atom-Economic Synthesis of Chiral Heterocycles | Dr. Abhishek Kumar Mishra | 12-03-2022 | 11-03-2024 |
| JC Bose National Fellowship the Malaria Parasite: Genome Maintenance, Transporters and Mitophagy | Dr. Saman Habib | 09-11-2021 | 08-11-2026 |
| JC Bose Fellowship: Assess the Metabolic Profile of NETotic PMNs so as to Identify Metabolites Associated with NETosis | Dr. Madhu Dikshit | 01-03-2021 | 20-11-2025 |
| Vaccine Development Against Visceral Leishmaniasis (VL) | Dr. Anuradha Dube | 29-04-2022 | 26-11-2023 |
| **Empowerment and Equity Opportunities for Excellence in Science (EEQ)** | | | |
| Elucidating the Mechanism of Sir2 (Deacetylase Enzyme) Mediated Epigenetic Regulation of G6PDH and DNA Repair Property in Manipulating AmB Induced Oxidative Stress and Apoptosis in AmB Unresponsive Clinical Isolates of *Leishmania donovani* | Dr. Bidyut Purkait | 14-03-2022 | 13-03-2025 |
| Development of Novel Dual Luciferase Reporter Based High Throughput Assay for Discovery of Autophagy Modulators and their Functional Chracterization in Mammalian System | Dr. Jayanta Sarkar | 24-01-2023 | 23-01-2026 |
| **Department of Science & Technology, Ministry of Science & Technology, India** | | | |
| Sophisticated Analytical Instrument Facility (SAIF) | Dr. K V Sashidhara | 01-04-2010 | 31-03-2025 |
| Creation of Nodal Centers for Development and Production of Key Starting Materials, Intermediates and other Raw Materials that are Required by the Health Care sector | Dr. Gautam panda | 31-03-2023 | 30-03-2024 |
| Establishment of Nodal Center for key Starting Materials and Intermediates under Therapeutics Chemicals Program | Dr. Koneni V. Sashidhara | 30-06-2023 | 29-06-2024 |
| Cost Effective Route of Nitisinone for Alkaptonuria and Hereditary Tyrosinemia-1 (HT-1) | Dr. Gautam Panda | 27-03-2023 | 26-03-2026 |
| Understanding CTD- Chromatin Crosstalk During Transcription Through Nucleosome | Dr. Sohail Akhtar | 20-08-2019 | 19-02-2024 |
| **KIRAN Division Scheme** | | | |
| Gender Advancement for Transforming Institutions (GATI) | Dr. Niti Kumar | 23-06-2021 | 31-03-2023 |
| **INSPIRE Fellowship Scheme** | | | |
| Microfluidic Devices for High Throughput Single Neuron Gene Therapy: Parkinson's Disease As the Model | Dr. Pallavi Gupta | 26-12-2022 | 25-12-2027 |
| **Women Scientist Scheme** | | | |
| Role of Malnutrition in Neurotoxic Potential of Deoxynivalenol, a Mycotoxin | Dr. Sakshi Mishra | 13-04-2022 | 12-04-2025 |
| Quest for Unsymmetrical Trisubstituted Methanes (TRSMs) and Ethanes (TRSEs) Leading to Inhibitors of Antimicrobial Resistance (AMR) | Dr. Deblina Roy | 01-11-2022 | 30-11-2025 |
| Receptor Targeted Plasmonic Gold Nanobubble: Diagnostic Probe for the Elimination of Post- Operative Residual Microtumor (MRD) | Dr. Lipika Ray | 23-05-2023 | 22-05-2026 |

| Department of Biotechnology, Ministry of Science & Technology, India | | | |
|---|---|---|---|
| Structure-Activity Validation of Inhibitors of Bacterial Peptidyl-tRNA Hydrolase for Tackling AMR | Dr. Ashish Arora | 22-07-2019 | 21-07-2023 |
| To Investigate the Role of HOXB1 in Spermatogenesis and Male Infertility | Dr. Rajender Singh | 02-09-2019 | 31-07-2023 |
| Studies on Clinical Efficacy of Identified Herbal Leads on Wound Healing and Veterinary Dermatological Complication | Dr. Manish Kumar Chourasia | 14-01-2020 | 13-01-2024 |
| Deciphering Mechanisms of Epigenetic Reprogramming Involved in Macrophage Polarization During Host-Pathogen Interaction in Experimental Visceral Leishmaniasis | Dr. Susanta Kar | 19-02-2020 | 17-05-2023 |
| Development of Small Molecular Antivirus Against Chikungunya and Japanese Encephalitis Virus | Dr. Sanjay Batra | 28-02-2020 | 27-02-2025 |
| SELECTAR: Selection for Antimicrobial Resistance by Antimicrobial Production Waste | Dr. Sidharth Chopra | 16-12-2020 | 15-12-2024 |
| A Study on the Intergenerational Effect of Maternal Vitamin D3 Deficiency on Cognition and Hippocampal Neurons in Rats | Dr. Naibedya Chattopadhyay | 13-08-2021 | 12-08-2024 |
| Exploring DNA Transactions and Genome Maintenance in the Malaria Parasite | Dr. Saman Habib | 24-09-2021 | 23-09-2024 |
| Bioprospecting of Marine Microbial Diversity for Various Products" under the Marine Bioresource and Biotechnology Network Programme | Dr. T Narender | 28-09-2021 | 27-09-2024 |
| Establishment of Bioinformatics and Computational Biology Centre at CSIR-CDRI: Innovation in Drug Discovery Research Using Bioinformatics and Computational Biology | Dr. Mohammad Imran Siddiqi | 14-10-2021 | 13-10-2026 |
| Apelin-ACE2 Axis Fate in Hypertension and Macrophage Syndrome as Complications in COVID-19: Focus on Gender, Age and Comorbidities | Dr. Manoj Kumar Barthwal | 16-02-2022 | 15-02-2026 |
| Elucidating the Role of Nucleotide-Binding Oligomerization Domain-Containing Proteins (NODs) in Development and Progression and Progression of Non-Alcoholic Fatty Liver Disease (NAFLD) | Dr. Akhilesh Kumar Tamrakar | 21-03-2022 | 20-03-2025 |
| Understanding the Role of Wat1/mLst8, a TOR Complex Protein in the Regulation of Mitochondrial Integrity and Calcium Ion Homeostasis | Dr. Shakil Ahmed | 17-03-2023 | 16-03-2026 |
| *In vivo* Validation and Dose Optimization of the Standardized Fraction of *Desmodium gangeticum* for Chronic Kidney Disease-Induced Osteoporosis | Dr. Naibedya Chattopadhyay | 06-09-2023 | 05-09-2025 |
| National Network Projects of CSIR-Central Drug Research Institute, Lucknow | Dr. Mohammad Imran Siddiqi | 20-10-2023 | 19-10-2028 |
| Preclinical Development of a Natural Molecule (N-012-0006) from *Crotalaria juncea* for the Management of Diabetic Nephropathy | Dr. Akhilesh K. Tamrakar | 29-01-2024 | 28-01-2027 |
| **Ramalingaswami Fellowship** | | | |
| Discovery of Novel Cell-Autonomous Host Pathways and the Counteracting Immune Evasion Strategies Employed by Vacuolar Pathogens -An Approach to Identify New Antimicrobial Host-Factors and Novel Microbial Targets | Dr. Arun Kumar Haldar | 09-08-2017 | 08-08-2024 |
| Unravelling the Role of Musashi2 (Msi2) in Cardiac Pathophysiology | Dr. Shashi Kumar Gupta | 15-05-2020 | 14-05-2025 |
| Delineate Molecular Mechanism in Development of Chemo-Resistance in Non-Hodgkin's Lymphoma | Dr. Neeraj Jain | 07-08-2019 | 06-08-2024 |
| Development of Novel Antiviral Nanoparticles Against enveloped Viruses Utilizing Host Cell Plasma Membrane Derived Vesicles | Dr. Sourav Haldar | 31-01-2022 | 30-01-2027 |
| Bioactive Combinatorial Synthesis of Cyclic Dipeptides for Diverse Biological Applications | Dr. Kinshuk Srivastava | 16-08-2019 | 15-08-2024 |
| **Tata Innovation Award** | | | |
| Development of Innovative Combinations of Umifenovir and Molnupiravir for Enhanced Antiviral Efficacy with a Focus On Japanese Encephalitis and SARS-CoV2 | Dr. R. Ravishankar | 25-09-2023 | 24-09-2026 |
| **DBT/Wellcome Trust India Alliance** | | | |
| Pre-Grants Research Management | Dr. Bhawana George | 01-10-2021 | 30-09-2024 |

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|---|---|---|---|
| Investigating the Role of Peroxisome-Mediated Immune Response During the Pathogenesis of Inflammatory Bowel Disease | Dr. Veena Ammanathan | 01-03-2023 | 28-02-2028 |
| **Indian Council of Medical Research, India** | | | |
| Development of a Reverse Genetic System for Japanese Encephalitis Virus as a Tool To Develop *In Vitro* and *In Vivo* Antiviral Screening Platforms | Dr. Chetan Dewaji Meshram | 01-01-2024 | 31-12-2026 |
| Centre for Product Development | Dr. Vivek Vidyadhar Bhosale | 11-12-2019 | 15-12-2024 |
| An Investigational Study on Mycobacteriophages and their Enzymes as New Drugs (IND) for Treating Tuberculosis | Dr. Amit Misra | 25-10-2019 | 24-04-2023 |
| Target Identification and Hit -To- Lead Optimization of SRI 12742 Targeting MDR *A. baumannii* | Dr. Sidharth Chopra | 25-03-2020 | 24-03-2024 |
| Synergistic Metal-Based Antimicrobial Agents for AMR Bacterial Pathogens: Combinatorial and Multimodal Approach | Dr. Sidharth Chopra | 15-10-2020 | 14-10-2023 |
| Investigation of Oxidative Stress Induced Epigenetic Causes and their Mechanism in Male Infertility | Dr. Rajender Singh | 25-03-2021 | 24-03-2024 |
| Design and Development of Injectable and Biodegradable in Situ Depot Forming Lyotropic Liquid Crystal System for Controlled Intratumoral Drug Delivery | Dr. Manish Kumar Chourasia | 28-01-2021 | 27-01-2024 |
| Characterization of VKORC1 SNP rs7294 and its Effect on MicroRNA Mediated Regulation of VKORC1 | Dr. Shashi Kumar Gupta | 03-01-2022 | 02-01-2024 |
| Phase 1 Academic Clinical Trail of Safety, Pharmacokinetics and Early Measurement of Drug Activity of CENTINHALE Dry Powder Inhalation | Dr. Amit Misra | 16-01-2023 | 15-07-2024 |
| A Phase III, Multicentre, Randomized, Double-Blind, Placebo-Controlled Interventional Study on Efficacy and Safety of Standardized Fraction of Picrorhiza Kurroa Royal Ex Benth (Picroliv) for 24 Weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD) | Dr. Vivek Vidyadhar Bhosale | 02-02-2023 | 01-02-2024 |
| Role of Mitochondrial Calcium Homeostasis in Synovial Fibroblast Invasion: Unraveling New Therapeutic Intervention for Rheumatoid Arthritis | Dr. Amit Lahiri | 16-02-2023 | 15-02-2026 |
| Evaluation and Validation of Bioactive Glass Based Micro Nanofibre in Non-Healing Chronic Diabetic Ulcer Using Animal Models, As Per Regulatory Guidelines | Dr. Srikanta Kumar Rath | 01-03-2023 | 28-02-2026 |
| Elucidating the Role of O-Fucosylation and C-Mannosylation of Malaria Parasite Proteins During Host-Parasite Interactions | Dr. Satish Mishra | 01-06-2023 | 31-05-2026 |
| Characterization of the Structure-Function Diversity of Glycosomal Proteins of Leishmania for the Design and Development of New Anti-Leishmanial Agents | Dr. J. Venkatesh Pratap | 15-06-2023 | 14-06-2026 |
| Targeting Bile Acid Receptor TGR5 for the Treatment of Ischemic Cerebral Stoke Associated Motor & Cognitive Deficits | Dr. Prem Narayan Yadav | 01-02-2024 | 31-01-2027 |
| In Silico Design and Synthesis of Inhibitors Targeting RNA Editing Pathway and Assessing their Anti-Leishmanial Efficacy *In-Vitro* and *In-Vivo* to Generate Anti-Leishmanial Agent | Dr. Bidyut Purkait | 09-02-2024 | 08-02-2027 |
| Drug Development Utilizing Natural Bioactive Compounds for the Selerostin Target in Postmenopausal Osteporosis | Dr. Manish K Chourasia | 15-02-2024 | 14-02-2028 |
| Development of Simultaneous Dual Action Synthetic Defence Peptides to Control the Menace of Resistance in ESKAPE Pathogens: Targeting the Antibiofilm and Antimicrobial Activities | Dr. Mukesh Pasupulati | 01-03-2024 | 28-02-2027 |
| Targeting Mitochondrial Fission with dietary Molecules Inhibits Hepatic Stellate Cell Activation and Progression of Non-Alcoholic Fatty Liver Disease: Pre-Clinical & Safety Validation | Dr. Kumaravelu Jagavelu | 21-02-2024 | 20-02-2027 |
| Therapeutic Targeting of HIF1α/VEGF Pathway with Cannabidiol (CBD) Analogues in Cerebral Stroke | Dr. D.P. Mishra | 16-02-2024 | 15-02-2027 |
| **Ayurveda, Yoga & naturopathy, Unani, Siddha and Homeopathy (AYUSH)** | | | |
| Reverse Pharmacology of Asrin and Dawa ul Shifa to Evaluate their Anti-Hypertensive Efficacy, Safety And Mechanism of Action | Dr. Kashif Hanif | 18-05-2020 | 18-08-2023 |

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|---|---|---|---|
| **Bill & Melinda Gates Foundation** | | | |
| Target Enabling Packages for Nonhormonal Contraception | Dr. Radha Rangarajan | 30-10-2023 | 14-10-2026 |
| **NIPER, Kolkata** | | | |
| Centre for Marine therapeutics | Dr. Koneni V. Sashidhara | 30-03-2023 | 29-03-2028 |
| **Lady Tata Memorial Trust Mumbai** | | | |
| Deciphering FLT3-ITD Elicited Signaling Pathways in AML Cell Growth and Block In Differentiation: Hunt for Therapeutic Targets and Inhibitors for Mutant FLT3 Proteins | Dr. Arun Kumar Trivedi | 17-03-2021 | 31-03-2024 |
| **Ignite, Life Science Foundation** | | | |
| Development of a Novel Hv1 Channel Inhibitor Alleviate Chronic Pain | Dr. Aravind Khatri | 18-08-2023 | 17-08-2026 |
| Targeting Morf512 Alternative Splicing to Prevent Cardiac Cachexia | Dr. Shashi Kumar Gupta | 18-08-2023 | 17-08-2026 |
| Betalactonase as an Antimicrobial | Dr. Mukesh Pasupuleti | 26-03-2024 | 25-09-2025 |
| **American Society of Hematology (ASH).Washington, D.C. United States** | | | |
| Identification of Molecular Therapeutic Target Leading to Development of Chemo-Resistance in Non-GC DLBCL Patients in India | Dr. Neeraj Jain | 01-07-2021 | 33-03-2025 |
| **Ministry of Health and Family Welfare (Department of Health Research)** | | | |
| Therapeutic Potential of Naringenin in Management of Polycystic Ovarian Syndrome | Ms. Rumaisa Rashid | 22-02-2021 | 21-02-2024 |
| **Department of Scientific and Industrial Research and Council of Scientific & Industrial Research** | | | |
| Creation of DSIR – Common Research and Technology Development Hub (CRTDH) in the Area of Affordable Health under DSIR-CRTDH Programme | Dr. Amit Misra | 01-01-2019 | 31-03-2025 |
| **Biotechnology Industry Research Assistance Council (BIRAC)** | | | |
| Engineering Conditionally Replication-Competent SARS-CoV-2 Viral Molecular Clones and Evalution of Cross-Variant Neutralization | Dr. Raj Kamal Tripathi | 14-06-2022 | 31-12-2023 |
| Therapeutics Targeting of Neutrophil Extracellular Traps Nets in Pulmonary Fibrosis, under Mission Covid Suraksha | Dr. Sachin Kumar | 16-10-2023 | 15-10-2025 |
| **Foundation for Innovation New Diagnostic (FIND) a Swiss Charitable through CSIR-IGIB, New Delhi** | | | |
| Microlabs based genomics surveillance of the SARS-CoV-2 | Dr. Rajender Singh | 01-11-2021 | 31-05-2023 |
| **The Phaeo and Para Cancer Charity, Scotland (PPCC)** | | | |
| Elucidating the Neural Role of SDHB1 in Context of Paraganglioma Employing a New *C. elegans* Model | Dr. Aamir Nazir | 13-07-2022 | 12-07-2024 |

## 5.3 Sponsored Projects

| Title of the Project | PI | Project Start Date | Completion Date |
|---|---|---|---|
| **Sponsored Projects** | | | |
| Non-Covalent Interaction of the API and Excipients | Dr. Ravishankar Ampapathi | 13-04-2022 | 12-04-2023 |
| Pharmacopeial Standardization and Anticancer Evaluation of Canceroso-1 a Traditional Electrohomeopathic Medicine Prepared by Kings Herbaloharnaceytucaks Ktd, Ahmdabad | Dr. Asif Ali | 27-06-2022 | 26-06-2023 |
| Antimicrobial Testing of Air Filters for Biomoneta | Dr. Sidharth Chopra | 18-07-2022 | 17-07-2023 |
| Antidiabetic Activity Assessment of the Herbal Product | Dr. Akhilesh K. Tamrakar | 04-04-2022 | 03-04-2023 |
| Micro CT of Rat bones | Dr. Naibedya Chattopadhyay | 07-12-2022 | 06-12-2023 |
| Genetic Characterization of Rats and Mice from Breeding Colony of Cadila | Dr. Rajdeep Guha | 30-01-2023 | 29-01-2024 |
| Pharmacokinetics Study of αβ-Arteether formulation | Dr. Rabi Shankar Bhatta | 30-05-2023 | 29-05-2024 |
| Scaled-Up Synthesis, Purification and Assessment of Chimeric Hydrogen Sulfide Donor Compounds for Potential Application in Hypobaric Hypoxia | Dr. Sanjay Batra | 23-01-2023 | 22-01-2026 |

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|---|---|---|---|
| Phytochemical and Immune Modulator Standardization of Ega-001 | Dr. Asif Ali | 20-06-2023 | 20-06-2024 |
| Synthesis of New Fluorescence Quenchers with Functional Modifications for Nucleic Acid Research | Dr. Atul Goel | 11-09-2023 | 10-09-2024 |
| Process Optimization and Synthesis of Iodo Acid Intermediate (KSM01) | Dr. Ajay K. Srivastava | 14-08-2023 | 13-08-2025 |
| Investigation of Metal Containing Compounds for Antimicrobioal Activity | Dr. Sidharth Chopra | 15-02-2024 | 14-02-2025 |
| Efficacy Assessment of Test Agents on Rats Bones Using Micro CT and Bending Strength Analysis | Dr. Naibedya Chattopadhyay | 23-02-2024 | 22-02-2025 |
| To evaluate the Anti-Filarial Efficacy of Oxfendazole Against Human Filarial Nematode *Brugia malayi* | Dr. Mrigank Srivastava | 11-03-2024 | 10-03-2025 |
| **Consultancy Projects** | | | |
| To Resolve the Obstacles Related to the Extraction & Identification Method of Phytocannabinoids in *Cannabis sativa* | Dr. Asif Ali | 17-07-2023 | 17-07-2024 |

## 5.4 Collaborative Projects

| Title of the Project | PI | Project Start Date | Completion Date |
|---|---|---|---|
| **Collaborative Scheme** | | | |
| Pre-Clinical Development of Carbon Nanospheres Conjugated HAT Activator (CSP-TTK21) | Dr. SK Rath | 04-05-2021 | 03-05-2023 |
| Mechanistic Studies with *Withania somnifera* Extracts and its Major Phytoconstituents on Innate Immune Cell Responses and their Efficacy in Experimental Animal Models of Immunosuppression and Inflammation | Dr. Madhu Dikshit | 31-03-2022 | 30-03-2025 |
| Preclinical Toxicity Study of Dhatri Lauha | Dr. S. K Rath | 17-02-2023 | 16-02-2025 |
| Pre-Clinical Development of Vasa (*Justicia adhatoda Linn.*) Leaves through AYUSH Route for Adjunct Therapy in Tuberculosis to Reduc Anti-Tubercular Treatment (ATT) Induced Hepatotoxicity | Dr. Virendra Prajapati | 25-02-2023 | 24-02-2025 |
| Pre-Clinical Development of Amalaki (*Phyllanthus emblica Linn.*) Fruit through AYUSH Route for Adjunct Therapy in Tuberculosis to Reduce Anti-Tubercular Treatment (ATT) Induced Hepatotoxicity | Dr. S. K Rath | 25-02-2023 | 24-02-2025 |
| Pre-Clinical Development of Guduchi (*Tinospora cordifolia* (Thunb) Miers) Stem through AYUSH Route for Adjunct Therapy in Tuberculosis to Reduce Anti-Tubercular Treatment (ATT) Induced Hepatotoxicity | Dr. Virendra Prajapati | 25-02-2023 | 24-02-2025 |
| Formulation Development of Topical Drug for Combined Radiation Injury | Dr. Rabi Shankar Bhatta | 24-07-2023 | 23-07-2025 |
| IND Enabling Studies of Redioprotective Drug Candidate N-Acetyl-L-Tryptophan | Dr. Rabi Shankar Bhatta | 27-09-2023 | 26-09-2025 |
| Development of IL-6 Based Radio-Protective Formulation, Pharmacokinetics and Toxicity Evaluation | Dr. Rabi Shankar Bhatta | 27-09-2023 | 26-09-2025 |
| IND Enabling Formulation, Pharmacokinetics and Toxicity Evaluation in NHP of Trichostatin A (TSA) | Dr. Rabi Shankar Bhatta | 27-09-2023 | 26-09-2025 |

