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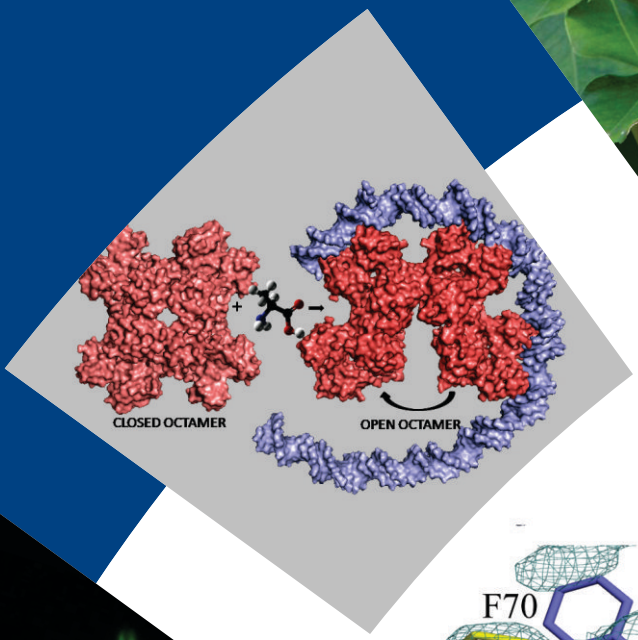
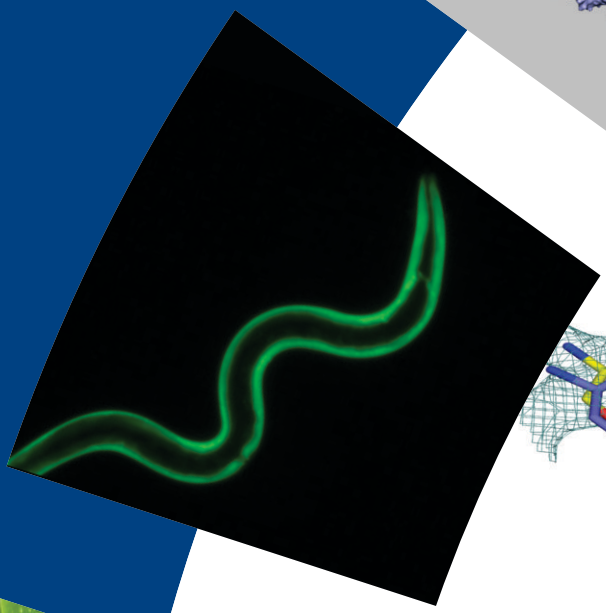
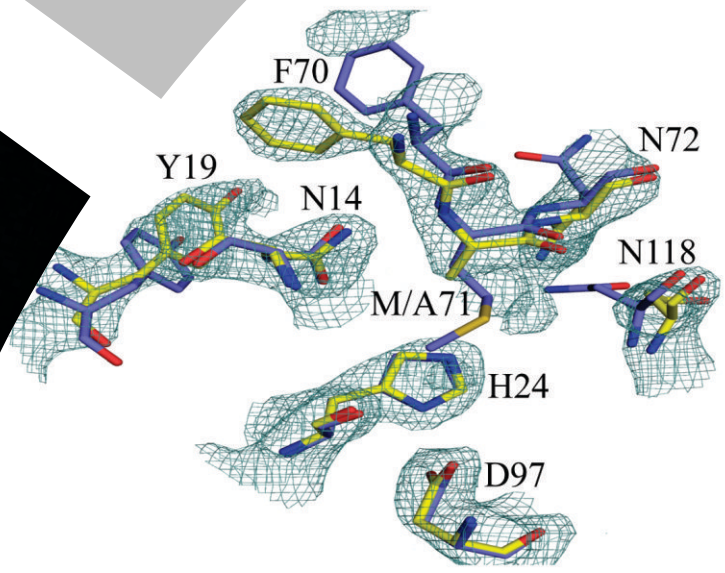
वार्षिक प्रतिवेदन
Annual Report
2017-18







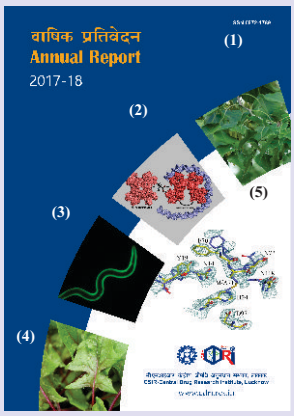
सीएसआईआर केन्द्रीय औषधि अनुसंधान संस्थान, लखनऊ
CSIR-Central Drug Research Institute, Lucknow
www.cdri.res.in

विषाक्तता एवं सेफ्टी फार्माकोलॉजी परीक्षण: जीएलपी अनुरुप सुविधा
Toxicity & Safety PharmacologyTesting: GLP Test Facility

Editorial Board

Acknowledgments

We sincerely thank all who have extended their generous support, advice and help, in the preparation of the Annual Report 2017-18. The effort of each and every person who has contributed in the making of this report is hereby acknowledged. We are grateful to all the Area Coordinators and Heads/In charge of Division/Units, Administration for timely submission of data and for the support.



1. Leaves of Sheeshum, *Dalbergia Sisoo* are used to make the CSIR-CDRI Ayush Drug, REUNION for rapid bone healing and osteoporosis

2. 'Open-Close' quaternary structural changes captured through crystal structures of a Feast/Famine regulatory protein from *M. tuberculosis*

3. Fluorecsent photomicrograph of transgenic *C. elegans* model of Parkinson's disease expressing 'human' alpha synuclein. The model is employed for studying effect of genetic and pharmacological interventions on alpha synuclein aggregation and associated endpoints.

4. CSIR-CDRI transfered the technology of standardized an extract and its formulation derived from the plant *Spinacea oleracea,* commonly known as Palak (Plant extract name: 2492-C003) that exhibits anti-osteoarthritic effects by preventing cartilage degradation.

5. Electron density map depicted around protein atoms shown in 'stick' representation

With best compliments from

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वार्षिक प्रतिवेदन
ANNUAL REPORT
2017-18

सीएसआईआर–केन्द्रीय औषधि अनुसंधान संस्थान, लखनऊ
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्)

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