# 6 Memorandum of Understandings, Agreements & Services

| Sl. No. | Title of Contract / Agreement | Client / Collaborator | Signing Date |
|---|---|---|---|
| **Licensing of Technology** | | | |
| 1. | Ophthalmic formulation of Amphotericin B | CIPLA Limited, Mumbai | 12-02-2024 |
| 2. | Phosphoramidite-based Fluorescence Quenchers with flexible functional modifications for biomedical applications | ESS CEE Biotech (India) Pvt. Ltd., Lucknow | 17-02-2024 |
| **Grant Agreement** | | | |
| 1. | Target Enabling Packages for Non-hormonal Contraception | Bill and Melinda Gates Foundation (BMGF), USA | 30-10-2023 |
| **Sponsored Agreement** | | | |
| 1. | To evaluate the Anti-filarial efficacy of Oxfendazole against human filarial nematode *Brugia malayi*. | Drugs for Neglected Diseases initiative India Foundation,New Delhi | 13-02-2024 |
| 2. | Efficacy assessment of test agents on rat bones using micro CT and bending strength analyses. | Adgyl Lifesciences Private Limited | 23-02-2024 |
| 3. | Investigation of metal containing compound for antimicrobial activity | University of Bern, Switzerland | 18-12-2023 |
| 4. | Process optimization and synthesis of ABT5 | Dr. Reddy's Laboratories Ltd., Hyderabad | 14-08-2023 |
| 5. | Synthesis of new fluorescence quenchers with functional modifications for nucleic acid research | ESS CEE Biotech (India) Pvt. Ltd., Lucknow | 05-09-2023 |
| 6. | Head-to-head testing of few dual agonists and corresponding single agonists in the tail flick model of analgesia using single dose intrathecal administration. | Sekkei Bio Private Limited, Chennai | 05-06-2023 |
| 7. | Phytochemical and Immuno modulator standardization of Ega-001. | Rabisan India Electrohomeo Pharma, Chamba | 22-06-2023 |
| **Consultancy** | | | |
| 1. | To Resolve the obstacles related to the extraction & identification method of phytocannabinoids in *Cannabis sativa* | Aglow sciences Marketing LLP, Mumbai | 17-07-2023 |
| **Memorandum of Cooperation** | | | |
| 1 | Development of radio-protective formulation, pharmacokinetic and toxicity evaluation | INMAS, DRDO, New Delhi | 05-09-2023 |
| 2. | IND enabling formulation, pharmacokinetics and toxicity evaluation of a compound | INMAS, DRDO, New Delhi | 05-09-2023 |
| 3. | IND enabling studies of radioprotective drug | INMAS, DRDO, New Delhi | 05-09-2023 |
| 4. | Formulation development of topical drug for combined radiation injury | INMAS, DRDO, New Delhi | 05-07-2023 |
| **Memorandum of Understanding signed for joint R&D** | | | |
| 1. | To promote institutional linkage between CSIR-CDRI and BITS Pilani and to explore avenues for possible collaboration in areas of mutual interest. | Birla Institute of Technology and Science, Pilani | 17-02-2024 |
| 2. | To promote institutional linkage between CSIR-CDRI and IISER-K and to explore avenues for possible collaboration in areas of mutual interest. | Indian Institute of Science Education And Research, Kolkata | 17-02-2024 |
| 3. | To conduct collaborative research programs in areas of mutual interest. | Zydus Lifesciences Limited, Ahmedabad | 16-02-2024 |
| 4. | Development of CSIR-Digital library of Indian medicinal plants and their metabolites. | C.M.P. Degree College, Prayagraj | 17-11-2023 |

| Sl. No. | Title of Contract / Agreement | Client / Collaborator | Signing Date |
|---|---|---|---|
| 5. | To promote institutional linkage between CSIR-CDRI and SGPGIMS and to explore other avenues for possible collaboration | Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow | 26-12-2023 |
| 6. | To explore for possible collaborative research programs in specific fields of interest. | SMS Medical College and Hospital, Jaipur | 08-11-2023 |
| 7. | Development of CSIR-Digital library of Indian medicinal plants and their metabolites. | Indira Gandhi National Tribal University, Amarkantak, Madhya Pradesh | 13-11-2023 |
| 8. | To promote institutional linkage between CSIR-CDRI, IIIT-H and Ihub-Data and to explore other avenues for possible collaboration. | International Institute of Information Technology, Hyderabad (IIIT-H), IIIT-H Data I-Hub Foundation, Hyderabad | 02-11-2023 |
| 9. | To promote institutional linkage between CSIR-CDRI and IIT-Madras and to explore other avenues for possible collaboration. | IIT, Madras | 04-09-2023 |
| 10. | To promote institutional linkage between CSIR-CDRI and IIIT-Delhi and to explore other avenues for possible collaboration. | Indraprastha Institute of Information Technology, Delhi | 21-06-2023 |
| 11. | To explore for possible collaborative research programs in specific fields of interest. | KGMU, Lucknow | 29-05-2023 |
| 12. | To promote institutional linkage between CSIR-CDRI and ICMR-NJIL&OMD and to explore other avenues for possible collaboration. | ICMR-National JALMA Institute for Leprosy and Other Mycobacterial Diseases, Agra | 28-04-2023 |
| 13. | To explore for possible collaborative research programs in specific fields of interest. | Aten Porus Lifesciences Pvt. Ltd., Bangalore | 03-05-2023 |
| 14. | To explore potential collaborative drug discovery research and development opportunities of mutual interest in the field of infectious diseases relevant for India and of global importance. | DNDi Drugs For Neglected Diseases Initiative India Foundation, New Delhi | 27-04-2023 |
| 15. | To promote institutional linkage between CSIR-CDRI and DHSGU and to explore other avenues for possible collaboration. | Dr. Harisingh Gour Vishwavidyalaya, Sagar, Madhya Pradesh | 19-04-2023 |
| **Collaborative Research Agreement** | | | |
| 1. | To identify and develop PARP-1 selective inhibitors for BRCA mutated cancer | Sravathi AI Technology Pvt. Ltd., Bengaluru | 26-07-2023 |
| **Agreement** | | | |
| 1. | Potential Anti-angiogenic Role of Azirines in the Ocular Neovascular Conditions | All India Institute of Medical Sciences, New Delhi | 11-07-2023 |
| **Secrecy Agreement** | | | |
| 1. | To disclose, receive, and exchange information relating to their businesses, products and technologies | Dr. Dhananjay Bakhle, Pune | 08-03-2024 |
| 2. | To disclose, receive, and exchange information relating to their businesses, products and technologies | Schrödinger, New York United States | 01-03-2024 |
| 3. | To disclose, receive, and exchange information relating to their businesses, products and technologies | Focelite Goodness India Pvt. Ltd, Bangalore | 13-02-2024 |
| 4. | To disclose, receive, and exchange information relating to their businesses, products and technologies | BVG Life Sciences Limited, Pune | 25-01-2024 |
| 5. | To disclose, receive, and exchange information relating to their businesses, products and technologies | Orbicular Pharmaceutical Technologies Pvt Ltd, Hyderabad | 22-12-2023 |
| 6. | To disclose, receive, and exchange information relating to their businesses, products and technologies | Anphar Laboratories Pvt. Ltd. Jammu | 27-12-2023 |
| 7. | To disclose, receive, and exchange information relating to their businesses, products and technologies | Bigtec Private Limited, Bangalore | 21-12-2023 |

| Sl. No. | Title of Contract / Agreement | Client / Collaborator | Signing Date |
|---|---|---|---|
| 8. | To disclose, receive, and exchange information relating to their businesses, products and technologies | OmRx Oncology, Inc, California | 20-12-2023 |
| 9. | To disclose, receive, and exchange information relating to their businesses, products and technologies | The University of Dundee, United Kingdom | 14-12-2023 |
| 10. | To disclose, receive, and exchange information relating to their businesses, products and technologies. | Indian Statistical Institute, Kolkata | 06-11-2023 |
| 11. | To disclose, receive, and exchange information relating to their businesses, products and technologies. | Mankind Pharma Ltd., New Delhi | 09-11-2023 |
| 12. | To disclose, receive, and exchange information relating to their businesses, products and technologies. | Eris Lifesciences Ltd., Ahmedabad | 20-09-2023 |
| 13. | To disclose, receive, and exchange information relating to their businesses, products and technologies. | BIOMÉRIEUX INDIA PVT. LTD, New Delhi | 08-09-2023 |
| 14. | To disclose, receive, and exchange information relating to their businesses, products and technologies. | NATCO Pharma Ltd, Hyderabad | 13-07-2023 |
| 15. | To disclose and receive the confidential information for the purpose of Process Development of a Intermediate. | Dr. Reddy's Laboratories Limited, Hyderabad | 26-07-2023 |
| 16. | Clinical Trial associated services | Translational Health Science and Technology Institute (THSTI), Faridabad | 17-07-2023 |
| 17. | Clinical Trial associated services | Bio Agile Therapeutics Pvt. Ltd., Bangalore | 14-07-2023 |
| 18. | Clinical Trial associated services | ABC Clinical Research Services, Lucknow | 11-07-2023 |
| 19. | Clinical Trial associated services | Ardent Clinical Research Services, Pune | 11-07-2023 |
| 20. | To disclose, receive, and exchange information relating to their businesses, products and technologies. | BDR Pharmaceuticals International Private Limited, Mumbai | 05-07-2023 |
| 21. | To disclose all Confidential information to the party for purpose of evaluating potential business relationship | Zydus Lifesciences Limited, Ahmedabad | 13-06-2023 |
| 22. | Empanelment of contract research organizations (CRO's) for Compound synthesis | Chemveda Life Sciences India Pvt. Ltd. Telangana | 18-04-2023 |
| 23. | For evaluating potential business relationship. | ID Business Solutions Limited, UK | 27-04-2023 |
| 24. | For evaluating potential business relationship. | Cipla Limited, Mumbai | 21-04-2023 |
| 25. | To share confidential information for the purpose of exploring possible transaction between parties | Dr. Reddy's Laboratories Limited, Hyderabad | 26-04-2023 |
| 26. | Empanelment of contract research organizations (CRO's) for Compound synthesis. | Dr. N.S. Labs, Hyderabad | 25-04-2023 |
| 27. | Empanelment of contract research organizations (CRO's) for Compound synthesis. | Presude Lifesciences Private Limited, Gurgaon | 25-04-2023 |
| 28. | Empanelment of contract research organizations (CRO's) for Compound synthesis | Mithros Chemicals Pvt. Ltd. Hyderabad | 25-04-2023 |
| 29. | Empanelment of Business Development Consultant | Sathguru Management Consultants, Hyderabad | 07-03-2023 |
| 30. | To disclose all Confidential information to the party for purpose of evaluating potential business relationship | Alembic Pharmaceuticals Ltd., Gujarat | 11-04-2023 |
| 31. | Outsourcing activities w.r.t. lung diseases project | Cardiff University, UK | 06-04-2023 |

| Sl. No. | Title of Contract / Agreement | Client / Collaborator | Signing Date |
|---|---|---|---|
| **Clinical Trial Agreement** | | | |
| 1. | A Phase III, multicentre, randomized, double-blind, placebo-controlled, interventional study on efficacy and safety of Standardized fraction of *Picrorhiza kurroa* Royal Ex Benth (Picroliv®) for 24 weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD). | Nizam's Institute of Medical Sciences, Hyderabad | 19-08-2023 |
| 2. | A Phase III, multicentre, randomized, double-blind, placebo-controlled, interventional study on efficacy and safety of Standardized fraction of *Picrorhiza kurroa* Royal Ex Benth (Picroliv®) for 24 weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD). | Postgraduate Institute of Medical Education and Research, Chandigarh | 29-08-2023 |
| 3. | A Phase III, multicentre, randomized, double-blind, placebo-controlled, interventional study on efficacy and safety of Standardized fraction of *Picrorhiza kurroa* Royal Ex Benth (Picroliv®) for 24 weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD). | King George's Medical University, Lucknow | 13-07-2023 |
| 4. | A Phase III, multicentre, randomized, double-blind, placebo-controlled, interventional study on efficacy and safety of Standardized fraction of *Picrorhiza kurroa* Royal Ex Benth (Picroliv®) for 24 weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD). | All India Institute of Medical Sciences, New Delhi | 16-05-2023 |
| 5. | A Phase III, multicentre, randomized, double-blind, placebo-controlled, interventional study on efficacy and safety of Standardized fraction of *Picrorhiza kurroa* Royal Ex Benth (Picroliv®) for 24 weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD). | Institute of Liver and Biliary Sciences (ILBS), New Delhi | 05-05-2023 |
| 6. | A Phase III, multicentre, randomized, double-blind, placebo-controlled, interventional study on efficacy and safety of Standardized fraction of *Picrorhiza kurroa* Royal Ex Benth (Picroliv®) for 24 weeks in the Management of Non-Alcoholic Fatty Liver Disease (NAFLD). | GSMC and KEM Hospital, Mumbai | 27-04-2023 |
| **Memorandum of Agreement** | | | |
| 1. | *In vivo* validation and dose optimization of the standardized fraction of *Desmodium gangeticum* for chronic kidney disease-induced osteoporosis | DBT, New Delhi | 13-02-2024 |
| 2. | Preclinical development of a natural molecule (N-012-0006) from *Crotalaria juncea* for the management of diabetic nephropathy | DBT, New Delhi | 01-02-2024 |
| 3. | Elucidating the role of Nucleotide Binding Oligomerization Domain containing Proteins (NODs) in Development and Progression of Non-alcoholic Fatty Liver Disease (NAFLD) | DBT, New Delhi | 24-01-2024 |
| 4. | Identifying kinases regulating Glucocorticoid receptor (GR) protein stability: its implication in combatting glucocorticoid (GC)-induced paclitaxel resistance in Triple Negative Breast Cancers (TNBCs) | DBT, New Delhi | 24-01-2024 |
| 5. | Bioprospecting of Marine Microbial diversity for various products under the Marine Bioresource and Biotechnology Network Programme. | DBT, New Delhi | 06-10-2023 |
| **IP Expense Sharing Agreement** | | | |
| 1. | Small molecule modulator targeting a rare histone modification, regulation of adipogenesis and pharmaceutical formulation thereof | Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru | 06-09-2023 |
| 2. | 1. Broad Spectrum Antimicrobial Metallopharmaceutical Agents Targeting MRSA and VRSA 2. Novel synthesis of substituted 3-(phenylcarbamoyl)benzoic acid: Evaluation as potential anticancer and anti-bacterial agents. | IIT, Kanpur | 07-08-2023 |

| Sl. No. | Title of Contract / Agreement | Client / Collaborator | Signing Date |
|---|---|---|---|
| 3. | Potency Of A Platinum-Nhc (N-Heterocyclic Carbene) Compound As Antibacterial Agent Targeting Drug Resistant *Staphylococcus aureus* | IIT, Kanpur | 07-08-2023 |
| **Material Transfer Agreement** | | | |
| 1. | 176492 Pet28a-SARS-CoV2-NSP13, 187656 pHis-TEV-NSP15, 159613 covid-sars2 nsp14/10 | Addgene, USA | 24-01-2024 |
| 2. | PC-12 & SH-SY-5Y | NCCS, Pune | 24-01-2024 |
| 3. | #145145, #165451 | Addgene, USA | 03-01-2024 |
| 4. | #124123, #124124, #124125 | Addgene, USA | 13-12-2023 |
| 5. | *Mycobacterium tuberculosis;*strain H37Ra, ATCC-25177 | ATCC, USA | 11-12-2023 |
| 6. | Addgene 69929:pET28-MBP-TEV | Addgene, USA | 07-12-2023 |
| 7. | Plasmid DNA construct pL1059 | Leiden University Medical Center, Netherlands | 12-09-2023 |
| 8. | Plasmodium and Human SHMT expression clones | National Science and Technology Development Agency (NSTDA)/ BIOTECH, Thailand | 11-08-2023 |
| 9. | Compounds OZ439, MMV609 and MMV183 | MMV Medicines for Malaria Venture, Geneva, Switzerland | 01-06-2023 |

# 7 Human Resource Development

## 7.1 Ph. D. thesis submitted during April 2023- March 2024

| Sl. No. | Name of Student | Title | Name of Supervisor | Date |
|---|---|---|---|---|
| | **Academy of Scientific and Innovative Research, Ghaziabad** | | | |
| 1. | Ms. Kushwaha Vinita Tribhuvan | Molecular & therapeutics approaches to ameliorate HFD- induced metabolic disorders enriching beneficial gut microbiome: Immuno-metabolic alteration in Adipose tissue | Dr. Anil N. Gaikwad | 06-04-2023 |
| 2. | Ms. Varsha Kumari | Understanding the role of RBR-E3 ubiquitin ligase in *Plasmodium falciparum* | Dr. Niti Kumar | 17-04-2023 |
| 3. | Mr. Dharmendra Katiyar | Design and synthesis of novel macrocyles and inclusion complexes for drug delivery applications | Dr. Tejender Singh Thakur | 25-04-2023 |
| 4. | Mr. Abdulkareem Adam Olaitan | A study on the effect of selective estrogen receptor modulation by Ormeloxifene on estrogen metabolism in pulmonary hypertension | Dr. Kashif Hanif | 22-05-2023 |
| 5. | Ms. Poonam Mehta | Investigation of the role of sncRNAs in spermatogenesis and male infertility | Dr. Rajender Singh | 23-05-2023 |
| 6. | Mr. Arun Agarwal | Development and characterization of phytosomes as drug delivery system of Formononetin: A potential anti-osteoporotic agent | Dr. Jiaur R. Gayen | 23-05-2023 |
| 7. | Ms. Sajiya Parveen | Synthesis of N/S- heterocyclic compounds for biomedical applications | Dr. Atul Goel | 23-05-2023 |
| 8. | Mr. Salique Hassan Shaham | Role of LEF and TCF protein in cerebral Malaria | Dr. Renu Tripathi | 23-05-2023 |
| 9. | Mr. Sumit Kumar Rastogi | Step-economical synthesis and bio-evaluation of small heterocyclic molecules employing green methodologies | Dr. Ravindra Kumar | 25-05-2023 |
| 10. | Ms. Ankita Rani | Investigating the role of Kruppel-like family of transcription factors(KLFs) in host immune-suppression during experimental visceral Leishmaniasis | Dr. Susanta Kar | 29-05-2023 |
| 11. | Ms. Priya Tiwari | A study on the role of Angiotensin converting enzyme 2/ Angiotensin (1-7)/ mas receptor (ACE2/Ang (1-7)/MasR) axis in neuroinflammation in hypertension | Dr. Kashif Hanif | 30-05-2023 |
| 12. | Ms. Alka Sharma | Isolation and synthesis of analogues of bioactive compound from Indian medicinal plants | Dr. K.V. Sashidhara | 05-06-2023 |
| 13. | Ms. Alisha Ansari | Studies towards the discovery of natural and nature-like molecules as potential biodynamic agents | Dr. K.V. Sashidhara | 05-06-2023 |
| 14. | Ms. Lalita Devi | Exploring diazo group chemistry for the synthesis of privileged aza-heterocycles | Dr. Namrata Rastogi | 08-06-2023 |
| 15. | Mr. Javed Miyan | Targeting RAS-mSIN1 interaction selectively inhibits mTORC2: implications in mitigating breast cancer metastasis *in vivo* | Dr. Smrati Bhadauria | 09-06-2023 |
| 16. | Mr. Anil Kumar Singh | Deciphering the mechanisms regulating CCAAT/enhancer-binding protein alpha (C/EBP )stability in cellular differentiation | Dr. Arun Kumar Trivedi | 22-06-2023 |

| | | | | |
|---|---|---|---|---|
| 17. | Mr. Md. Naiyaz Ahmad | Identification and biological evaluation of hit molecule(s) for mycobacterial diseases | Dr. Arunava Dasgupta | 26-06-2023 |
| 18. | Ms. Anu Chauhan | Study of selected genes of *Mycobacterium tuberculosis* for their role in survival and persistence | Dr. Sudheer Kumar Singh | 28-06-2023 |
| 19. | .Ms. Simmi Anjum | Understanding the role of Wat1/mLst8,a TOR complex protein in the regulation of mitochondrial integrity in *Schizosaccharomyces Pombe* | Dr. Shakil Ahmed | 03-07-2023 |
| 20. | Ms. Priyanka Rawat | Identification, structural characterization and quantification of naturally occurring bioflavonoids utilizing liquid chromatography-tandem mass spectrometry | Dr. Sanjeev Kanojiya | 02-08-2023 |
| 21. | Ms. Khushboo Sinha | Decoding the molecular signatures for Triple Negative Breast Cancer (TNBC) | Dr. Dibyendu Banerjee | 03-08-2023 |
| 22. | Mr. Kasim Ali | Tri and tetra- substituted methanes and ethanes as medicinally important molecules | Dr. Gautam Panda | 03-08-2023 |
| 23. | Mr. Ankit Saxena | Nature product based anti -parasitic agents and NMR based metabolomics | Dr. Sanjeev Kanojiya | 07-08-2023 |
| 24. | Ms. Kusum Devi | To explore novel strategies to repair emphysematous lung and pulmonary inflammation in airway disorders | Dr. Baisakhi Moharana | 07-08-2023 |
| 25. | Ms. Akanksha Vyas | Identification and characterization of cancer oocyte antigen (COA) SAS1B as potential biomarker for cervical cancer | Dr. Monika Sachdev | 07-08-2023 |
| 26. | Mr. Afsar Ali Khan | Design and synthesis of novel $\beta^{2,3}$- amino acids embedded cyclic tetrapeptides as anticancer agents and nitropheny (pheny) sulfane derivatives as PCSK9 inhibitors | Dr. Dipankar Koley | 07-08-2023 |
| 27. | Mr. Girija Patel | Development of green methodologies towards C-C, C-N and N-N bond formation for the synthesis of biologically active compounds | Dr. Prem Prakash Yadav | 07-08-2023 |
| 28. | Mr. Himalaya Singh | Elucidating the role of lymphangiogenesis and angiogenesis in cardiovascular diseases | Dr. Kumaravelu Jagavelu | 07-08-2023 |
| 29. | Ms. Sristi Agarwal | Preclinical pharmacokinetics and biomarkers profiling of *Trigonellla foenum-graecum* in polycystic ovary syndrome induced rats | Dr. Rabi S. Bhatta | 07-08-2023 |
| 30. | Mr. Anubhav Yadav | Role of KOR activation in treatment refractory depression and psoriatic dermatitis | Dr. Prem N. Yadav | 07-08-2023 |
| 31. | Mr. Kushagra | Identification of potential anti-neurodegenerative agents using integrated artificial intelligence and molecular modeling approach | Dr. M. I. Siddiqi | 16-10-2023 |
| 32. | Mr. Kulkarni Chirag Deepak | Assessment of Phytopharmaceutical and Nutraceutical agents for the treatment of osteoporosis in preclinical models | Dr. Naibedya Chattopadhyay | 30-10-2023 |
| 33. | Ms. Jyoti Shukla | Mannich cyclization between hydroxylactam and acetal: Application in the synthesis of izidine alkaloids | Dr. Dipankar Koley | 03-11-2023 |
| 34. | Ms. Adity Gupta | Understanding the epigenetic modification of CTD of RNA polymerase II in eukaryotic transcription. | Dr. Md. Sohail Akhtar | 08-11-2023 |

| | | | | |
|---|---|---|---|---|
| 35. | Mr. Jhajan Lal | Molecular editing and scaffold diversification of novel therapeutic peptides and salicylanilides and their biological significance of novel therapeutic peptides and salicylanilides and their biological significance | Dr. Damodara Reddy N | 09-11-2023 |
| 36. | Ms. Anamika | Transition metal-catalyzed synthesis of novel heterocycles towards GPCR modulators and development of green process for Centhaquine | Dr. Ajay Kumar Srivastava | 09-11-2023 |
| 37. | Ms. Mohini Soni | Structural and functional characterization of *Leishmania donovani* metabolic proteins and mutants of coronin | Dr. J. Venkatesh Pratap | 30-11-2023 |
| 38. | Ms. Divya Rai | To study the role of small molecules and cross kingdom miRNA as bone anabolics | Dr. Ritu Trivedi | 22-12-2023 |
| 39. | Mr. Krishan Kumar Saini | Harnessing the role of crosstalk between ER-Stress and ferroptosis in cancer | Dr. Dipak Datta | 26-12-2023 |
| 40. | Ms. Deepti Shrivastava | Investigation of organellar solute transporters of *Plasmodium falciparum* | Dr. Saman Habib | 26-12-2023 |
| 41. | Mr. Deep Chandra Balodi | Functional characterization of dipeptidylcarboxypeptiase (LdDCP) of *Leishmania donovani* | Dr. Amogh Sahasrabuddhe | 26-12-2023 |
| 42. | Mr. Anirban Sardar | To evaluate the biological Function of mesenchymal stem cells and the metabolic alterations associated with skeletal health due to fat infiltration in the bone marrow niche | Dr. Ritu Trivedi | 29-12-2023 |
| 43. | Ms. Shivani Sharma | Investigating the impact of different classes of pharmacologic interventions on bone-remodeling in preclinical models of chronic-kidney disease | Dr. Naibedya Chattopadhyay | 04-01-2024 |
| 44. | Mr. Dharmendra Kumar | Exploration and development of copper-catalyzed insertion reactions for the construction of C-N bond | Dr. Malleswara Rao Kuram | 05-01-2024 |
| 45. | Mr. Ravi Kumar Vats | Synthesis of new fluorescent heterocyclic compounds and their potential applications | Dr. Atul Goel | 05-01-2024 |
| 46. | Mr. Kuldeep Singh | Design and synthesis of heterocyclic molecules *via* C - N/C bond formation as antimalarial agents | Dr. Prem Prakash Yadav | 05-01-2024 |
| 47. | Ms. Shalini Gautam | Development of surface modified smart nanocarriers for enhanced chemotherapeutic efficacy of anticancer drugs against breast cancer | Dr. Prabhat Ranjan Mishra | 05-01-2024 |
| 48. | Ms. Disha Marwaha | Self-assembled systems for potential co-delivery for tumor targeting | Dr. Prabhat Ranjan Mishra | 05-01-2024 |
| 49. | Mr. Muhammad Fahad Jamali | Harnessing the reactivity of trifluorodiazoethane for the synthesis of trifluoromethylated organic compounds | Dr. Kishor Mohanan | 05-01-2024 |
| 50. | Mr. Amol Bisen | Design and development of sustained-release eye drop formulation containing antimicrobial drugs for the management of recalcitrant keratitis | Dr. Rabi S. Bhatta | 05-01-2024 |
| 51. | Mr. Shadab Ahmad | Identification and development of natural agents for the management of diabetic nephropathy | Dr. Akhilesh K Tamrakar | 05-01-2024 |
| 52. | Ms. Trisha Roy | Deciphering the transcriptional events leading to the upregulation of SOCS isoforms by *M. tuberculosis* in macrophages | Dr. Amit Misra | 18-01-2024 |

| | | | | |
|---|---|---|---|---|
| 53. | Ms. Sangh Priya Singh | Synthesis of pharmaceuticals-relevant fused oiperazinones through post Ugi functionalization | Dr. Ajay Kumar Srivastava | 01-02-2024 |
| 54. | Mr. Saroj Maji | Quest for cationic anti-microbials and anti-cancer agents based on Bucky bowl derived unnatural amino acids and Heterocycles | Dr. Gautam Panda | 05-02-2024 |
| 55. | Mr. Mehmood Ali | Characterization of antidiabetic properties of fragments derived from innate immune signaling protein and adipokine | Dr. J. K. Ghosh | 16-02-2024 |
| 56. | Ms. Shaziya Khan | Understanding mitochondrial dynamics and immune response cross talk in ulcerative colitis pathogenesis | Dr. Amit Lahiri | 27-02-2024 |
| 57. | Mr. Anil Chauhan | Development of desymmetrization Strategy for the synthesis of ring-fused heterocycles of biological relevance. | Dr. Ravindra Kumar | 20-03-2024 |
| 58. | Mr. Aradhya Tripathi | Understanding the role of HSP110 and its co-operation with co-chaperone in human malaria parasite. | Dr. Niti Kumar | 20-03-2024 |
| 59. | Mr. Vishal Upadhyay | Identifying interacting protein partners of Runx2: Elucidating biological relevance of their interaction in Runx2 regulated bone biology | Dr. Arun Kumar Trivedi | 28-03-2024 |
| **Jawaharlal Nehru University, New Delhi** | | | | |
| 60. | Mr. Mukesh Kumar | Pharmacokinetic, bioavailability enhance-ment and drug-drug interaction of novel anti-Leishmanial agent 96-261 | Dr. Rabi S. Bhatta | 19-05-2023 |
| 61. | Mr. Sushil Kumar | Evaluation of natural and synthetic bioactive molecules for targeting drug resistant pathogens and cancer | Dr. Dibyendu Banerjee | 30-06-2023 |
| 62. | Mr. Lalan Kumar | Synthesis of β-carboline based anti-parasitic and CNS-active agents | Dr. Sanjay Batra | 31-07-2023 |
| 63. | Ms. Vaishali Tyagi | Characterization of oocyte maturation through chemo-ablated infertile mouse model | Dr. Monika Sachdev | 31-07-2023 |
| 64. | Mr. Jitendra Singh | A study to investigate the role of astrocytic mitochondria during neurodegeneration | Dr. Shubha Shukla | 31-07-2023 |
| 65. | Ms. Jayanti Vaishnav | NMR based structural investigations on endothelin receptors & their interactions with designed anti -hypertensive agents; XIAP with SMAC mimetics; relaxation analysis of SIX3 proteins, conformational analysis on pancreastatin related peptides; and metabolomic studies of cerebral ischemia in rat model | Dr. Ravi Sankar Ampapathi | 31-07-2023 |
| 66. | Ms. Parul | Investigation to delineate the molecular and cellular mechanism of susceptibility to stress | Dr. Shubha Shukla | 31-07-2023 |
| 67. | Mr. Sunil Kumar Raman | Comparative preclinical evaluation of standard anti-Tuberculosis chemotherapy and emerging interventions *via* pulmonary delivery | Dr. Amit Misra | 01-01-2024 |
| 68. | Ms. Sandhya Singh | Unravelling the role of Musashi2 (MSI2) in cardiac pathophysiology | Dr. Shashi Kumar Gupta | 19-03-2024 |

### 7.2 Skill Development Program (Healthcare & Life Science)

Skill India is an initiative launched to empower the youth of our country with skill sets that make them more employable and productive in their work environment. Skill shortage remains one of the major constraints to the continued growth of the Indian economy. We wish to address this knowledge gap with the professionally trained youth of India. The courses have been designed to meet the aspirations of students, young researchers, and industry-sponsored personnel looking for training. We offer seven certificate courses under the CSIR-CDRI Skill Development Program. These courses provide an opportunity for skill development and hands-on experience in the area of healthcare and life science. During this period 360 aspirants from more than 145 colleges/institutes in different parts of the country have participated.

| Sl. No. | Skill Development Training Programs | No. of Trainees | Name of the Coordinators |
|---|---|---|---|
| | | | |
| 1 | Advanced Spectroscopic (NMR, HPLC, LC-MS, UV/IR) Techniques 07.08.2023 to 29.09.2023 | 16 | Dr. Sanjeev K. Shukla |
| 2 | Advanced Course on Care, Management of Laboratory Animals & Experimental Techniques 29.05.2023 to 16.06.2023 | 13 | Dr. Rajdeep Guha |
| 3 | Computational Approaches to Drug Design and Development Certificate 04.12.2023 to 12.01.2024 | 10 | Dr. M. I. Siddiqui |
| 4 | Plant Authentication, Phytochemical Extraction, Formulation, and HPLC Analysis of Herbal Products1 5.01.2024 to 09-02-2024 | 9 | Dr. Vineeta Tripathi |
| 5 | Basic Training in Electron Microscopy Techniques for Life Sciences 20.11.2023 to 08.12.2023 | 4 | Dr. Kalyan Mitra |
| 6 | Pharmaceutical Product Development and Quality Control 26-02-2024 to 22-03-2024 | 10 | Dr. P. R. Mishra |
| 7 | Pathological Tools & Techniques for biomedical applications 26.06.2023 to 04.08.2023 | 25 | Dr. M. N. Mugale |
| 8 | Skill Development Program for Post Graduate Students 01.04.23 to 31.03.24 | 206 | All R&D Scientists |
| 9 | • Advanced Training Program for the Trainees from Academia/ R&D Institutes/Industry· <br>• Post Graduate Dissertation Program · <br>• Summer Fellowship Training Program: IAS, INSA-IASc-NASI Summer Fellows, AcSIR-Dr. APJ Abdul Kalam Summer Trainees, Students from IIT's under MoU, BITS, UPCST Fellowship, INSPIRE Fellowship 01.04.23 to 31.03.24 | 67 | All R&D Scientists |
| | Total Number | 360 | |

# 8 Honours & Awards

**Dr. Divya Singh**

- Elected Fellow of National Academy of Sciences, India 2023

**Dr. Namrata Rastogi**

- SERB Power (Promoting Opportunities for Women in Exploratory Research) Fellowship

**Dr. Madhav Nilakanth Mugale**

- IAVP- Dr. B.L. Purohit Memorial Best Toxicologist-Pathologist Award
- Best Poster Presentation " at Society of Toxicopathology (STP-I), Gandhi Nagar Gujrat
- Dr. K.R. Bhardwaj Award (Excellence in Laboratory Animal Science) by Laboratory Animal Science Association India (LASAI-2023) at CSIR-NEIST, Jorhat, Assam

**Dr. Pintu Kumar Mandal**

- ACCTI C.G. Merchant Memorial Award, by Association of Carbohydrate Chemists & Technologists (INDIA)

**Dr. Bidyut Purkait**

- Best Poster Presentation for 'Mechanism of Sir 2 (deacetylase enzyme) Mediated Epigenetic Regulation of G6PDH in Manipulating AmB-induced Oxidative Stress in AmB Unresponsive Clinical Isolates of *Leishmania donovani*' at Golden Jubilee Conference of the Indian Immunology Society, by All India Institute of Medical Sciences, New Delhi

**Mr. Rohit Singh Rawat**

(Student of Dr. Dibyendu Banerjee)

- AWSAR Award for "Autophagy: A Hijacked House Cleaning Machinery is a Culprit in Making Cancer Cells More Powerful Against Chemotherapy" by Department of Science and Technology, Govt. of India

**Mr. Amit Singh Adhikari**

(Student of Dr. Nilanjana Majumdar)

- JSPS Hope Fellow Award for "Iridium-catalyzed Enantioselective Allylic Substitution of Vinylcyclopropanes By Carboxylic Acids" at 15th HOPE meeting with Nobel Laureates, 2024, by Department of Science and Technology,

**Ms. Akanksha Vyas**

(Student of Dr. Monika Sachdev)

- Best AWSAR Story Award for 'An Oocyte Protein can be a Magical Molecule to Detect Cervical Cancer' by DST & Vigyan Prasar, New Delhi

**Ms. Garvita Mishra**

(Student of Dr. Bidyut Purkait)

- Best Poster Presentation for 'Targeting RNA editing ligase 1 (Ld REL 1) of *Leishmania donovani* for the Development of novel Anti-leishmanial Agent' at Golden Jubilee Conference of the Indian Immunology Society, 2023 by All India Institute of Medical Sciences, New Delhi

**Ms. Anushka Rastogi**

(Student of Dr. Dipankar Koley)

- Best poster Award 'Manganese Catalyzed Site-Selective Hydroxymethylation to 2-pyridines and Isoquinolones via C-H Activation' at XVIII J-NOST Conference for Young Researchers 2023, IISER, Pune, Maharashtra

**Ms. Neha Agarwal**

(Student of Dr. Prabhat Ranjan Mishra)

- Best Poster Award 'Surface Modified Eudragit Nano-Therapeutic Bearing Doxorubicin and Rutin Synergistically Improves Therapeutic Outcomes in Breast Cancer Bone Metastasis' in Manipal Pharmaceutics Conference (MPCON)-2023, Manipal, Karnataka

**Mr. Shashawat Gupta**

(Student of Dr Atul Goel)

- ACS Best Poster Prize for "Development of fluorescent Dyes and Quenchers for Diagnostic Applications in Patient Clinical Samples" at 32nd CRSI National Symposium in Chemistry (CRSI-NSC-32), Pilani, Rajasthan

**Ms. Sakshi Priya Jaiswal**

(Student of Dr. Atul Goel)

- RSC Best Oral Presentation Award for "Development of new Fluorescent Probes for Detection of Cancer and Viral Infections" at International Conference on "Luminescent Materials: From Fundamentals to Applications" (ICLMFA-2024), Amritsar, Punjab

**Ms. Nisha Gupta**

(Student of Dr Atul Goel)

- RSC Best Poster Presentation Award for "Development of new Fluorescent Dyes for Hypochlorite Ion-Sensing and Staining of dsDNA" at International Conference on "Luminescent Materials: From Fundamentals to Applications" (ICLMFA-2024), Amritsar, Punjab

**Mr. Shyamal Pal**

(Student of Dr. Atul Goel)

- RSC Best Poster Presentation Award for "Synthesis of Natural Pterocarpans and their fluorescent tagging for monitoring biological pathways" at International Conference on "Luminescent Materials: From Fundamentals to Applications" (ICLMFA-2024), Amritsar, Punjab

**Ms. Sandhya Singh**

(Student of Dr. Shashi Kumar Gupta)

- Second prize in Oral Presentation for "Musashi-2 Causes Cardiac Hypertrophy and Heart Failure by Inducing Mitochondrial Dysfunction through Destabilizing Cluh and Smyd1 mRNA" in 4th National Biomedical Research Competition (NBR COM), 2023, by Society of Young Biomedical Scientists (SYBS), ESIC Medical College and Hospital, Alwar, Rajasthan

**Mr. Shakti Prakash**

(Student of Dr. Shashi Kumar Gupta)

- Prof. CC Kartha Travel Grant Award on Oral Presentation for "Identification of Novel Signaling Molecules Involved in Cardiac Remodeling and Regeneration" at 2nd Annual Meeting of International Society for Heart Research (Indian Section) International Academy of Cardiovascular Sciences (Indian Section), 2023, by Department of Cardiology, AIIMS, Jodhpur, Rajasthan

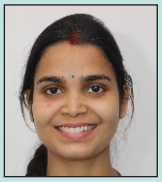
**Ms. Kaveri Rajaram Washimkar**

(Student of Dr. Madhav Nilakanth Mugale)

- Best Poster Presentation "Longitudinal Assessment of Bleomycin-Induced Pulmonary Fibrosis By Evaluating TGF-β1/Smad2, Nrf2 Signaling and Metabolomics Analysis in Mice" at 4th National Biomedical Research Competition (NBR COM), 2023, by Society of Young Biomedical Scientists (SYBS), ESIC Medical College and Hospital, Alwar, Rajasthan

**Ms. Sunaina Kumari**

(Student of Dr. Shashi Kumar Gupta)



- Young Researcher Award (Oral presentation) for "Quaking knockdown Leads to Cardiac Cachexia and Heart Failure in Mice by Altering Morf4l2 Alternative Splicing" at 4th National Biomedical Research Competition (NBR COM), 2023, by Society of Young Biomedical Scientists (SYBS), ESIC Medical College and Hospital, Alwar, Rajasthan

**Ms. Shivani Choudhary**

(Student of Dr. Nayan Ghosh)

- Dalton Transactions Poster Prize for "Copper-catalyzed Stitching of 2-Carbonyl-anilines with 1,3-Butadienes: An Access to Pyrrolo[2,3-b]quinoline and Its Photophysical Studies" at Catalysis for Sustainability, 2023, by Indo-French Seminar, IISER Thiruvananthapuram, Kerala

**Ms. Rohini Nandi**

(Student of Dr. Satish Mishra)

- Best Poster Presentation Award for "EDP is Required for Efficient Transition from Sporozoite to Blood Stage Infection" at 46th All India Cell Biology Conference (Theme: Cell Biology at the Crossroads of Interdisciplinary Sciences), 2023, by ACTREC, Mumbai, Maharashtra

**Ms. Himadri Shukla**

(Student of Dr. Satish Mishra)

- Best Oral Presentation Award for "Elucidating the Role of Base Excision Repair Enzymes in Organellar Genome Maintenance in the Malaria Parasite" at the International Conference of Integrative Chemistry, Biology & Translational Medicine, Udaipur, Rajasthan

**Ms. Plabita Paul**

(Student of Dr. Satish Mishra)

- Best Oral Presentation Award for "Neddylation is Essential for Malaria Transmission in *Plasmodium berghei*" at International Conference of Integrative Chemistry, Biology & Translational Medicine, Udaipur, Rajasthan

**Ms. Indrani Chakraborty**

(Student of Dr. Satish Mishra)

- Best Oral Presentation Award for "Modulation of Host Response by *Plasmodium* during Liver Stage Development: A Strategy to Survive" at the International Conference of Integrative Chemistry, Biology & Translational Medicine, Udaipur, Rajasthan

**Mr. Gaurav Prajapati**

(Student of Dr. Kinshuk Raj Srivastava)

- Best Poster Award for "E.coli as a Chasis for Lycopene Bio-Production: A Synthetic Biology Infused Whole Cell Catalysis Platform" at International Conference on Bio-Technological Intervention for Health, Agriculture and Circular Economy in BioSangam, 2024, at MNNIT, Prayagraj, Uttar Pradesh

**Mr. Mohsin Ali**

(Student of Dr. Sanjeev Kanojiya)

- Best Poster Presentation for "Tandem Mass Spectrum Database: An Open-Access MS/MS Library of Naturally Occurring Bioactive Compounds (Utility and its applications)" at International Conference on Traditional Medicine & Phytopharmaceuticals (ICTMP) & 11th International Congress of Society for Ethnopharmacology (SFEC) 2024, by CSIR-IIIM, Jammu

**Ms. Shreya Jaiswal**

(Student of Dr. Manoj Kumar Barthwal)

- Prof. NS Dhalla Award for "Modulation of Innate Immune Response Ameliorates Angiotensin II Induced Cardiac Hypertrophy and Fibrosis" at International Society for Heart Research (ISHR) 2024, by AIIMS Jodhpur, Rajasthan

**Mr. Shubham Jaiswal**

(Student of Dr. T. Narender)

- Best Poster Presentation Award for "Synthesis of Highly Substituted Isoquinolines/ Isoquinolones by Ruthenium(II)-Catalyzed Reaction of Benzyl/ $\alpha$-Methyl benzyl/Benzoyl isocyanates with Diaryl Alkynes" at National Conference on Recent Trends in Polymer & Chemical Sciences, 2023 by Mohanlal Sukhadia University, Udaipur, Rajasthan

**Mr. Sunil Kumar Raman**

(Student of Dr. Amit Misra)

- Outstanding Student Poster Presentation Award for "Dry Powder Inhalation of Lytic Mycobacteriophages in Pulmonary Tuberculosis" at Asian Federation of Pharmaceutical Sciences biennial meeting (Theme: Collaboration for Breakthroughs in Pharmaceutical Sciences), 2023, Hanoi, Vietnam

**Mr. Devanshu Kaushik**

(Student of Dr. PN Yadav)

- Best Poster Award for "Role of TGR5 in Neural Stem Cell Homeostasis" at XLI Meeting of Indian Academy of Neurosciences, by Jiwaji University, Gwalior, Madhya Pradesh

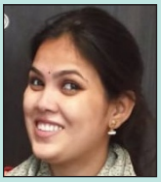
**Ms. Abhipsa Sinha**

(Student of Dr. Dipak Datta)

- Rambhau Kulkarni Young Scientist Award for 'Acyl-CoA Synthetase 4 (ACSL4)-Driven Modulation of Histone Acetylation Dynamics Orchestrates Triple Negative Breast Cancer Metastasis in IACR 2024, by IISER Pune, Maharashtra

**Ms. Rachana Meena**

(Student of Dr. Damodara Reddy)



- Best Poster Presentation for "Metal -Free Sp2-C7-H-Borylation of Tryptophan Peptide and Stage Modification" at Drug Development & Drug Delivery: An International Conference, CD4,2023, by Institute of Pharmaceutical Science, University of Lucknow, Lucknow, Uttar Pradesh

**Ms. Priyanka Rawat**

(Student of Dr. Sanjeev Kanojiya)

- Best Poster Presentation Award for "Bone Fracture-Healing Property of Purified Flavonoid Enriched Fraction from Oxystelma esculentum with their Phytochemical Investigation using Ultra-Performance Liquid Chromatography-Mass Spectrometry" at the Global Indian Young Scientists Research and Innovation Conference, 2023, by the National Agricultural Science Complex - ICAR, New Delhi

**Mr. Rahul Roy**

(Student of Dr. Mrigank Srivastava)

- Best Poster Presentation Award for "Deciphering the cross Talk Between Innate Lymphoid Cells Type 2 (ILC2) and Eosinophils During Tropical Pulmonary Eosinophilia at the Golden Jubilee Conference of The Indian Immunology Society-Immunocon, 2023, by AIIMS, New Delhi

**Ms. Laxmi Ganga**

(Student of Dr. Mrigank Srivastava)

- The Cytometry Society (TCS) Annual award in Basic Sciences-2023 (First Prize) for "Immunophenotypic and Functional Characterization of Eosinophil and Migratory Dendritic Cell Subsets During Filarial Manifestation of Tropical Pulmonary Eosinophilia" at 15th TCS Annual conference, 2023, by AIIMS, New Delhi

Section
IV

# Events & Activities Organized

# 1 Events & Activities

**1. Institutional Events**

1.1. 73rd Annual Day Celebrations and 49th Sir Edward Mellanby Memorial Oration 17 February 2024
1.2. 82nd CSIR Foundation Day Celebrations at CSIR-CDRI, Lucknow 26 September to 4 October 2023
1.3. 77th Independence Day Celebrations 15 August 2023
1.4. 75th Republic Day Celebrations 26 January 2024
1.5. National Technology Day Celebration on 11 May 2023
1.6. National Science Day Celebration 28 February 2024

**2. Symposiums**

2.1. One-Day Symposium on Preclinical Animal Models and Available Alternatives 24 April 2023
2.2. Half-day symposium on sustainable approaches in Medicinal Chemistry 26 April 2023
2.3. One-Day symposium on "Patient Engagement- Benchmark in Clinical Trials" on 19 May 2023.
2.4. Half-day Symposium on 'GLP Studies: Requirement for IND Submission' 26 March 2024
2.5. India bioscience Regional Young Investigator Meet 13 - 15 September 2023
2.6. 6th CSIR-CDRI Nobel Symposium 12 December 2023
2.7. One-Day Symposium on "Career Development in Biological and Biomedical Sciences 6 February 2024

**3. Workshops and Training**

3.1. Silver Jubilee 25th INDO-US Flow Cytometry workshop on "Flow Cytometry and its Advanced Application in Biological Sciences" 7 - 8 February 2024
3.2. Seminar cum Workshop on Emerging Trends in Computer Aided Drug Design 26 February 2024
3.3. Webinar on GraphPad Prism (A tool for data analysis and visualization) 20 November 2023
3.4. Workshop on 3D- Bioprinting 30 January - 1 February 2024
3.5. Training program on MyLOFT (MyLibraryOnFingerTips) 19 October 2023
3.6. Scientific and Technical Awareness Training Program in Animal Ethics & Experimentation 20-30 November, 2023
3.7. Fostering Unity in Diversity - A Team Building Workshop 8-9 December 2023

**4. Science Outreach and Societal Activities**

4.1. Jigyasa- Quest for curiosity (year-long program)
4.2. Indian International Science Festival 14 December 2023

**5. Awareness Programs / Thematic Celebrations**

5.1. Swachhata Pakhwada 1 - 15 May 2023
5.2. National Intellectual Property Festival 14-18 July 2023
5.3. Library Week 22 - 25 August 2023
5.4. International Yoga Day 21 June 2023
5.5. Bhujal Saptah 16 - 22 July 2023
5.6. Emergency Climate Week 22 - 28 July 2023
5.7. Artificial Intelligence (AI) awareness program 10 August 2023
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5.9. Ayurveda Day Celebrations in Collaboration with Regional Ayurveda Research Institute (RARI) 6 November 2023
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5.11. Awareness program on the occasion of 3rd Janjatiya Gaurav Divas 23 November 2023
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5.13. Quami Ekta Day celebration 19 - 25 November 2023

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# 1 Institutional Events

## 1.1 73rd Annual Day Celebrations and 49th Sir Edward Mellanby Memorial Oration

The CSIR Central Drug Research Institute celebrated its 73rd Annual Day Celebration on February 17, 2024. On this occasion, Dr. Radha Rangarajan, Director, CSIR-CDRI presented the institute's Annual Day report highlighting the strides made in drug discovery, diagnostics, and process technologies during the year. On this momentous occasion the 49th Sir Edward Mellanby Memorial Orations was delivered by Dr. Jyotsna Dhawan, Emeritus Scientist, CSIR - Centre for Cellular & Molecular Biology, Hyderabad.

Dr. Ashutosh Sharma, President of the Indian National Science Academy and former Secretary of the Department of Science & Technology, Government of India, and esteemed Chair Professor at IIT Kanpur graced the event as Chief Guest and delivered the Annual Day lecture. During the event, CSIR-CDRI signed a licensing agreement with M/s ESS CEE Biotech India for the Phosphoramidite-based quenchers technology. The entire celebration was witnessed by present as well as former staff and students of CSIR-CDRI. During the day, the winners of Annual Day sports activities were felicitated by the Director. In the evening, cultural program was organized followed by Annual Day Dinner for all the staff, students and guests.

## 1.2 82nd CSIR Foundation Day Celebrations at CSIR-CDRI, Lucknow

The 82nd Foundation Day of the Council of Scientific and Industrial Research (CSIR) was celebrated in a grand way on three different days. On 26 September, "Open Day" event was organized, which was participated by the students and teachers from school and colleges from across the region including Sultanpur, Hardoi, Raebareli, Unnao, Kanpur and Lucknow.

On 3 October 2023, Foundation Day Felicitation event was organized at CSIR-CDRI. In the event, the Director, CSIR-CDRI felicitated the winners of various competitions organized for the school students during open day organized on 26 September. Further, Meritorious children of CSIR-CDRI staff members, colleagues who were superannuated during the preceding year and colleagues who have completed 25 years of service at CSIR-CDRI were felicitated by the Director on this occasion.

On 4 October 2023, the Lucknow based CSIR Institutes - CSIR-CDRI, NBRI, CIMAP and IITR jointly organized a grand celebration of 82nd CSIR Foundation Day event at Atal Bihari Scientific Convention Centre, Lucknow. Dr. Renu Swarup, Former Secretary, Department of Biotechnology, Government of India graced the occasion as Chief Guest and delivered the foundation day lecture on 'Technological Innovations: Addressing Critical Priorities Impacting Society'. Dr. Sonia Nityanand, Vice Chancellor, King George's Medical University, Lucknow graced the occasion as Guest of Honour. During the event, Dr. Radha Rangarajan, Director, CSIR-CDRI, Dr. Prabodh K Trivedi, Director, CSIR-CIMAP, Dr. Bhaskar Narayan, Director, CSIR-IITR and Dr. Ajit K Shasany, Director, CSIR-NBRI addressed the audience and informed about the accomplishments of the CSIR Institutes in the service of nation. Distinguished fraternity from Lucknow, Former and present staff and students of CSIR labs and Press & Media participated in the event.

## 1.3 77th Independence Day Celebrations

As a part of 77th Independence Day celebrations on 15 August 2023, Dr. Radha Rangarajan, Director, CSIR-CDRI hoisted the national flag. In her address, the Director encouraged all the staff and students to contribute their best for the Science & Technology programs of CSIR-CDRI and the nation at large. The CSIR-CDRI staff, students, and family members joined for the flag hoisting and national anthem.

**Cultural Program:**

On the eve of Independence day, 14 August 2023 a cultural program was organized at CSIR-CDRI by the staff club. In this program, Dr. Dipankar Koley, Senior Principal Scientist and Dr. Amogh Sahasrabuddhe, Senior Principal Scientist performed Instrumental music. During the occasion, Dr. Radha Rangarajan, Director presided and addressed the audience.

## 1.4 75th Republic Day Celebrations

Institute celebrated 75th Republic Day on 26 January 2024, to commemorate the date on which the Constitution of India came into effect replacing the Government of India Act (1935). Dr. Radha Rangarajan, Director, CSIR-CDRI hoisted the National Flag and addressed all the staff members and students of the Institute. In her address, she recalled the efforts and sacrifice of our freedom fighters in establishing a sovereign democratic country and also inspired the staff to understand the responsibility towards our society.

**Cultural Program:**

On the eve of Republic day, on 25 January 2024, a cultural program was organized at CSIR-CDRI by the staff club. In this program, a suspense thriller play with patriotic message, written and directed by Mr. Shubhdeep Raha was performed by Dr. Anil Rastogi, former Head, Biochemistry division, CSIR-CDRI and team. During the occasion, Dr. Radha Rangarajan, Director presided and addressed the audience and felicitated the artists.

## 1.5 National Technology Day Celebrations

The 25th National Technology Day was celebrated in CSIR –CDRI on 15 May 2023 to commemorate the achievements & honor of India's scientists, engineers, researchers and their achievements with the theme of "Integrated Approach in Science and Technology for a Sustainable Future". On this occasion, Dr. Manjiri Bakre; founder CEO of OncoSteam Diagnostics Pvt. Ltd. delivered 'Technology Day' talk on "Overuse of Chemotherapy leads to physiological and financial toxicity". Dr. Dhananjay Dendukuri; Co-founder & CEO of Achira Labs Pvt. Ltd. delivered another talk and shared his thoughts on "Microfluidic technologies in the post-COVID world will play significant role in point of care testing". The event was witnessed by staff and students of CSIR-CDRI.

## 1.6 National Science Day Celebrations

National Science day is celebrated in India on 28th February of every year to commemorate the great discovery of the Raman effect by our own world class Indian Physicist Sir C.V Raman for which discovery he was awarded Nobel Prize in 1930. CSIR-CDRI, Lucknow celebrated the National Science Day in the gracious presence of Dr. Vineet Ahuja, Professor, MD, DM, MNAMS, Department of GastroEnterology, AIIMS, New Delhi. He delivered an interesting lecture on "Microbiome manipulation therapies in inflammatory bowel disease". The event was presided by Dr. Radha Rangarajan, Director, CSIR-CDRI, Staff and students participated in the event and got the glimpses of IBD from clinician point of view.

## 2 Symposiums

### 2.1 One Day Symposium on Preclinical Animal Models and Available Alternatives

One Day Symposium on "Preclinical Animal and Available Alternatives" in commemoration of 'World Laboratory Animal Day' was organized on 24 April 2023 in collaboration with Laboratory Animal Science Association of India (LASAI). Dr Sujit Kumar Dutta, Joint Commissioner, Ministry of Animal Husbandry, Dairying and Fisheries delivered a talk on animal role in making different medicine and perform various experiment. Dr. Suresh Poosala, Founder, Oncoseek Bio Pvt. Ltd introduced alternatives and some animal model of disease in drugs discoveries. Later on Dr. Parthasarathy Ramakrishnan from CSIR-IITR gave a presentation on Computational Toxicology Platform toward replacing animal testing. Dr. Chetana Sachidanandan CSIR-IGIB, New Delhi presented Zebra fish as a model for human disease. Dr. Aamir Nazir, CSIR-CDRI Lucknow presented *C. elegans* as alternative to animal model for disease research. Vjeta Jaiswal Cellink Bio printing, Bangalore presented a new concept that was 3D Bio printing: An Alternative to Animal Testing. Dr. Vivek Tyagi, Senior Consultant, CCSEA, New Delhi gave speech on CCSEA- Aim Rules, function and Recent Notifications of CCSEA for nomination and establishments. Dr. UD Gupta, Ex- Director in Charge, ICMR-NJILOMD, Agra presented report on Biosafety practices and infectious Diseases. Dr. Satish Panchal, Sun Pharma Advanced Research Company Ltd (SPARC) presented the Regulatory requirement of using dogs in non- clinical research. Dr. Neeraj Khatri, CSIR- IMTech, Chandigarh presented some guideline on Approval and Inspection of Animal Facilitates in India as per CCSEA guidelines.

## 2.2 Half-Day Symposium on Sustainable Approaches in Medicinal Chemistry

To commemorate the outstanding contributions of Dr. Atul Kumar, Chief Scientist, and Head, Medicinal and Process Chemistry Division, CSIR-CDRI, Lucknow, a half day symposium was organized on 26 April 2023. Professor Diwan S. Rawat, Department of Chemistry, University of Delhi, Delhi delivered a talk on the discovery of Nuclear receptor Nurr1 Agonist as a ray of hope for the treatment of Parkinson's disease. Dr. Akanksha Gupta, talked about the discovery of anti-cancer agent through total synthesis of natural products via carbohydrate as chiral pool agent and Dr. Atul's former student Dr. Siddharth Sharma briefed about organic chemistry of Isocyanides and their progress from flask to Electrochemical cell. The event was witnessed by staff, students of CDRI, former students, and family members of Dr. Atul Kumar.

### 2.3. One-Day symposium on "Patient Engagement- Benchmark in Clinical Trials"

CSIR-CDRI in partnership with DNDi India Foundation organized a symposium titled "Patient Engagement: Benchmark in Clinical Trials on 19 May 2023. The symposium was organized on the eve of International Clinical Trials Day that is celebrated on May 20 every year to commemorate the day in 1747 when James Lind, a Scottish physician, conducted what is considered the first clinical trial in history. By doing so he laid the foundation for modern clinical research. Dr. Kavita Singh, Director of DNDi, discussed the patient engagement experience of DNDi in conducting kala azar clinical trials in Bihar. Dr. J.S. Srivastava, Professor and Head of the Psychiatry Department at Hind Institute of Medical Sciences and former Chief Scientist at CSIR-CDRI, discussed the concept of adopting a Patient-Centric Approach for Clinical Trials. Dr. Pooja Sharma, Founder CEO of APAR Health delivered her talk on "Patient Engagement: Putting Patients First". The event was successful in terms of creating awareness towards emphasizing the need for more patient-centric approach in clinical studies.

## 2.4 Half-day Symposium on 'GLP Studies: Requirement for IND Submission'

To commemorate the outstanding contribution of Dr. Sharad Sharma, Chief Scientist, Toxicology Division, CSIR-CDRI, Lucknow, a half day symposium was organized on 26 March 2024 under the theme of "GLP Studies: Requirement for IND Submission". The symposium was enriched with lectures by eminent personalities such as Dr. Sebastian V. Joseph, Senior Director, Toxicology and Nonclinical Development, (gave talk on IND enabling preclinical studies: Scientific and regulatory considerations to ensure subject safety), and Prof. Manthan D. Janodia, Professor and Head of Department of Pharmacy Management, Manipal University, Manipal (delivered talk on GLP studies and Pharmaceutical regulatory requirements). The evet was further proceeded with reflection and recollection of Dr. Sharad Sharma's eventful journey and brilliant contribution in preclinical studies in CDRI, who served the Institute for more than 28 years. The event was witnessed by his beloved staff and students of CDRI.

## 2.5. India Bioscience Regional Young Investigator's Meet

CSIR CDRI along with SGPGI, Lucknow, IIT Kanpur, BHU, Varanasi and IISER Bhopal hosted The Regional Young Investigators' Meeting (RYIM) 2023-2024 on from 13 to 15 September, 2023, under the theme, "The significance of collective efforts in driving transformative developments in the field of bioscience". The meet was comprising three days of vibrant discussions, knowledge sharing, and skill development, providing a valuable platform for young investigators to connect, collaborate, and accomplish in the world of bioscience. It was Dr. Karishma Kaushik, representing IndiaBioscience, shed light on the theme "Engaging the Communities, Enabling Change," followed by a thought-provoking lecture by Prof. Arun Shukla from IIT Kanpur, who shared insights on "Skills for Running a Lab Successfully and Building a Local Community". Prof. L.S. Shashidhara, Director of NCBS, Bangalore, captivated the audience with his talk on "Taking Your Mentorship to the Next Level". Dr. Radha Rangarajan, Director of CSIR-CDRI, shared her expertise on "Translational Research: Understanding the Continuum from Bench to Bedside". Later, a stimulating panel discussion was conducted on "The Art of Establishing and Maintaining Collaboration" and a cross-talk session between researchers and clinicians. The distinguished panel included Dr. Radha Rangarajan of CSIR-CDRI, Prof. L.S. Shashidhara of NCBS, Bangalore, Dr. Uday Ghoshal of SGPGIMS, Dr. Satyendra Kumar Singh of KGMU, and Dr. Jagavelu Kumaravelu of CSIR-CDRI, who served as the moderator. Their collective insights sparked engaging conversations on the dynamics of collaboration between researchers and healthcare professionals. On concluding day, there was an enlightening talk by Dr. Sanjay Mishra, a Scientist at the Department of Biotechnology (DBT), India. The meet was concluded with a captivating workshop titled "Crafting Your Career" (CYC) by Dr. Karishma S Kaushik and Ms. Ankita Rathore, representatives of IndiaBioscience.

## 2.6. 6th CSIR-CDRI Nobel Symposium

6th CSIR-CDRI Nobel symposium was organized on 12 December, 2023 in honor of the Nobel Laureates in the fields of Chemistry and Physiology/Medicine 2023. This student-led symposium series, initiated in 2018, is aimed at inspiring young scientific minds and encourage coming up with innovative ideas that will benefit the society. The symposium featured a series of lectures by Research Scholars on topics illustrating the discoveries in the fields of Chemistry and Physiology/Medicine, which received Nobel Prize in 2023. The event was presided by the Director Dr. Radha Rangarajan. PhD students, Ms. Suchitra Gupta, Ms. Arpita Banerjee, Mr. Souvik Barman, Ms. Sapna Shrivtastav, Ms. Sonu Khanka and Mr. Girdhar Bhati presented the Nobel winning work in Chemistry (Theme: Quantum Dots: Theoretical Concept to Discovery and Practical Application in Day-to-Day Life) and Physiology & Medicine (Theme: Pioneering Nucleoside Modification for the Development of mRNA Vaccine against COVID-19) of the year 2023. The students were mentored by Dr. Nilanjana Majumdar, Dr. Pintu Kumar Mandal and Dr. Niti Kumar. Event was attended by all the Scientists and students. The Director felicitated all the presenters with a citation and memento.

## 2.7. One Day Symposium on "Career Development in Biological and Biomedical Sciences

CSIR-CDRI, in collaboration with the Trust for Education and Training in Cytometry (TETC), successfully organized a symposium aimed at illuminating diverse career pathways in Biological & Biomedical Sciences on 6 February 2024. On the onset of symposium, Dr. Rekha Gour, Co-Founder of TETC, India and Organizing Chairperson, underscored the organization's vision to facilitate knowledge exchange among experts in the field, empowering participants to grasp both fundamental and advanced concepts in career development. Dr. Michael D'Silva, Lead Investigator at Syngene International, Bangalore, and Dr. Arvinder Singh, Director of Human Diagnostics, Gurgaon, shed light on the opportunities available in corporate research. Mr. Ayush Mishra, CINO of Anervea, Pune, offered invaluable insights into Company Start-up and Entrepreneurship. Dr. Naibedya Chattopadhyay, Chief Scientist at CSIR-CDRI talked about success strategies for postdoctoral research whereas Dr. Saman Habib, Chief Scientist at CSIR-CDRI talked about scientific positions in government organizations. Dr. SK Varshney outlined in detail about Funding/Grants opportunities available with government organizations. Dr. Hemant Agrawal, Director, Flow Cytometry Solutions, Jaipur informed how students can make their Careers in Flow Cytometry. The symposium concluded with a dynamic panel discussion chaired by Dr. Manoj Barthwal (CSIR-CDRI) and Dr. Rekha Gour, fostering a live interaction between speakers and participants.

## 3. Workshops / Trainings

### 3.1. Silver Jubilee 25th INDO-US Flow Cytometry Workshop on "Flow Cytometry and its Advanced Application in Biological Sciences

CSIR-CDRI hosted a two-day workshop on 6-7 February 2024 about the advanced applications of flow cytometry in Biological Sciences in collaboration with the Trust for Education and Training in Cytometry (TETC) India. The workshop was inaugurated by the Director, CDRI, Dr. Radha Rangarajan. Dr. Derek Davies from The Francis Crick Institute, London, who is a luminary in the realm of flow cytometry with over three decades of pioneering contributions, graced the occasion as Chief Guest of the workshop. The other distinguish dignitaries in the workshop were Dr. Krishnamurthy from NCBS, Pune; Dr. Rupesh Shrivastava from AIIMS New Delhi. Specialists from Beckman-Coulter, ThermoFisher and Cytek Biosciences showcased the Latest advancement flow cytometry. The expert scientists provided and hands-on training to the participants during this two days' workshop.

### 3.2 Seminar cum Workshop on Emerging Trends in Computer Aided Drug Design

CSIR-CDRI organized an informative seminar cum-workshop "Emerging Trends in Computer Aided Drug Design" on 26 February, 2024. Dr. Gaurav Ahuja, from IIIT Delhi delivered an interesting talk themed, "illuminating dark metabolome using artificial intelligence". The entire event was organized by Centre for Bioinformatics and Computational Biology division of CSIR-CDRI, and preceded by Director, D. Radha Rangarajan who also delivered the welcome address. The students and staff of the Institute got good exposure on usage of AI in the area of drug design which opens the multiple ways in hypothesizing the drugs and the targets. The use of AI would also help in minimizing the usage of lab animals thereby providing an efficient was timesaving method in metabolome studies.

### 3.3. Webinar on GraphPad Prism (A tool for data analysis and visualization)

The Knowledge Resource Centre, CSIR-CDRI, organized a webinar on "GraphPad Prism: A tool for data analysis and visualization" on 20 November 2023. Ms. Sadidah, Executive, Sales & Marketing, GraphStats Technologies, delivered an informative talk on software utility. Faculties and students of CDRI attended the webinar with enthusiasm. As the software is used at every step of the scientific study, the facility has been made available centrally to all the staff and students at "Digital Library Access Zone", inside the KRC building.

### 3.4 Workshop on 3-D Bioprinting

CSIR-CDRI in collaboration with AVAY Biosciences, Bangalore organized a 3-day hands on workshop on 3D bioprinting technology from 30 January to 1 February, 2024. AVAY Biosciences kept their 3D bioprinting machine in the Institute for reasonable time which allowed researchers to get exposure to preliminary concept pertaining to 3D matrix printing, 3D organoid printing, scaffold printing and to understand its utility in drug discovery applications.

### 3.5. Training Program on MyLOFT (My Library On Finger Tips)

Knowledge Resource Center (KRC) of CSIR CDRI, subscribes number of online version of journals for our readers to expand the access and increase the usage beyond office hours. In this regard, KRC has subscribed to an application for the convenience of the users viz., MyLOFT (My Library On Finger Tips) to facilitate remove access to electronically subscribed world-class information resources, search, analyze and save the search results on the portal. In order to facilitate the usage, KRC organized MyLOFT training program on 19 October 2023. Mr. Vaibhav Goel, Product Trainer, MyLOFT, introduced the application to many students and staff who participated in the event enthusiastically to acknowledge the utility of the application.

### 3.6 Scientific and Technical Awareness Training Program in Animal Ethics & Experimentation

The scientific and technical skill development program (STSDP) is conducted on 20-30 November 2023 in CSIR-CDRI to train internal research scholars in laboratory animal experimentation, regulatory guidelines, and laid down SOPs of animal use. Students have been imparted training in animal care, handling, dosing, anesthesia, analgesia, euthanasia, necropsy, and tissue collection.

### 3.7 Fostering Unity in Diversity – A Team Building Workshop

A two-day off-site team-building workshop was held at the SGPGI Campus Guest House, Lucknow on 08-09 December 2023 for members of the Bill and Melinda Gates Foundation grant (BMGF) team. Facilitated by acclaimed accredited Life Coach Kanika Mehrotra, renowned for her expertise in Emotional Intelligence, the session aimed to deepen participants' understanding of their emotions and improve their overall well-being. With a track record of working with prestigious organizations spanning consulting firms to esteemed United Nations agencies like the World Health Organization and UNICRI, Kanika led a dynamic program filled with team-building activities, discussions, and assignments. The workshop also comprised of yoga session in the morning to rejuvenate the participants. The workshop's objective was to foster team cohesion and alignment towards a shared goal, imparting valuable soft skills such as effective communication in challenging scenarios, adept multitasking, and cohesive team building to the attendees.

## 4. Science Outreach and Societal Activities

### 4.1 Jigyasa-Quest for curiosity

Jigyasa is a path-breaking initiative to inculcate scientific temper amongst students. CSIR extends scientific knowledge to students and teachers from more than 1000 KV schools across India.

Student motivation and Student-Scientist Connect programs: These programs have been arranged with a major objective of motivating young students for pursuing a career in Science and explore the knowledge of drug Discovery and Research. This program is aimed to inculcate the scientific temperament among students and to motivate them to make Aatmanirbhar Bharat through scientific interventions. The colleges participated are; the tribal areas girl's students Sansad Bharat Darshan from the constituency of Shri Anurag Singh Thakur, Union Minister for Information & Broadcasting and Youth Affairs & Sports, Govt. of India, Nakhashatra Foundation, Lucknow, Chand Bhanu Gupta Agriculture PG College, Bakshi Ka Talab, Lucknow, for S R Global School, Lucknow, S R Global School, Lucknow, City International School, Lucknow, Hygia College of Pharmacy, Faizullaganj, Lucknow, SRMU, Barabanki, Bansal Institute of Engineering & Technology, Sitapur Road, Lucknow, Guru Gorakhsnath Institute of Medical Sciences, Gorakhpur, Shree Shankar Mumukshu Vidhyapeeth, Shahjhanpur, Upper Primary School, Kathwara, Bakshi ka Talab, Khawaja Moinuddin Chishti Language University IIM Road, Lucknow, Shree Nishadraj Akhandanand Post Graduate College, Amethi, Kendriya Vidyalaya, CRPF, Bijnour, Lucknow, Kasturba Gandhi Awasiya Vidyalaya, Kumhrawa, Bakshi ka Talab, Lucknow, Goal Institute of Pharmacy & Sciences, Lucknow, Army Public School, LBS Marg, Lucknow, Kendriya Vidyalaya, AFS, Memora, Lucknow, Kendriya Vidyalaya, IIT Knapur, Sagar Public School, Gandhi Nagar, Bhopal (M.P.), wards of 59th Vahini Sashastra Seema Bal (SSB), Nanpara, Bahraich, Amity Institute of Biotechnology, Amity University, Lucknow, Maharishi University of Information Technology (MUIT), Lucknow, Saroj Group of Institutions, Lucknow, I. P. Post-Graduation Collage, Bulandshahar, Nandini Nagar Mahavidyalaya, Gonda, Jhunjhunwala PG College, Ayodhya, Govt. Girls High School, Adaura, Auras, Unnao, K.C. Collage, Church Gate, Mumbai, Awadh College of Pharmacy, Barabanki, Seth Vishambhar Nath Group of Institutions, Barabanki, Sainath College of Pharmacy Hinduwari, Sonbhadra, Collage of Agricultural Biotechnology, Sabour, (Bihar), Babu Sunder Singh College of Pharmacy, Nigoha, Lucknow, BRD PG College, Deoria, JSS College of Pharmacy, Mysore (Karnataka), Vivek College of Technical Education, Bijnour, CSJM University, Signa College of Pharmacy, C.S.J.M. University of Kanpur, Chandra Shekhar Singh College of Pharmacy, Prayagraj, Shubash Chandra Bose Institute of Higher Education, IIM road, Lucknow, Mahayogi Gorakhnath University, Gorakhpur, B.N. College of Pharmacy, BKT, Lucknow and Dr. APJ Abdul Kalam Technical University, Lucknow. More than 700 students of above mentioned colleges participated in the program.

### 4.2 India International Science Festival (IISF) 2023

CSIR-CDRI organized a comprehensive Public Outreach program in schools of Sitapur, Barabanki and Lucknow as Pre-Fest event of IISF 2023 on 14 December 2023. The event took place across five schools (PM Shri Kendriya Vidyalayas of IIM Lucknow and CRPF Bijnor, Bakshi Ka Talab, Govt. Inter College, Lucknow, Govt. Girls Inter College, Barabanki, Pt Deen Dayal Upadhyay Govt. Modern Inter College, Sitapur) in three different districts of Uttar Pradesh, where dedicated teams of scientists from CDRI engaged with students in an interactive and educational manner. Our distinguished group of scientists committed to fostering scientific curiosity among students, connecting them with IISF-2023 and involving them in quiz competition. During their visits, the scientists not only informed students about the upcoming India International Science Festival but also encouraged them to explore and engage with science in a creative and innovative manner.

## 5. Awareness Programs/ Thematic Celebrations

### 5.1 Swachhata Pakhwada

In accordance with the Annual calendar 2023, as a part of the Ministry of Science & Technology, CSIR-Central Drug Research Institute organized the Swachhata Pakhwada 2022 during 1-15 May with enthusiasm and innovation. The fifteen daylong celebration was initiated with the Swachchhata Pledge taking ceremony. The staff and scientists and students along with the Director Dr. Radha Rangarajan took the pledge that they will remain committed towards cleanliness and devote time for the same. Dr. Ranvir Singh, Convener, Swachhata Pakhwara coordinated the various events during the celebration which included; Cleaning / Development of new lawn with tree plantation, Awareness campaign among CDRI residents, Shram Daan by CSIR-CDRI family for Clean and Green campus, Disposal of old and obsolete equipment's, Digitation and Weeding out of old records, Cleaning of water coolers, purifiers and water tanks, Cleaning of HVAC plant air filter and exchange of fresh water between units, fire hydrants pumps etc. Cleanness of Buildings, Checking of water accumulation in campus. Color coded waste bin and hygiene kit distribution for all laboratories and office. An awareness campaign and rally was also organized and awareness banners were placed in various locations around the campus of CDRI to sensitize the people. Some mass awareness lectures by Experts and Group discussion were also part of the program.

## 5.2 National Intellectual Property Festival

CSIR CDRI celebrated National Intellectual Property Festival from 14 to 28 July 2023, as part of the Azadi Ka Amrit Mahotsav (AKAM) campaigns that focused on Intellectual Property Rights (IPR) aligned to the thematic objectives of ATMANIRBHARTA. In this aforesaid view, CSIR-CDRI invited experts such as, Dr. Indra Dwivedy (Former Chief Scientist, CSIR-IPU & Group Leader – Patents), Dr. Kausalya Santhanam, Founder of SciVista IP & Communication, Bengaluru), Ms. Kavita Poddar and Mr. Yogesh Kardame from Questel Orbit, and Ms. Vanshika& Ms. Anukruti from SIIC-IIT Kanpur, for interaction with faculty and students. Guest speaker, Dr. Indra Dwivedy, a renowned expert in the field of intellectual property, in her talk entitled, "Intellectual Property Rights: Drafting of patent specification and Patent filing procedures". Ms Kavith and Mr. Yogesh emphasized on the significance of 'Comprehensive Prior Art Search' in establishing the 'Novelty' for filing IP instruments. Ms. Vanshika &; Ms. Anukruti stressed on the importance of IPRs for the research scholars and faculty members who are aspiring to establish Start-UP entities and taking best advantage of the DBT-BIRAC's; Biotechnology Innovation Grant.

On 26th to 27th July 2023, an event was organized by CSIR Jigyasa Team at CSIR-CDRI inviting a group of around 100 middle school students from City International School, Bakshi Ka Talab, Lucknow and S R Global School, Lucknow, respectively. On concluding day of the festival, Dr. Kausalya Santhanam, shared valuable insights in her talk entitled "Indian Patent Law: An evolving scenario" about the pivotal role played by IPR in fostering innovation and protecting valuable information. The entire event was coordinated by Dr. Sripathi Rao Kulkarni, IP Coordinator, CSIR-CDRI. He also delivered a series of lectures pertaining to "Understanding 'Bouddhik Sampada and its Protection', ""Bouddhik Sampada Sanrakshan" for the students of Sri Ram Swarup Memorial University, Barabanki, Uttar Pradesh, HYGIA College of Pharmacy, Lucknow.

Later on 21st September 2023, a lecture was organized in CDRI, where esteemed guests, Dr. Kishore Sreenivasan (Head, CSIR URDIP, Pune), Dr. Lipika Patnaik (Senior Principal Scientist, CSIR-IPU, New Delhi) and Dr. Sivakami Dhulap (Senior Scientist, CSIR-URDIP, Pune) gave very informative talks on Patentability, freedom to operate and techno commercial evaluation protocols and patent filing/prosecution.

## 5.3 Library Week

The Knowledge Resource Centre, knowledge management facility, CSIR-CDRI, organized Library week program 22 -25 August 2023. It was contended with many exciting events like lectures, quiz competition, workshops etc., by eminent personalities in order to inculcate the integrity and ethics in students while publishing articles. On day 1, a workshop was conducted on "Common Pitfalls in Scientific Writing and Science of Synthesis Orientation" by Dr. Rohit Bhatia (Acquisitions Editor Thieme Chemistry) and Mr. Vineet Sharma (Sales Associate, North India) where students and staff were exposed to an informative exercise pertaining to understanding the common mistakes done during scientific writing. On second day, book based quiz competition was organized under the chairmanship of Dr. Sharad Sharma, Chief Scientist. Many students and staff participated in the event and it was coordinated by Dr. Ritu Trivedi. On third day, a lecture was delivered entitled, "Research Integrity and Publications Ethics" by Mr. S K Mallik, Former Scientist-in-Charge, KRC, CDRI. Mr. Binoy Halam, Sales Manager, Total Library Solutions, presented an informative talk on, "Improving Research Writing and Publication Output Using Grammarly" on the 4th of the program. On the concluding day of the Library Week, a new facility, "Digital Library Access Zone" was inaugurated by Director, CDRI, Dr. Radha Rangarajan, inside the KRC building.

### 5.4 International Yoga Day

Yoga has now become a global festival. Yoga is not only for any individual but for the entire humanity. With a theme of 'Yoga for Humanity', CSIR-CDRI celebrated International Yoga Day on 21 June 2023. Staff and students participated in the Yoga Practice in the morning at 7:00 AM organized at the CSIR-CDRI campus. Through social media as well as internal communication tools, awareness of the benefits of yoga was communicated among staff and students

### 5.5 Bhujal Saptah

Bhujal Saptah was celebrated in CDRI from 16 to 22 July 2023 under the theme of "Yeh sankalp nibhana hai- har ek boondh bachana hai" in order to create awareness on judicial and sustainable use of water among the staff and students.

## 5.6 Emergency Climate Week

CDRI celebrated Climate Emergency week from 22 to 28 July in order to create the awareness regarding our responsibility in lowering the carbon footprint effectively. The awareness component has been incorporated in all Jigyasa programs so that the realization is inculcated in kids from the early stage of development. Dr. Sanjeev Yadav, Coordination, addresses the student groups to witness the importance of Climate Change and the urgent need for addressing the forthcoming damage to mankind in the form of rising global temperatures. He also mentions the significance of 'Climate Clock' and displayed the same before them.

## 5.7 Artificial Intelligence (AI) awareness program

CSIR-CDRI hosted Artificial Intelligence (AI) awareness program under the aegis of CSIR Jigyasa program throughout the month of August. On 10 August 2023, a group of enthusiastic students from Chandrabhanu Gupt Agriculture Post Graduate College pursuing BSc in Agriculture were invited to the Institute to learn the transforming role of AI in the realm of agriculture. Dr. Santosh Shukla, Scientist, CSIR-CDRI, demonstrated "how it can be harnessed to optimize various aspects of agriculture, ranging from crop monitoring and disease detection to yield prediction and precision farming". The visit to the Bioinformatics lab left the students with a profound understanding of how data-driven insights can be harnessed for agricultural advancements, followed by Botany Unit of SAIF&R followed, providing the students with an opportunity to meet with Scientist Dr. Vinita Tripathi, who unraveled the intricate connection between agriculture, medicine, and the role of plants in shaping the pharmaceutical landscape. Dr. D K Mishra took the students through the world of herbarium - a collection of preserved plant specimens. On 29 August, 2024, under the same awareness program, special lecture entitled, "AI in healthcare and drug discovery" Mr. Shubham R. Londhe, Senior software engineer, Vamstar, UK. Mr. Londhe shed light on use of new tools such as chat GPT in design of new promising drugs.

### 5.8 Vigilance Awareness Week

The Vigilance Awareness Week was observed from 30 October 2023 to 5 November 2023. The theme of the week was "Say no to corruption; commit to the Nation". Corruption has been regarded as one of the foremost hindrances to national development and progress. As a part of the event, the Director administered the integrity pledge to all the staff on 30 October 2023. As a part of the event, several programs were organized including Pledge on Vigilance, visit to Schools for creating awareness among the students, debate, quiz competitions, Nukkad natak, Lectures relevant to create awareness among the staff and students towards vigilance

## 5.9 Ayurveda Day Celebrations in Collaboration with Regional Ayurveda Research Institute (RARI)

CSIR-CDRI celebrated 8th Ayurveda Day, by hosting one-day camp, in collaboration with the Regional Ayurveda Research Institute (RARI), Lucknow, on 6 November 2023. The highlight of the celebration was the "Swasth Parikshan" and Ayurveda consulting organized by AYUSH doctors and staff from RARI, including. Dr. Alok Kumar Srivastava, Dr. Anjali Baijnath Prasad, Dr. Alka Dixit, Mr. Ratnesh Verma, Mr Rohit Singh and Mr. Mahendra. Dr. Alok Kumar Srivastava, from RARI highlighted the program's overarching goal, which is to reintroduce Ayurveda into every household, preserving and promoting this time-honored tradition. Dr. Anjali from RARI delivered a lecture on "Ayush Aahar" explained the significance of Ayush Aahar on the health. During this one-day camp, CDRI staff and research scholars actively participated in health checkup sessions.

## 5.10 International women's day celebration

International Women's Day, celebrated globally on 8 March 2024, serves as a poignant reminder of the ongoing struggle for gender equality and the need to eradicate societal biases. CDRI, with a commitment to promoting gender equality and fostering an inclusive society, celebrated International Women's Day, 2024 throughout the month of March to honor and celebrate the achievements, contributions, and resilience of women based on this year's theme, "Invest in Women: Accelerate Progress". The month-long celebration commenced with a Logo Competition with the theme “Spirit of Womenhood”. The Campus Run was organized on 5 March, with a motto of fun, fitness and fabulous company, designed to inspire to embrace physical fitness and pursue academic aspirations with vigor and determination. The run was flagged off by Dr. Radha Rangarajan, Director, CSIR-CDRI. The next event in the series was a thought-provoking Nukkad Natak performed by CSIR-CDRI students and staff members on 8th March, showcasing poignant narratives that highlight the challenges and triumphs of women in contemporary society.

An Art Exhibition display from 13 - 31 March 2024 provided a platform for aspiring artists in CSIR-CDRI community to showcase their talent and express their unique perspectives on gender equality and women's empowerment on the occasion of International Women's Day, 2024. The event was concluded on 19 March, 2024 with a Panel Discussions themed “Honest Conversations: Work, Family and Society”. The discussion was moderated by Director, CSIR-CDRI, and the panelists included Dr. Manidipa Banerjee Professor, IIT-Delhi, Dr. Shalini Arya Professor, ICT-Mumbai, Dr. Saman Habib, Chief Scientist, CSIR-CDRI and Dr. Sonia Verma Scientist, CSIR-CDRI. The exchange of insightful ideas and opinions by accomplished panelists sparked meaningful discourse among CSIR-CDRI community about gender equality, equity and sensitivity.

## 5.11 Awareness program on the occasion of 3rd Janjatiya Gaurav Divas

In commemoration of 3rd Janjatiya Gaurav Divas, the birth anniversary of Bhagwan Birsa Munda, the CSIR-Central Drugs Research Institute (CDRI) Lucknow organized an Awareness Program at Kasturba Gandhi Awasiya Balika Vidyalaya, Kumhrawan, Bakshi ka Talab, Lucknow, on 23 November 2023. A team from CDRI went to the school and successfully conducted the program. The team led by JIGYASA coordinator Dr. Sanjeev Yadav and Principal Scientists Dr. Sripathi R Kulkarni, along with four other staff members from the institute, aimed to inspire and motivate the girls from underprivileged rural areas to progress in their life. Principal of KGBV, Mrs. Mamta Singh appreciated the efforts made by the team CDRI for motivation of the girls and other teacher and staff also participated enthusiastically in the program.

## 5.12 Anti-Terrorism Day

The day May 21, 2023 was observed as Anti-terrorism day to generate awareness about the danger of terrorism and violence and its effect on the people, society and the country as a whole. It was on this day in 1991 that former Prime Minister Rajiv Gandhi fell to the designs of terrorists. The objective behind the observance of Anti-Terrorism Day is to wean away people from terrorism and violence. The day was marked by a pledge-taking ceremony for staff and students among other activities.

## 5.13 Qaumi Ekta Week

With a view to fostering and reinforcing the spirit of Communal Harmony, national Integration, and pride in vibrant, composite culture and nationhood, the "Qaumi Ekta Week" (National Integration Week) was observed at CSIR-CDRI from the 19 to 25 November, 2023. Staff and students of the Institute took National Integration Pledge on 24 November 2023.

## 6. Hindi Rajbhasha Activities

In accordance with the official language Act of the Government of India, many events are organized under Hindi Pakhwada for the promotion of the official language "Hindi".

### 6.1 Hindi Pakhwada

Institute organized "Hindi Pakhwada 2023" from 14 to 28 September 2023. In this 14-day long program, competitions of different genres, such as dictation writing, original Hindi slogan, poem recitation, note writing, essay writing, and Hindi Translation were organized.


### 6.2 One-day Hindi Workshops

One-day Hindi workshops were organized by Hindi Anubhag of CSIR-CDRI on 8 September and 15 December 2023. The staff and students participated in the workshop actively. Former Senior Hindi Officer Dr. V.N. Tiwari gave an enigmatic lecture on "Rajbhasha Prabhandhan & Google Voice Typing".

### 6.3 Hasya Kavi Sammelan

The Hindi Rajbhasha Section of CSIR CDRI, hosted "Hasya Kavi Sammelan" to entertain the staff and students on 3 October, 2023. Eminent guests such as Dr. Suresh Awasthi, Dr. Sarvesh Asthana, Mr. Ashish Anal, Dr. Shlesh Gautam and Dr. Sandeep Sharma who profound comic poets and lyricists graced the event and entertained the audience with their rib tickling comedy. The entire event was coordinated by Mr. Pankaj Kumar Shukla, Sr. Technical Officer, who himself is a comic poet by hobby.

## 7 Sports & Recreational Activities

### 73rd CSIR-CDRI Annual Day Sports Events

As a part of the 73rd CSIR-CDRI Annual Day, Staff Club of the Institute organized various Indoor and Outdoor sports activities, including Badminton, Bridge, Campus Run, Carom, Chess, Cricket, Football, Kabaddi, Table Tennis, Volleyball for the staff and students of the Institute during January 2024. Large number of students, staff, family members participated in the sports events and exhibited sportive spirit and team building skills. Winners were felicitated during the Annual Day event on 17 February 2024.

# 2 Distinguished Visitors and Lectures

| Distinguished Visitor | Title of Lecture | Date |
|---|---|---|
| **Dr. Adarsh Tripathi**<br>Professor of Psychiatry<br>KGMU, Lucknow. | A key skill for living a better and stress-free life. | 06-04-2023 |
| **Dr. Shruthy Suresh Aggarwal**<br>Assistant Professor, Trivedi School of Biosciences,<br>Ashoka University & An INSPIRE Faculty Fellow | Identifying the seeds of cancer metastasis. | 10-04-2023 |
| **Dr. C Rangarajan**<br>Chairman, Madras School of Economics<br>Former Governor, Reserve Bank of India | India @ 75 and Beyond. | 17-04-2023 |
| **Dr. Rachit Agarwal**<br>Assistant Professor,<br>Centre for Bio Systems Science and Engineering,<br>Indian Institute of Science, Bengaluru. | Tuberculosis: New culture systems and therapeutic interventions. | 21-04-2023 |
| **Ms. Aakansha Pathak**<br>Lead-Learning, Talent Management<br>Aurigene Oncology Limited, Bengaluru. | Bridging the gap between academia and corporate | 30-05-2023 |
| **Prof. Prabal Banerjee**<br>Department of Chemistry,<br>Indian Institute of Technology (IIT), Ropar. | Electro-organic synthesis: A sustainable and versatile tool for accessing functionalized diverse cyclic and acyclic scaffolds | 04-07-2023 |
| **Prof. Sameer Khandekar**<br>Sir M. Visvesaraya Chair Department of Mechanical Engineering, Indian Institute of Technology, Kanpur. | Recognizing innovations in the field of education, health, environment and culture. | 01-09-2023 |
| **Prof. H. ILA**<br>Hindustan Lever Research Professor, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru. | New directions In heterocyclic synthesis. | 10-10-2023 |
| **Dr. Badri N. Dubey**<br>Centre for Structural Systems Biology (CSSB)<br>Deutsches Elektronen-Synchrotron (DESY)<br>Hamburg, Germany. | Understanding the 'brain' behind bacterial success: Molecular mechanisms of small molecules that modulate signalling circuits. | 18-10-2023 |
| **Prof. Deepak Kaushal**<br>Southwest National Primate Research Centre (SNPRC), Texas Biomedical Research Institute,<br>San Antonio. | The nonhuman primate preclinical model of TB and TB/AIDS: Immune responses in and prior to formation of granulomas. | 30-10-2023 |
| **Prof. Anukul Jana**<br>Associate Professor,Tata Institute of Fundamental Research (TIFR), Hyderabad. | Functionalization of donor-stabilized carboniccarbon as atomic carbon equivalent. | 03-11-2023 |

| | | |
|---|---|---|
| **Prof. Vijay Tiwari**<br>Professor and Chair, Wellcome-Wolfson Institute for Experimental Medicine, QUB, UK | Deciphering disease mechanisms through functional genomics. | 08-11-2023 |
| **Dr. Sajal Kumar Das**<br>Assistant Professor, Department of Chemical Sciences, Tezpur University, Tezpur. | Halting the expected rearomatization after dearomatization: Diastereoselective synthesis of spiroindolenines and polycyclic indolines. | 15-11-2023 |
| **Dr. Amit Dutt**<br>Principal Investigator/ Scientist G, Tata Memorial Centre, ACTREC, Mumbai. | Understanding lymph node metastases in oral cancer by genomic analysis. | 21-11-2023 |
| **Dr. Sahab Uddin**<br>Application Scientist, Life Sciences Solutions, Thermo Fisher Scientific. | Lightning fast discoveries powered by high-content screening: An update on automated microscopy/ HCS cellomics. | 28-11-2023 |
| **Ms. Neetu Gupta**<br>Advocate and Program Co-ordinator, Association for Advocacy and Legal Initiative Trust | Sexual Harassment at Workplace Place Prevention | 11-12-2023 |
| **Dr. Arijit Bhattacharjee**<br>Advisor in Med Tech/ BioTech/ Agri Tech at Start up Incubation and Innovation Centre, IIT Kanpur. | Navigating innovation: From concept to commercialization of technologies with SIIC,IIT Kanpur. | 05-01-2024 |
| **Prof. Rita Tiwari**<br>Professor of Parasite Cell Biology,Faculty of Medicine and Health Sciences. University of Nottingham, UK | Divide and Rule: Unravelling cell division in *Plasmodium*. | 15-01-2024 |
| **Dr. Sukalyan Bhadra**<br>Senior Scientist, CSIR-Central Salt & Marine Chemicals Research Institute(CSMRI), Bhavnagar, India. | New concepts for catalytic α-functionalization reactions. | 23-01-2024 |
| **Dr. Angelo Frei**<br>University of Bern, Switzerland | Exploring the frontier of metal complexes as antibiotics: Promise and discovery | 08-02-2024 |
| **Prof. Amitabha Chattopadhyay**<br>CSIR- Bhatnagar Fellow,CSIR-CCMB, Hyderabad | G protein coupled receptors and cholesterol sensitivity: Excitements and challenges | 15-02-2024 |
| **Dr. Rajeev Indrajit Desai**<br>Assistant Professor, Department of Psychiatry, Director, Integrative Neurochemistry Laboratory, Harvard Medical SchoolMcLean Hospital, USA | Development and evaluation of antibody-based therapy CSX-1004 for fentanyl overdose and fentanyl-related opioid use disorder. | 23-02-2024 |
| **Dr. Hidenori Takahashi**<br>Executive Director, Therapeutics Group, Schrodinger Inc. | Adapting a digital chemistry strategy for drug discovery. | 04-03-2024 |
| **Prof. Laxmi T. Rao**<br>Professor of Neurophysiology, NIMHANS, Bengaluru | Early life stress and sensation seeking behaviour at adolescence age. | 08-03-2024 |

# 3 Faculty Seminar Series

**Dr. Arun Trivedi**
Nemo Like Kinase (NLK) Promotes Differentiation Arrest in AML by Targeting C/EBPalpha and PU.1
06-04-2023

**Dr. Prem Prakash Yadav**
Optimization Studies on Arylimidazoles: Learnings from Malaria Libre Project
10-05-2023

**Dr. Shashi Kumar Gupta**
RNA-Binding Proteins: Potential Therapeutic Target for Cardiovascular Diseases
08-06-2023

**Dr. Ajay Kumar Srivastava**
Construction of Novel Molecular Frameworks through Multi-Component Reactions: Towards Greener and Sustainable Future
22-06-2023

**Dr. Asif Ali**
How to Find Medicines: From Natural Sources to Modern Therapeutics
13-07-2023

**Dr. Pallavi Gupta**
Microfluidic Devices for High Throughput Single-Cell Analysis
27-07-2023

**Dr. Jimut Kanti Ghosh**
Utilization of Protein Segments for Identifying New Bioactive Peptides
10-08-2023

**Dr. Niti Kumar**
Handholding Between two Machineries for Proteostasis Balance in the Malaria Parasite
24-08-2023

**Dr. Kishor Mohanan**
Expeditious, General Approaches to Important Organofluorines Employing Trifluorodiazoethane
14-09-2023

**Dr. Madhav Nilakanth Mugale**
Cytokine Storm and Role of NRF2 Regulator in Pulmonary Fibrosis and Lung Carcinogenesis
05-10-2023

**Dr. Amit Lahiri**
Mitochondrial Dynamics and Immune Response Cross-Talk During Inflammatory Bowel Disease
19-10-2023

**Dr. Satish Mishra**
The Multifunctional Autophagy Pathway as a Potential Drug Target for Malaria
02-11-2023

**Dr. Damodara Reddy**
Drug Discovery Through Molecular Editing and C-H Functionalization of Therapeutic Peptides and Salicylanilides
30-11-2023

**Dr. Aamir Nazir**

The Role of Glia-Enriched PTR-10 in Neuronal Health: Studies Employing *C. elegans* Model

28-12-2023

**Dr. Pintu Kumar Mondal**

Quest for Novel Therapeutics: Bridging of Glycoscience with Heterocycles

22-02-2024

**Dr. Veena Ammanathan**

Exploring the Role of Peroxisomes During Bacterial Infections

07-03-2024

# 4 Visits and Deputations Abroad

**Dr. Rajesh Jha,** Principal Scientist, was awarded with ICMR DHR International Fellowship for Young Biomedical Scientists 2022-23. Dr Rajesh Jha was on deputation from 29-03-2023 to 27-03-2024 to Baylor College of Medicine, Houston, Texas, USA.

**Dr. Kashif Hanif,** Senior Principal Scientist, was on deputation to Samueli School of Engineering, University of California, Irvine (UCI), USA for the award of USIEF, Fulbright-Nehru Academic and Professional Excellence Fellowship 2023-2024 from 01-08-2023 to 31-03-2024.

**Dr. Namrata Singh,** Scientist, was on deputation to receive the IUPAC-Solvay International Award for Young Chemist and to attend the 49" IUPAC-CHAINS World Chemistry Congress (WCC), which was held at the World Forum, Hague, Netherlands from 20-08-2023 to 25-08-2023.

**Dr Rahul Shukla,** Scientist, was on deputation to attend the 16" International Research Conference, which was held in General Sir John Kotelawala Defence University (KDU-IRC) in Sri Lanka from 07-09-2023 to 08-09-2023.

**Dr. Jayanta Sarkar,** Senior Principal Scientist, was awarded the SERB International Research Experience (SIRE) fellowship. Dr Jayanta Sarkar was on deputation to the Department of Microbiology and Immunology, Indiana University, School of Medicine, United States from 30-09-2023 to 29-03-2024.

**Dr. Aamir Nazir,** Senior Principal Scientist, was on deputation from 11 October 2023 to 14 October 2023 (Excluding travel time) to attend the "The Indo-German workshop on Enabling Methodologies for Rational Design of Complex System" at Julius Maximilian University of Wurzburg, Germany.

**Dr. Mohammad Imran Siddiqi,** Chief Scientist was invited as a visiting researcher at the Department of Biomedical Engineering Faculty of Engineering, Ankara University, Turkey, sponsored by the Scientific and Technological Research Council of Turkey (TUBITAK) from 23-10-2023 to 21-11-2023

# 5 Membership of Distinguished Committees/Boards/Societies

**Dr. Radha Rangarajan, Director**

- Chairperson, Award Committee of SGPGIMS, Lucknow
- Member, Advisory-cum-Monitoring Committee of Biotech Park, Lucknow
- Member, Biotechnology Vision Group for UP (committee constituted by DG/Secretary, DSTUP)
- Member, Scientific Advisory Committee (SAC) of CBMR, Lucknow
- Member, Drugs Technical Advisory Board, CDSCO
- Member, Hub Governing Body of BioCyTiH Foundation, a Technology Innovation Hub of BITS Pilani
- Domain Expert for the Assessment of Technologies in Chemical, Pharmaceutical, Healthcare, and Medical Sciences domains for TIFAC
- Member, Selection Committee, DST INSPIRE Faculty Fellows
- Member, Scientific Program Committee of IHub-Data, an initiative of the International Institute of Information Technology, Hyderabad to develop AI algorithms for drug discovery and other areas of healthcare
- Member, Board of Governors, Tres Cantos Open Lab Foundation
- Member, Selection committee to identify startups to fund through the National Initiative for Developing and Harnessing Innovations-Seed Support System at AIC-CCMB
- Advisor, AMR Declaration Trust
- Member of the Jury, C-CAMP AMR Quest for innovative drugs and diagnostics projects, 2020- CCAMP is a CARB-X Accelerator

**Dr. Sanjay Batra**

- Chairperson SERB POWER Grant projects monitoring committee for Physical sciences
- Member, NPDF Expert Committee – Life Sciences
- Member, SERB-Organic Chemistry – PAC
- Member, SERB Task Force for Covid-19- Water surveillance
- Member, ASPIRE Chemical Sciences Research Committee

**Dr. Saman Habib**

- Dean (Biological Sciences), AcSIR
- Member, Selection Committee for INSPIRE Faculty (DST)
- Co-Chair, Technical Expert Committee (TEC) for Infectious Disease Biology, DBT, New Delhi
- Core Member, Program Advisory Committee (PAC) on Organismal and Evolutionary Biology (OEB) under Life Sciences, SERB
- Member, Expert Committee of S. Ramachandran National Bioscience Fellowship for Career Development DBT, New Delhi
- Life member, Indian Society of Cell Biology
- Life member, Society of Biological Chemists (India)
- Member, selection committee for ASPIRE projects in Life Sciences (CSIR)
- Member, SRF and RA selection committee for General Biology, CSIR-HRDG
- Fellow, Indian National Science Academy, New Delhi
- Fellow, Indian Academy of Sciences, Bangalore
- Fellow, The National Academy of Sciences India, Allahabad

**Dr. Sharad Sharma**

- Life Member, Indian Society of Cell Biology
- Life Member, Society of Toxicology, India
- Life Member, Indian Medical Association
- Life Member, Indian Association of Pathologists
- Lead Inspector, National GLP Compliance Monitoring Authority, DST, India

**Dr. S K Rath**

- Life Member, Indian Society of Cell Biology
- Life Member & Joint Secretary, Laboratory Animal Science Association of India
- Life Member, Environmental Mutagen Society of India
- Life Member, Society Biotechnology, India
- Life Member, Society of Toxicology, India
- Member, Subject Expert Committees, CDSCO, India since January 13, 2020
- Member, Expert committee, sub-committee to examine regarding banning of manufacturing, import & export of cosmetics over 1 ppm mercury by Minamata Convention.
- Member, RDC, AIB, AMITY University Lucknow
- Member, IEC, CRI (H) Lucknow
- Member, Board of Studies, Institute of Advanced Molecular Genetics & Infectious Diseases (IAMGID), ONGC Centre for Advanced Studies (OCAS), Lucknow University
- Member, Governing Body, ONGC Centre for Advanced Studies (OCAS), Lucknow University
- Member, Medical Sciences review committee, UPCST, Lucknow till December, 2023
- Main Nominee of CCSEA in the IAEC of IIT, Kanpur.
- Main Nominee of CCSEA in the IAEC of CSIR-NBRI,

Lucknow

- Scientific Nominee of CCSEA in the IAEC of CSIR-CIMAP, Lucknow
- Scientific Nominee of CCSEA in the IAEC of NIPER-R, Lucknow
- Scientific Nominee of CCSEA in the IAEC of Aryakul Group of Institute, Lucknow
- Member, Medical Science and Pharmaceutical Science Domain Pool Scientist Scheme, CSIR-HRDG
- Member, Interdisciplinary Science Domain for RA and SRF Scheme, CSIR-HRDG

**Dr. Amit Misra**

- Life Member, Indian Pharmaceutical Association
- Vice-President (India), Asian Federation for Pharmaceutical Sciences
- Member, South Centre (Geneva) and Third World Network (Kuala Lumpur) Consultative Groups on Biologicals and Biosimilars
- Member, Subject Expert Committee (Antimicrobial, Antiparasitic, Antifungal, Antiviral) of CDSCO advising DCGI for New Drug approvals
- Member, Medical Biotechnology and Medical Nanotechnology Sectional Committee, (MHD 20) of the Bureau of Indian Standards, Government of India
- Member, Board of Studies, Jamia Hamdard, New Delhi
- Member, Board of Studies, Madan Mohan Malaviya University of Technology, Gorakhpur
- Member, Board of Governors, NIPER, Hajipur. Life Member, Indian Pharmaceutical Association
- Member, Controlled Release Society India Chapter
- Member, CSIR SRF/RA Selection Committee on "Medical and Pharmaceutical Sciences (MEDIC/11)
- Member, Board of Studies, Jamia Hamdard, New Delhi
- Member, Board of Studies, Madan Mohan Malaviya University of Technology, Gorakhpur
- Member, Board of Governors, NIPER, Hajipur

**Dr. Gautam Panda:**

- Member, Evaluation Committee of MEXT and JSPS fellowships, Japan
- Member, Indian JSPS Alumni Association (IJAA)
- Member, National Academy of Sciences (MNASc), Allahabad

**Dr. Atul Goel**

- President, Luminescent Organic Consortium of India (LOCI)
- Fellow of Indian Academy of Sciences (FASc), Bengaluru
- Editorial Board Member, Journal of Biochemical and Molecular Toxicology (Wiley Publication)
- Member, Board of Studies (Applied Sciences), Institute of Engineering & Technology, Lucknow
- Life Member (LM-4155), The Society of Biological Chemist (SBC), Bengaluru, India
- Life Member (L-31190), The Indian Science Congress Association (ISCA)
- Life Member (LM-1435), Chemical Research Society of India (CRSI)
- Life Member, Indian Chemical Society (ICS), Kolkata
- President, Luminescent organic Consortium of India

**Dr. Ritu Trivedi**

- Member, Technical Expert Committee (TEC) for Biotechnology Support Programme for NER, DBT, New Delhi (2022-25)
- Member, Technical Expert Committee (TEC) for Biotechnology Support Programme for Microbial and Natural Sciences, DBT, New Delhi (2022-25)
- Member, Board of Studies and Research, NIPER (Raebareli)
- Member, Working Group "CSIR-Ministry of AYUSH" for cooperation on activities of common interest
- Editorial Board Member, Frontiers in Endocrinology
- Editorial Board Member, Journal Current Regenerative Medicine
- Executive Member, Indian Society for Bone and Mineral Research (ISBMR)
- Member Academic committee, Jawaharlal Nehru University, New Delhi
- Executive Member, Indian Society of Cell Biology
- External Member, Technical Committee, SGPGIMS, Lucknow

**Dr. Bhupendra N Singh**

- Vice-President, Indian Society of Cell Biology (2023-2025)
- Life Member, Indian Society of Cell Biology
- Life Member, Laboratory Animal Science Association of India
- Life Member, All India Society of Human Genetics

**Dr. Prabhat Ranjan Mishra**

- Life Member, The Society of Biological Chemist, Bangalore, India
- Life Member, Indian Pharmaceutical Association
- Life member, Indian Society of Cell Biology
- Executive member, Indian Society of Cell Biology
- Expert Member, Project Monitoring Committee, BIRAC, Department of Biotechnology, Govt. of India: Being a member of Biotechnology Industry Research Assistance Council (BIRAC), discharge my duties in evaluating proposal submitted to BIRAC and inspecting at

manufacturing sites as and when required (Since 2016 to till date)

- Member, Board of Studies, Department of Pharmaceutics, Jamia Hamdard New Delhi: As a member of board of studies involved in assessing and discussing issues related to academics (Since April 2018 to till date)
- Member of Technical committee (BIS), Medical biotechnology and nano-technology, Govt. of India (Since 2012 to till date)
- Member, Advisory Board of PhD student at Nirma University, Ahmedabad since June 2018
- Member, Institutional Academy of Scientific and Innovative Research (AcSIR) committee
- Member, Academic committee, Jawaharlal Nehru University, New Delhi (JNU-CIMAP)
- Expert member, Academic Advisory Committee, NIPER-Raebareli
- Member, Senate, NIPER-Raebareli

**Dr. Sanjeev Kanojia**

- Member, Bureau of Indian Standards (BIS) Govt. of India (Organic Chemicals, Alcohols & Allied Products)
- Task Force-Member, Equipment utilization of various R&D institutions in India, DST, Govt. of India
- Member, High-end equipment technical committee in Food Safety Drug Administration, Uttar Pradesh
- Life-Member, Indian Society for Mass Spectrometry (ISMAS)

**Dr. Jimut Kanti Ghosh**

- Member, American Peptide Society since 2017
- Editorial Board member, Scientific Reports since June 2015

**Dr Koneni V Sashidhara**

- Member, Senate Committee of National Institute of Pharmaceutical Education and Research (NIPER-K) Kolkata

**Dr. Prem N Yadav**

- Life time member, Indian Academy of Neurosciences
- Life time member, Indian Pharmacological Society
- Life time member, Indian Immunological Society

**Dr. T. Narender**

- Member, Task Force Committee on Phytopharmaceuticals constituted by the Indian Pharmacopeia Commission (IPC), Ghaziabad
- Member, Committee for Ashwagandha-Related Issues constituted by Ministry of AYUSH, New Delhi

**Dr. Rajdeep Guha**

- Member, Laboratory Animal Scientists Association (LASA)
- Secretary, Laboratory Animal Science Association of India (LASAI)
- Member, FAD5 Sectional Committee, Bureau of Indian Standards

**Dr. Aamir Nazir**

- Fellow, Society of Applied Biotechnology, India
- Academic Editor, PLOS One
- Executive Member and Treasurer Lucknow Branch, Indian Academy of Neurosciences
- Life Member, Society of Biological Chemists, India
- Executive Member, Indian Society of Cell Biology
- Life Member, Laboratory Animal Science Association of India
- Executive Member, Society of Alternatives to Animal Experiments, India
- Life Member, Environmental Mutagen Society of India

**Dr. Kalyan Mitra**

- Life Member, The Electron Microscopy Society of India

**Dr Jiaur R. Gayen**

- Life-Member, Association of Biotechnology and Pharmacy, India
- Life-Member, Indian Society for Mass Spectrometry
- Life-Member, Indian Pharmacological Society
- Life-Member, Society of Biological Chemists, India
- Life-Member, Indian Science Congress Association
- Life-Member, Laboratory Animal Science Association of India
- Life-Member, Society of Applied Biotechnology, India

**Dr. Namrata Rastogi**

- Co-Convener, Lucknow/Kanpur Chapter of Chemical Research Society of India
- Member, National Organic Symposium Trust (NOST)
- Member, Special Call Expert Committee (SCEC) under SERB
- Member (Co-opted), Expert Committee for NPDF & SRG schemes under SERB
- Member, International Advisory Board, Asian Journal of Organic Chemistry, Wiley
- Member, International Advisory Board, Synthesis, Thieme Chemistry
- Life Member, Chemical Research Society of India (CRSI)
- Life Member, Indian Society of Chemists and Biologists (ISCB)
- Editorial Board member of Elsevier Journals "Tetrahedron" and "Tetrahedron Letters"

**Dr. Mrigank Srivastava**

- Member, Executive committee, Indian Society of Parasitology
- Life Member, Indian Society of Parasitology

- Life Member, Indian Immunology Society
- Life Member, Indian Society of Cell Biology
- Member, Executive committee, Society for Integrative Biosciences, JNU, New Delhi
- Life member, The Cytometry Society of India
- Life member, International Society for Advancement of Cytometry (ISAC)

**Dr. Sarika Singh**

- Life-member, National Academy of Sciences, India
- Life-Member, Society of Toxicology, India
- Life-Member, Indian Academy of Neurosciences
- Life-member, Indian Society of Cell Biology
- Member, Royal Society of Biology
- Life member, National Academy of Biological Sciences
- Life-member, National Environmental Science Academy
- Life-member, Indian Society of Chemists and Biologists
- Associate Member, Movement Disorder Society of India (Non-Medical)

**Dr. Rajesh Jha**

- Life Member, Laboratory Animal Science Association of India.
- Life Member, Society for Reproductive Biology and Comparative Endocrinology (SRBCE), University of Madras, Chennai
- Life Member, Indian Society for the Study of Reproduction and Fertility (ISSRF), University of Rajasthan, Jaipur
- Life Member, Jansankhya Sthirata Kosh / National Population Stabilization Fund, Ministry of Health and Family Welfare, Government of India
- Scientist Nominee of CPCSEA in the IAEC of Career Institute of Medical Sciences & Hospital, Lucknow

**Dr. Akhilesh Tamrakar**

- Life member of the Society of Biological Chemist, India

**Dr. Vivek Vidydhar Bhosale**

- Elected Member of National Academy of Medical Sciences, India
- Life Member of Indian Pharmacology Society, India
- Member, Medical Council of India

**Dr. Madhav Nilakanth Mugale**

- Veterinary council of India (VCI): Reg. No. 3535
- Indian Association of Veterinary Pathologist (IAVP): Reg. No. IAVP/ M-81/ 2011
- Maharashtra state Veterinary council (M.S.V.C.): Reg. No. 8313
- Society of Toxicology of India (STPI): Reg. No.1234
- Laboratory Animal Science Association (LASA): Reg. No. 587
- Laboratory Animal Science Association of India (LASAI): Reg. No. L- 766

**Dr. Mukesh Pasupuleti**

- Honorary Associate Editor, Indian Journal of Medical Research, Official journal of Indian council for medical research, New Delhi, India

**Dr. Arun Kumar Trivedi**

- Member, Indian Society for Bone & Mineral Research (ISBMR)

**Dr. Dibyendu Banerjee**

- Life Member, The Society of Biological Chemists, Bengaluru, India
- Executive Member, Indian Society of Cell Biology

**Dr. Tejender Thakur**

- Assistant editor, Inorganic Chemistry Communication Journal

**Dr. Niti Kumar:**

- Member, CSIR Sports Promotion Board (CSIR-SPB)

**Dr. Virendrakumar M Prajapati**

- Life Member of the Veterinary council of India (VCI)
- Life Member of the Indian Association of Veterinary Pathologists (IAVP)
- Gujarat State Veterinary Council (G.V.C.)
- Life Member of the Society of Toxicology of India (STPI)
- Executive Member of Laboratory Animal Science Association of India (LASAI)
- Life Member of Vadodara Veterinary Society
- European Register Toxicologist (UK-ERT by Royal Society of Biology)

**Dr. Chetan D. Meshram**

- ACS Infectious Diseases Early Career Editorial Board member (2024)

**Dr. Namrata Singh**

- Life membership, Chemical Research Society of India
- Member as a young professional, MHD 20, Medical Equipment and Hospital Planning Department, Medical Biotechnology and Medical Nanotechnology Sectional Committee.

**Dr. Sonia Verma**

- Indian Society for Histocompatibility and Immunogenetics
- Indian Academy of Neurosciences

**Dr. Neeraj Jain:**

- Associate International Member, American Society of Hematology, USA

# The Staff

## DIRECTOR

**Dr. Radha Rangarajan,** M.S., Ph.D.

## DIVISION OF BIOCHEMISTRY & STRUCTURAL BIOLOGY

***Chief Scientist***

Saman Habib, M.Sc., Ph.D., FASc, FNASc, FNA,

Ravishankar Ramachandran, M.Sc., Ph.D., *Head of the Division*

Sabyasachi Sanyal, M.Sc., Ph.D. FNASc

Jimut Kanti Ghosh, M.Sc., Ph.D., FNASc

J. Venkatesh Pratap, M.Sc., Ph.D.

Mohammad Imran Siddiqi, M.Sc., Ph.D

***Senior Principal Scientist***

Vinita Chaturvedi, M.Sc., Ph.D. *(Superannuated on 30.7.2023)*

Shakil Ahmed, M.Sc., Ph.D.

Mohammad Sohail Akhtar, M.Sc., Ph.D

Amogh Anant Sahasrabuddhe, M.Sc., Ph.D.

Akhilesh Kumar Tamrakar, M.Sc., Ph.D.

***Principal Scientist***

Tejender S. Thakur, M.Sc., Ph.D.

Arun Kumar Haldar *(Joined w.e.f. 05.01.2024)*

**Senior Scientist**

Ashish Arora, M.Sc., Ph.D.

***Sr. Technical Officer (3)***

Ishbal Ahmad, M.Sc.

***Sr. Technical Officer (2)***

Ruchir Kant, M.Sc. Ph.D., PGDCA

Rima Ray Sarkar, M.Sc.

***Sr. Technical Officer (1)***

Ajay Singh Verma, M.Sc.

Anupam Jain, M.Sc.

Sarita Tripathi, M.Sc.

Priyanka Trivedi, M.Sc.

***Technical Officer***

Karthik R., M.Sc., Dip. in DCLM

***Sr. Technician (2)***

Radhey Shyam Ram, Intermediate

## DIVISION OF CANCER BIOLOGY

***Senior Principal Scientist***

Arun Kumar Trivedi, M.Sc., Ph.D.

Dipak Datta, M.Sc., Ph.D., *Head of the Division*

Jayanta Sarkar, M.V.Sc., Ph.D.

***Principal Scientist***

Dibyendu Banerjee, M.Sc., Ph.D.

***Sr. Technical Officer (1)***

Shyam Singh, M.Sc.

Sanjeev Meena, M.Sc.

## DIVISION OF ENDOCRINOLOGY

***Chief Scientist***

Naibedya Chattopadhyay, M.Sc., Ph.D.

Durga Prasad Mishra, M.Sc., Ph.D. *Head of the Division*

***Senior Principal Scientist***

Ritu Trivedi, M.Sc., Ph.D., FNASc, *In-charge Academic Affairs*

Divya Singh, M.Sc., Ph.D.

Rajender Singh, M.Sc., Ph.D.

Monika Sachdev, M.Sc., Ph.D.

***Principal Scientist***

Rajesh Kumar Jha, M.Sc., Ph.D.

***Principal Technical Officer***

Balvir Singh, M.Sc.

***Sr. Technical Officer (1)***

Konica Porwal, M.Sc.

Jaspreet Kaur, M.Sc.

Amar Deep Lakra, M.Sc.

***Sr. Technician (3)***

Geet Kumar Nagar, B.Sc. *(Superannuated on 30.11.2023)*

***Jr. Stenographer***

Harish Kumar Checker

***Lab. Assistant***

Mahesh Chandra Tewari, B.Sc.

Ram Karan, Intermediate

## DIVISION OF MEDICINAL AND PROCESS CHEMISTRY

***Chief Scientist***

Atul Kumar, M.Sc., Ph.D., *Head of the Division, (Superannuated on 30.4.2023)*

Sanjay Batra, M.Sc., Ph.D., FNASc, FRSC, Head of the Division

Atul Goel, M.Sc., Ph.D., FASc, AVHF (Germany)

Gautam Panda, M.Sc., Ph.D., FAScT, MNASc, JSPS

T. Narender, M.Sc., Ph.D.

***Senior Principal Scientist***

K. V. Sashidhara, M.Sc., Ph.D. *Supervising Scientist In-charge, SAIF*

Prem Prakash Yadav, M.Sc., Ph.D.

Dipankar Koley, M.Sc., Ph.D.

Kishor Mohanan, M.Sc., Ph.D.

Pintu Kumar Mandal, M.Sc., Ph.D.

Asif Ali, M.Sc., Ph.D

***Principal Scientist***

Ranvir Singh, M.Tech., *Unit In-charge, Centralized Utility Services*

Ajay Kumar Srivastava, M.Sc., Ph.D.

Ravindra Kumar, M.Sc., Ph.D.

Namrata Rastogi, M.Sc., Ph.D.

Richa Pandey, M.Sc., Ph.D.

Nilanjana Majumdar, M.Sc., Ph.D.

***Senior Scientist***

Kinshuk Raj Srivastava, M.Sc., PhD

Malleswara Rao Kuram, M.Sc., Ph.D.

Damodara Reddy N., M.Sc., Ph.D.

Chandra Bhushan Tripathi, M.Sc., Ph.D.

Nayan Ghosh, M.Sc., Ph.D.

Valmik Shinde, M.Sc., Ph.D.

Ramesh Chintakunta, M.Sc., Ph.D.

***Principal Technical Officer***

Deepali Pandey, B.Sc.

***Sr. Technical Officer (2)***

K. S. Anil Kumar, M.Sc., Ph.D., P.G.D.C.A.

Ashok Kumar Sharma, B.Sc., D.Ch.E., A.M.I.E.

Tahseen Akhtar, M.Sc., Ph.D.

Suriya Pratap Singh, M.Sc., Ph.D.

***Sr. Technical Officer (1)***

Atma Prakash Dwivedi, M.Sc.

***Technical Officer***

Shiv Ram Mishra, BTech (M.E.)

***Technical Assistant***

Jitendra Singh, M.Sc.

Bhawana Sharma, M.Sc., Ph.D.

***Sr. Technician (3)***

A. K. Pandey, B.Sc. *(Superannuated on 29.2.2024)*

S. C. Tiwari, B.Sc.

Manju, B.Sc.

Shailendra Mohan, M.Sc., PGDCA

***Sr. Technician (2)***

Ram Lakhan, Intermediate

***Technician (2)***

H. R. Misra, M.Sc. *(Superannuated on 30.5.2023)*

N. P. Misra, M.Sc.

Kul Bahadur Thapa, BCA, Diploma (Electronics)

***Technician (1)***

Rajesh Kumar Verma, B.Sc

***Principal Private Secretary***

Avadhesh Kumar, B.A.

***Lab. Assistant (2)***

J. C. Rajan

Mohd. Islam

SC Yadav

## DIVISION OF MOLECULAR MICROBIOLOGY AND IMMUNOLOGY

***Chief Scientist***

B. N. Singh, M.Sc., Ph.D., *Head of the Division*

***Senior Principal Scientist***

Y. K. Manju, M.Sc., Ph.D.

Arunava Dasgupta, M.Sc., Ph.D.

Satish Mishra, M.Sc., Ph.D.

Sidharth Chopra, M.Sc., Ph.D.

Mukesh Pasupuleti, M.Sc, Ph.D.

Sudheer Kumar Singh, M.Sc., M.Tech., Ph.D.

***Principal Scientist***

Mrigank Srivastava, M.Sc., Ph.D.

Niti Kumar, M.Sc., Ph.D.

***Senior Scientist***

Bidyut Pukrait, M.Sc., Ph.D.

***Scientist***

Neha Topno, M.Sc.

Suresh Kumar Kalangi, M.Sc., Ph.D. *(Joined w.e.f. 18.01.2024)*

***Principal Technical Officer***

Agney Lal, B.Sc. *(Superannuated on 30.6.2023)*

Rishi Narayan Lal, M.Sc.

***Sr. Technical Officer (2)***

Sandeep Kumar Sharma, M.Sc., Ph.D.

***Sr. Technical Officer (1)***

Shikha Mishra, M.Sc.

Ashan Manhas, B.Sc., M.L.T.

Atul Krishna, B.Sc., DMLT

***Technical Assistant***

Shabeer Ali H., M.Sc., PhD.

***Sr. Technician (3)***

D. K. Tripathi, M.Sc., Ph.D. *(Superannuated on 31.3.2024)*

***Lab Assistant***

Ravi Shankar Mishra

Ram Prakash, B.A.

Shyam Sunder Yadav, B.A.

***Lab. Attendant (2)***

Ram Das

## DIVISION OF NEUROSCIENCE AND AGEING BIOLOGY

***Senior Principal Scientist***

Prem N. Yadav, M.Sc., Ph.D., Head of the Division

***Principal Scientist***

Shubha Shukla, M.Sc., Ph.D.

***Senior Scientist***

Arvind Khatri, M.Sc., Ph.D.

***Scientist***

Sonia Verma, M.Sc., Ph.D.

***Sr. Technical Officer (1)***

Sachi Bharti, M.Sc.

Deepmala, M.Sc.

***Private Secretary***

Renuka Mushran, B.A.

## DIVISION OF PHARMACEUTICS AND PHARMACOKINETICS

***Chief Scientist***

Amit Misra, M. Pharm., Ph.D.

Prabhat Ranjan Mishra, M. Pharm., Ph.D., FNASc, *Head of the Division*

***Senior Principal Scientist***

Manish Kumar Chourasia, M. Pharm., Ph.D.

Rabi Sankar Bhatta, M. Pharm., Ph.D.

***Principal Scientist***

Jiaur Rahaman Gayen, M. Pharm., Ph.D.

***Scientist***

Namrata Singh., M.Sc., Ph.D.

***Pr. Technical Officer***

A. S. Kushwaha, B.Sc.

***Sr. Technical Officer (2)***

Kavita Singh, M.Sc., Ph.D.

***Senior Technical Officer (1)***

Deepak, M.Sc.

S. Mehazabeen, M.Sc.

***Sr. Technician (3)***

Narendra Kumar, B.Sc.

***Lab. Assistant***

Ram Kumar

Chandramani

Ram Bhajan Shukla, Intermediate

## DIVISION OF PHARMACOLOGY

***Senior Principal Scientist***

Manoj Kumar Barthwal, M.Sc., Ph.D., *Head of the Division*

Anil N Gaikwad, M.S. (Pharma.), Ph.D.

Kumaravelu Jagavelu, M.Sc., Ph.D.

Kashif Hanif, M.Sc., Ph.D.

***Principal Scientist***

Sachin Kumar, M.Sc., Ph.D.

Amit Lahiri, M.Sc., Ph.D.

***Senior Scientist***

Baisakhi Mohrana, M.V.Sc., Ph.D.

Shashi Kumar Gupta, M.Sc., Ph.D.

***Principal Technical Officer***

C. P. Pandey, M.Sc., Ph.D., M.H.R.

***Sr. Technical Officer (2)***

Sheeba Saji Samuel, M.Sc., Ph.D.

***Sr. Technical Officer (1)***

Smriti, M.Sc.

Pankaj Kumar Shukla, B.Sc., P.G.D.B.T.

***Sr. Technician (3)***

Ramesh Chandra, M.Sc.

Anil Kumar Verma, B.Sc.

***Private Secretary***

Renuka Mushran, B.A.

## DIVISION OF TOXICOLOGY & EXPERIMENTAL MEDICINE

***Chief Scientist***

Sharad Sharma, M.B.B.S., M.D., *Head of the Division*

S. K. Rath, M.Sc., Ph.D.

***Senior Principal Scientist***

Aamir Nazir, M.Sc., Ph.D.

Smrati Bhadauria, M.Sc., Ph.D.

Sarika Singh, M.Sc., Ph.D.

***Principal Scientist***

Vivek Vidyadhar Bhosale, M.B.B.S., M.D.

Madhav Nilakanth Mugale, M.V.Sc., Ph.D.

***Senior Scientist***

Virendrakumar Prajapati, M.V.Sc, ERT

Ashish Awasthi, M.Sc., Ph.D. *(Joined w.e.f. 15.01.2024)*

***Principal Technical Officer***

P. K. Agnihotri, M.Sc., Ph.D. *(Superannuated on 31.12.2023)*

Sadan Kumar, M.Sc. *(Superannuated on 31.1.2024)*

***Senior Technical Officer (2)***

Anurag Kumar Srivastava, M.Sc.

Shail Singh, M.Sc., Ph.D.

***Senior Technical Officer (1)***

Anil Kumar Meena, M.Sc., B.Ed.

Navodayam Kalleti, M.Sc.

***Technical Officer***

Sudhaker Yadav, M.Sc., M.L.T.

***Technical Assistant***

Akhilesh Kumar, M.Sc., Ph.D.

***Sr. Technician (3)***

M.P.S. Negi, B.Sc., PGDC (Biometry & Statistics)

*(Superannuated on 31.3.2024)*

Anupma, B.Sc.

***Lab. Assistant***

Umesh Kumar, Intermediate

Ram Kumar, High School (Science)

## DIVISION OF VIRUS RESEARCH & THERAPEUTICS

***Senior Principal Scientist***

Raj Kamal Tripathi, M.Sc., Ph.D. Head of the Division

***Senior Scientist***

Chetan Meshram, Ph.D.

***Scientist***

Rahul Shukla, Ph.D.

## NATIONAL LABORATORY ANIMALS FACILITY

***Senior Principal Scientist***

Dhananjoy Hansda, M.V.Sc.

S. Rajakumar, M.Sc

***Principal Scientist***

Rajdeep Guha, M.V.Sc., Ph.D. *Scientist-In-Charge*

***Scientist***

Shishir Kumar Gupta, M.V.Sc., Ph.D.

***Senior Technical Officer***

Zaheeb Rasheed Wani

Chandra Shekhar Yadav, M.Sc., PGDCA

***Technical Assistant***

Vijay Kumar Verma, M.Sc., Ph.D.

***Sr. Technician (3)***

Ravindra Singh, M.Sc., Ph.D. *(Superannuated on 30.6.2023)*

Sanjeev Kumar Saxena, B.Sc.

***Sr. Technician (2)***

Ravi Kumar Shukla, Intermediate (Sci.)

Narendra Kumar, B.A.

Dinesh Kumar, B.A.

Pradeep Tirkey, Intermediate

***Sr. Stenogrpaher***

Surendra Kumar, B.Com.

***Lab. Attendants (2)***

Najibullah

## SOPHISTICATED ANALYTICAL INSTRUMENT FACILITY AND RESEARCH

***Senior Principal Scientist***

N. K. Agarwal, M.Sc. *(Instrumentation)*

*(Superannuated on 31.1.2023)*

Ravi Sankar Ampapathi, M.Sc., Ph.D., *NMR Unit In-charge (Temporary transfer to CSIR-IICT)*

Kalyan Mitra, M.Sc., Ph.D., *Electron Microscopy Unit In-charge*

Sanjeev Kumar Shukla, M.Sc., Ph.D. (*NMR Unit)*

Manoj Kumar Rawat, M.Tech. *(Instrumentation)*

Sanjeev Kanojiya, M.Sc., Ph.D. *Mass Spectrometry Unit In-charge*

D. K. Mishra, M.Sc., Ph.D., *Botany, Unit In-charge*

***Principal Scientist***

Vineeta Tripathi, M.Sc., Ph.D. *(Botany)*

Santosh Kumar, M.Sc., Ph.D. (Instrumentation)

***Principal Technical Officer***

H. M. Gauniyal, M.Sc., Ph.D. (NMR Unit)

***Sr. Technical Officer (3)***

Ram Karan Harijan, AMIE (Instrumentation)

***Sr. Technical Officer (2)***

Sanjay Kumar, B.Tech. (Instrumentation)

***Sr. Technical Officer (2)***

Binod Kumar Saw, M.Sc.

***Sr. Technical Officer (1)***

Garima Pant, M.Sc.

Amit Kumar, M.Tech.

Dharmesh Kumar, M.Sc.

Pooja Soni, Diploma, BE

Tofan Kumar Rout, M.Sc., Ph.D.

Jeevan Prakash Pandey, Diploma in Electronics

Kamlesh Singh

***Technical Assistant***

Vipin Kumar, M.Sc., PhD

Pooja Singh, M.Sc.

Mohan Kumar A.S., M.Sc.

***Sr. Technician (3)***

S. A. Singh, B.Sc., PGDCA

J. K. Joshi, B.Sc.

***Sr. Technician (2)***

O. P. Gupta, B.Sc.

D. N. Vishwakarma *(Superannuated on 31.10.2023)*

***Sr. Stenographer (Hindi)***

Anil Kumar, B.Com.

***Lab. Assistant***

R. C. Maurya

Lakhana Devi

***Lab Attendant (2)***

Ashok Kumar

## KNOWLEDGE RESOURCE CENTRE

***Principal Scientist***

Laxman Singh Meena, M.Sc., PhD.

***Senior Technical Officer (2)***

Ramesh Chandra Gupta, *M.L.I.Sc,*

***Senior Technical Officer***

Pankaj Upreti, *M.L.I.Sc,*

## SCIENTIFIC DIRECTORATE

***Senior Principal Scientist***

Anand P. Kulkarni, M.Sc., Ph.D., *Head PME, In-charge, KRC, Supervising Scientist In-charge, Auditorium*

***Scientist***

Shruthi R Raju, M.Sc., Ph.D.

***Principal Technical Officer***

Ravindranath S. Londhe, GD Art (Commercial), Art Teachers Dip.

***Sr. Technical Officer (1)***

Arbind Kumar, B.C.A., PGDAM

Farha Khan, M.C.A.

***Technical Officer***

Ashok Kumar, Diploma in Mechanical Engineering

***Sr. Technician (2)***

Suresh S. Bhakuni, *(Superannuated on 31.8.2023)*

***Technician (1)***

Sumit Khichi , Intermediate, ITI Jodhpur

***Sr. Stenographer***

Himanshu Upadhyay, B.A.

## ACADEMIC AFFAIRS UNIT

***Principal Scientist***

Sanjeev Yadav, M.Sc., Ph.D., PG Diploma in Bioinformatics

Hijas KM, M.Sc., Ph.D., *(Joined w.e.f. 08.02.2024)*

## BUSINESS DEVELOPMENT & INTELLECTUAL PROPERTY UNIT

***Principal Scientist***

Naseem Ahmed Siddiqui., B. Pharma (Hons), M.B.A., PhD, *Head, Business Development*

Sripathi Rao Kulkarni, M.Sc., Ph.D., P.G. Dip. in Patents Law, IP Co-ordinator

***Scientist***

Kaushik Bhattacharjee, M.Sc., Ph.D., *(Joined w.e.f. 08.02.2024)*

***Sr. Technical Officer (2)***

Jai Prakash Dwivedi, BTech, MBA

***Senior Technical Officer***

Neelima Srivastava, M.C.A.

***Technical Assistant***

Shraddha Jain, MBA

***Technician (2)***

Susheel Kumar, Intermediate

## COMPUTER CENTRE

***Chief Scientist***

Kural, B.E., *In-Charge*

***Scientist***

Santosh Shukla, B.Tech.

***Senior Technical Officer***

Ajay Kumar Maurya, M.Tech.

***Technical Officer***

Mukesh Kumar, B.Tech. *(Joined w.e.f. 17.08.2023)*

## LABORATORY ENGINEERING SERVICES

***Senior Superintending Engineer***

Parvez Mahmood, B.Sc. Engineering (Civil), *In-Charge*

*(Superannuated on 30.6.2023)*

Kamal Jain, B.E., (Electrical), In-charge

***Executive Engineer***

Mohit Kumar Shukla, A.M.I.C.E. (Civil)

Jai Prakash, Diploma in Mech. Engg. (Ref. & AC)

Sidho Hembrom, Diploma in Mech. Engg.

D. K. Vishwakarma, Diploma in Civil Engg.

Brahma Singh, AMIE in Electrical Engg.

***Assistant Engineer***

Madhukar Saroj, Diploma, B.Tech. (Civil)

Ajay Kumar, B.Sc., Diploma in Electronics Engg.

***Sr. Stenographer (Hindi)***

Raj Kumar, B.A.

***Multi Tasking Staff***

Hanuman

Maikulal-II

***Sr. Technician (2)***

Harish Kumar, Intermediate, ITI

Swapan Karmi

***Lab. Assistants***

S. K. Bhattacharya

Darshan Lal

***Lab Attendant (2)***

Sandeep Roy, High School *(Superannuated on 31.12.2023)*

Dhirendra Misra, Intermediate

Mohd. Irfan, Intermediate, ITI

Raju Vishwakarma

Hari Om Garg

Gaya Prasad

Ram Asrey

Suresh Kumar

***Multi Tasking Staff (Non-Technical)***

Faizi

## COA OFFICE

***Senior Controller of Administration***

*Bhaskar Jyoti Deuri*

***Administrative Officer***

Rashmi Rathore

Neetu Kumari

***Asstt. Section Officer (G)***

Kamla Kandpal, M.A.

***Jr. Stenographer***

Kshma Bajpai, B.A.

***Multi Tasking Staff***

Ravi Kanojiya

Ravi Sonkar

## DIRECTOR'S OFFICE

***Private Secretary***

Sumit Srivastava, B.Com.

V. P. Singh, B.A.

***Sr. Technician (2) (Driver)***

Shakeel Ahmad Khan *(Superannuated on 30.6.2023)*

***Lab. Attendant (2)***

Nand Kishore Manjhi, ITI

***Multi Tasking Staff***

Rajesh

## ESTABLISHMENT I

***Section Officer (G)***

Sufia Kirmani

***Assistant Section Officer (G)***

Jagdish Prasad, B.Sc., MPA

Saju P. Nair

***Senior Secretariat Assistant (G)***

Anjali Singh, B.A.

***Sr. Stenographer***

Deepak Dhawan, B.A

***Jr. Stenographer***

Aman Soni *(joined w.e.f. 27.06.2023)*

**JSA**

*Shailja Bahal (joined w.e.f. 22.06.2023)*

*Abhishek Kashyap (joined w.e.f. 25.05.2023)*

***Lab. Assistant***

Vinod Kumar

***Lab. Attendant (1)***

*Nidhi Srivastava (joined w.e.f 30-05-2022)*

***Multi Tasking Staff***

*Mohammad Haroon*

## ESTABLISHMENT II

***Section Officer (G)***

Vibhash Kumar, BA (Hons., CIC)

***Assistant Section Officer (G)***

Dilip Kumar Sen, B.Com.

Neena Raizada, B.A.

Ajai Shukla, M.Com.

Vijay Kumar Bhartey, B.A.

***Senior Secretariat Assistant (G)***

Anoop Thakur, B.Tech. (ECE) O-level

Vinay Kumar Singh, B.C.A.

***Jr. Stenographer***

Shivam Verma *(joined w.e.f. 30.06.2023)*

## GENERAL SECTION

***Section Officer (G)***

*K K Saxena*

***Assistant Section Officer (G)***

Rani, High School

Mohd. Irfan, *(Superannuated on 31.1.2024)*

***Senior Secretariat Assistant (G)***

Deepak Kumar Gupta, M.Com.

Rishi Kant, M.Sc., B.Ed., O-Level

***Senior Secretariat Assistant (G)***

Mohd. Saleem, Prathama (equi. to High School)

***Junior Secretariat Assistant (G)***

Kalpanath Sharma, Intermediate

Bhupendra Kumar *(joined w.e.f. 26.05.2023)*

Ashutosh Chaudhary *(joined w.e.f. 26.06.2023)*

***Private Secretary***

Seema Srivastava, M.A

***Sr. Technician (2) (Driver)***

K. K. Kashyap, *(Superannuated on 30.6.2023)*

Vivek Kumar Mishra

***Lab Attendent (2)***

K. P. Mishra, High school

***Multi Tasking Staff***

Saurav Sarkar, Intermediate

## BILL SECTION

***Section Officer (G)***

Vivek Bajpai

***Senior Secretariat Assistant (G)***

Nida Parveen, B.Com.

Indra Prakash Singh, B.A.

Kumar Saurabh, B.Com.

***Junior Secretariat Assistant (G)***

Harshita Maheshwari *(joined w.e.f. 23.06.2023)*

***Sr. Stenographer***

Vineet Pandey, B.A., P.G. Comp.

***Jr. Stenographer***

Lalit Kumar, B.A.

***Lab. Assistant (2)***

Vinod Kumar Sharma, B.A.

## VIGILANCE

***Section Officer (G)*** *Additional Charge (E-II)*

Vibhash Kumar, B.A. (Hons), CIC

***Senior Secretariat Assistant (G)***

Jaya Singh, B.Sc.

***Junior Secretariat Assistant (VIGILANCE)***

Aastha *(joined w.e.f. 03.07.2023)*

***Lab. Assistant***

Ramesh Chandra

## HINDI SECTION

***Hindi Oficer***

Sachin Mishra *(joined w.e.f. 14.11.2023)*

***Hindi Translator***

Bihari Kumar *(joined w.e.f. 18.10.2023)*

***Private Secretary***

Anil Kumar, B.Com

## SECURITY

***Security Officer***

Anil Kumar Upadhyay, M.A.

## FINANCE & ACCOUNTS

***Controller of Finance & Accounts***

Sanjeev Shekhar, MA, MBA

***Finance & Accounts Officer***

Prasoon Mishra

Dharmraj

***Section Officer (F&A)***

Gitendra Kumar Gupta, MA

Pankaj Kumar, MA, MBA

Neeraj Kumar, MA, MPhil

***Assistant Section Officer (F&A)***

Ajay Kumar, B.A.

Preeti Gangwar, MA

Sanjay Kumar, B.A.

***Senior Secretariat Assistant (F&A)***

Chandrashekhar, Intermediate

Abhishek Kumar, Intermediate

Mamata Chourasia, M.A.

***Junior Secretariat Assistant (F&A)***

Mohd. Firoz, B.A.

Satyam Tiwari *(joined w.e.f. 18.05.2023)*

Harshit Mishra *(joined w.e.f. 24.05.2023)*

Raman Kumar *(joined w.e.f.12.06.2023)*

***Private Secretary***

Jitendra Patel, M.A.

***Sr. Stenographer (H) (MACP)***

Mohammad Sufiyan, B.Com.

***Lab. Attendant (2)***

Vikramaditya, High School

***Multi-Tasking Staff***

Shekhar Singh, B.Com.. M.B.A.

***Lab. Assistant***

Satish Chandra Yadav, B.Sc.

## STORES & PURCHASE

***Controller Store & Purchase***

Vinay Kumar, PG

***Store & Purchase Officer***

Neelambuj Shanker Prasad, MCom, MBA

G S Verma, AMIE, MBA

***Section Officer***

Govind Kumar Jha, MBA

***Assistant Section Officer (S&P)***

Mahesh Kumar, M.A.

M. C. Verma, B.Com.

***Senior Secretariat Assistant (S&P)***

Kanchan Bala, B.A.

Anil Kumar, B.A.

G. P. Tripathi, Intermediate

***Junior Secretariat Assistant (S&P)***

Ram Kumar, B.Com.

Ambica Bhawani Vaka *(joined w.e.f. 18.05.2023)*

Satyam Rathour *(joined w.e.f17.05.2023)*

Naveen *(joined w.e.f. 1.*06.2023)

Dileep Tiwari *(joined w.e.f. 30.06.2023)*

***Sr. Technician (2)***

Ravi Kumar Mehra, B.A.

***Multi Tasking Staff***

Sudhir Kumar Yadav, Intermediate

***Private Secretary***

Vinod Kumar Yadav, BA

## CSIR DISPENSARY

***Medical Officer Group III (5)***

Kunal Gupta, M.B.B.S. *In Charge*

***Medical Officer Group III (4)***

Shalini Gupta, M.B.B.S., PGDHHM

***Senior Technical Officer (01)***

Saurav Kumar KC

Pradeep Singh *(Joined w.e.f. 26.12.2023)*

***Technician (2)***

Shraddha, M.A., Diploma in Nursing, Post Basic Diploma in Dialysis, Certificate in child care nutrition

***Technician (1)***

Shahzada Jalal (Pharmacist)

Simpi Gupta (Pharmacist)

***Lab. Assistant***

S. K. Paswan, Intermediate (Retired on 31.01.2024)

***Lab. Attendant (2)***

Shubhendra Kumar, Intermediate

## CANTEEN

***Clerk (ACP)***

Y.K. Singh, BA (Count C)

**Asstt. Halwai**

Uma Shankar

***S/Man***

Raj Kumar

***Wash Boys***

Ram Murat

Dinesh Pal Singh

***Bearer***

Ganga Ram Yadav

# Note

# Note

# Note

# CDRI की नई दवा से जल्द जुड़ेगी हड्डी

डॉ. दिव्या ने टीम

के साथ हासिल की

उपलब्धि, क्लिनिकल

ट्रायल की

■ दीपांकुर सक्सेना, लखनऊ

केंद्रीय औषधि अनुसंधान संस्थान (सीडीआरआई) की नई दवा टूटी हड्डी को जल्द जोड़ने में कारगर साबित होगी। खासियत यह है कि खाने वाली दवा एसO07-1500 की काफी कम मात्रा के सेवन से ही आराम मिलेगा। दवा के क्लिनिकल ट्रायल की अनुमति मिल गई है। इसके साथ ही गुजरात की कंपनी को

रंगराजन के अनुसार एक नई फास्ट फ्रेक्चर हीलिंग दवा तैयार की गई है, जो हड्डी को को जल्दी ठीक करने के साथ दर्द से भी राहत देगी। संस्थान की डॉ. दिव्या के नेतृत्व में टीम ने सीडीआरआई एसO07-1500 के रूप में एक सिंथेटिक मॉलिक्यूल तैयार किया है, जिसे औषधि नियामक निकायों से प्रथम चरण के

सिंथेटिक मॉलिक्यूल है। वर्तमान में कोई भी ओरल एक्टिव फ्रेक्चर हीलिंग मॉलिक्यूल राष्ट्रीय या अंतरराष्ट्रीय उपलब्ध नहीं है। अब तक वीएम हुई हड्डियों के लिए दिया जाता है। महंगा होने के साथ ही

# CDRI to work on major drugs, aims to cut healthcare costs

...ing the year-long plan, CDRI director ...id "CSIR-CDRI is dedicated ... drugs.

...hawan sa

# सीएसआईआर–सीडीआरआई में स्वच्छता के लिए शपथ लेने के साथ स्वच्छता पखवाड़ा का हुआ शुभारम्भ

ब्यूरो चीफ आर एल पाण्डेय

...महात्मा गांधी ने एक ऐसे ...जो न

के दौरान आयोजित होने वाले विभिन्न कार्यक्रमों के बारे में जानकारी दी। उन्होंने कहा, इस आयोजन के लिए विभिन्न गतिविधियों की योजना बनाई गई है। वृक्षारोपण के साथ नए लॉन की सफाई एवं बेहतर बनाना, ...आई निवासियों के बीच जागरूकता अभियान चलाना, स्वच्छ एवं ...सीएसआईआर–सीडीआरआई परिवार द्वारा श्रमदान,

# सीएसआईआर-सीडीआरआई, लखनऊ में ऊर्जा साक्षरता प्रशिक्षण और जलवायु घड़ी जागरूकता कार्यक्रम का आयोजन किया गया

वैचारिक तूफान,संवाददाता।

लखनऊ। जलवायु परिवर्तन विश्व भर को प्रभावित कर ...हा है, लेकिन 1.5 डिग्री सेल्सियस से अधिक तापमान उन ...अरब से अधिक लोगों के लिए विनाशकारी साबित होगा, ...जलवायु परिवर्तन के ...हते हैं, जैसा कि ...

...कगार पर है। विश्व पृथ्वी दिवस के उपलक्ष्य में आयोजित ... छात्र-वैज्ञानिक कनेक्ट कार्यक्रम, सीएसआईआर-जिज्ञास ... के अन्तर्गत में आयोजित किया गए थे जिसमें फार्मेसी छात्रो ... हेतु कैरियर के विभिन्न अवसरों की भी जानकारी साझा की ... गई। डॉ संजीव यादव ने विभिन्न क्षेत्रो के बारे में बताया जहां ... छात्र अपनी सामर्थ एवं अपनी कमजोरियों को ध्यान में ... रखते हुए देखते हुए खुद के लिए उपयुक्त विकल्प चुन ...

# Research Scholars explored the AI's Role in Accelerating Drug Development during Jigyasa Program at CSIR-CDRI Lucknow

By Aapkikhabar newsAug 29, 2023, 20:47 IST

Bureau chief R L Pandey

LucknowI The CSIR- Central Drug Re...

under the 'Jigyasa P...

# सीडीआरआई में स्टूडेंट-साइंटिस्ट कनेक्ट प्रोग्राम

PIC: DAINIK JAGRAN-I NEXT

# डीआरआई में राष्ट्रीय बौद्धिक संपदा महोत्सव का ...द्धिक सम्पदा को समय पर सुरक्षित करने के महत

...न टाइम्स संवाददाता

...आईआर सीडीआरआई ...त्सव

के बारे में जा... प्रदान की। एक ... तक चलने वा... उत्सव में सीएस... सीडीआरआई ... शोधकर्ताओं, ... उद्यमियों और ... उनकी बौद्धि... की सुरक्षा के ...

{ BREAKTHROUGH }

# CDRI unveils enhanced 1990s contraceptive pill 'Saheli' with minimal chemical burden

Aakash Ghosh

aakash.ghosh@htlive.com

**LUCKNOW:** The CSIR-Central Drug Research Institute (CDRI) in Lucknow has introduced an innovative contraceptive named ...ifene'. The break-

...ers, dextro-ormeloxifene, and levo-ormeloxifene (levormeloxifene). Extensive preclinical studies have indicated higher efficacy of the levo counterpart, levormeloxifene. This research solely focuses on testing the levo model as a contraceptive, ... trials, this contraceptive will bolster family planning initiatives, adding to the existing range of contraceptive services within the Programme. These services encompass Oral Contraceptive Pills, condoms, government-provided 'Nirodh'

# विज्ञान ज्योति कार्यक्रम में लड़कियों ने सीडीआरआई में अपने रोल मॉडल के साथ बातचीत की और विज्ञान अन्वेषण के प्रति उनके जुनून के बारे में जानकारी ली



# CSIR institutes welcome 2,600 schoolchildren on 'Open Day'

TIMES NEWS NETWORK

**A DATE WITH SCIENCE** Students studying scientific models at CDRI

**Lucknow:** Over 2,600 students of the city got a chance to learn and interact with some top scientists when they visited three scientific institutes , including CSIR-Central Drug Research Institute (CDRI), National Botanical Research Institute (NBRI) and Central Institute of Medicinal and Aromatic Plants (CIMAP), on Tuesday.

The occasion was 'Open Day' celebrations that ... vi Gupta. ... students and educators from 25 schools and colleges parti...

Another student Shipra ... from the same ...

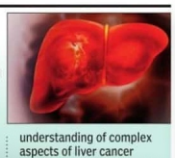
# Researchers find cure to liver cancer through target therapy

Study A Joint Effort Of CDRI, CIMAP & PGI

Mohita.Tewari
@timesgroup.com

**RAY OF HOPE**

- The research finds that cancer cells change metabolic programming, and it can be used as diagnostic tool for cancer prevention
- It also unravels insights into metabolic mysteries behind Hepatocellular Carcinoma, a challenging ... liver cancer



understanding of complex aspects of liver cancer and also holds promise for developing new ways to diagnose & treat the disease

...pact on the cell's metabolism, which was found to ...

# सीएसआईआर-सीडीआरआई लखनऊ ने हरित पहल के साथ नए शामिल हुए पीएचडी छात्रों हेती इंडक्शन सेरेमोनी: शोधारंभ का आयोजन किया

...लेना) की एक नई पहल शुरू की ...मारे परिसर को न सिर्फ हरा-भरा ...में मदद करती है, अपितु कार्बन ...इसकी देखभाल करेंगे एवं संस्थान छोड़ने से पहले स्मृति चिन्ह के तौर पर सौंप कर जाएंगे। युवा उभरते वैज्ञानिकों को ... महत्वपूर्ण भूमिका निभाई है। निदेशक ने इस बात पर जोर दिया कि वैज्ञानिक बनने का मार्ग एकरेखीय नहीं है। इसमें उतार-चढ़ाव, अप्रत्याशित चुनौतियाँ और सदि... एवं प्रेरित रहते हुए सशक्त बने रह ... हैं। अपने संबोधन के दौरान, निदेश ... जलवायु आपातकाल एवं दुनिया ... कार्बन पदचिह्न में खतरनाक वृद्धि ... गंभीर मुद्दे पर भी बात की। उन्होंने ... पर्यावरण संरक्षण के प्रति संस्थान ... जिम्मेदारी बनती है कि कार्बन के ... कम किया जाए। वृक्षारोपण कार्य... उद्देश्य छात्रों के बीच पर्या... जिम्मेदारी और चेतना को भाव... करना एवं उन्हें प्रकृति का संरक्ष... के लिए प्रोत्साहित करना ... सीडीआरआई में उनके कार्य... दौरान लगाए गए पेड़ छात्रों द्वारा

# सीएसआईआर-सीडीआरआई ने कैंसर के इलाज हेतु नवीन थेरेपी विकसित करने के लिए बेंगलुरु स्थित स्टार्टअप के साथ हाथ मिलाया

## पारंपरिक औषधि अनुसंधान विशेषज्ञता के साथ आर्टिफिशियल इंटेलिजेंस का संयोजन, कैंसर के इलाज हेतु नई चिकित्सा विधि विकसित करने का मार्ग प्रश...

...पूरो चीफ आर एल पाण्डेय ...खनऊ। कृत्रिम बुद्धिमत्ता–आध... ...य औषधि अनुसंधान में अग्रणी ...य स्टार्टअप कंपनी, श्रावती ...टेक्नोलॉजीज प्राइवेट लिमिटेड ...सीएसआईआर–सीडीआरआई ...य औषधि अनुसंधान संस्थान), ...ने कैंसर उपचार के लिए ...केंद्रीय तकनीक विकसित ...के लिए एक रणनीतिक ...की घोषणा की है।

...योग में श्रावती ...

को मान्य करेगा। दोनों संस्थाएं इस प्रकार चुने हुए सक्रिय यौगिकों (एनसीई) को परखने एवं अनुकूलित करने के बाद नवीन कैंसर रोधी प्रत्याशी दवा के तौर पर इनका चयन कर नैदानिक मूल्यांकन के लिए मिलकर काम करेंगी। श्रावती एआई के संस्थापक एवं प्रबंध निदेशक डॉ. किशन गुर्रम ने कहा, फ्लैसर के लिए नई चिकित्सीविधि (थेरापुटिक्स) विकसित ...

सीएसआईआर के पैन–कैंसर मिशन कार्यक्रम की नोडल लैब है, जिसका उद्देश्य ट्रिपल नेगेटिव ब्रेस्ट जैसे महत्वपूर्ण एवं अति महत्वपूर्ण कैंसर के इलाज के लिए दवाएं प्रदान करना है। सीएसआईआर–सीडीआरआई निदेशक डॉ. राधा रंगराजन ने कहा यह सहयोग पैन–कैंसर मिशन के लक्ष्यों को आगे बढ़ाने में मददगार साबित होगा। श्रावती ...

# CDRI JOINS HANDS WITH START-UP

Sravathi AI Technology Pvt Ltd has announced a strategic collaboration to develop new therapeutics for the treatment of cancer. The

**CSIR-Central Drug Research Institute, Lucknow**

Sector 10, Jankipuram Extension, Sitapur Road, Lucknow

Phone Number: +91-522 2772450 Email: director@cdri.res.in

Website: www.cdri.res.in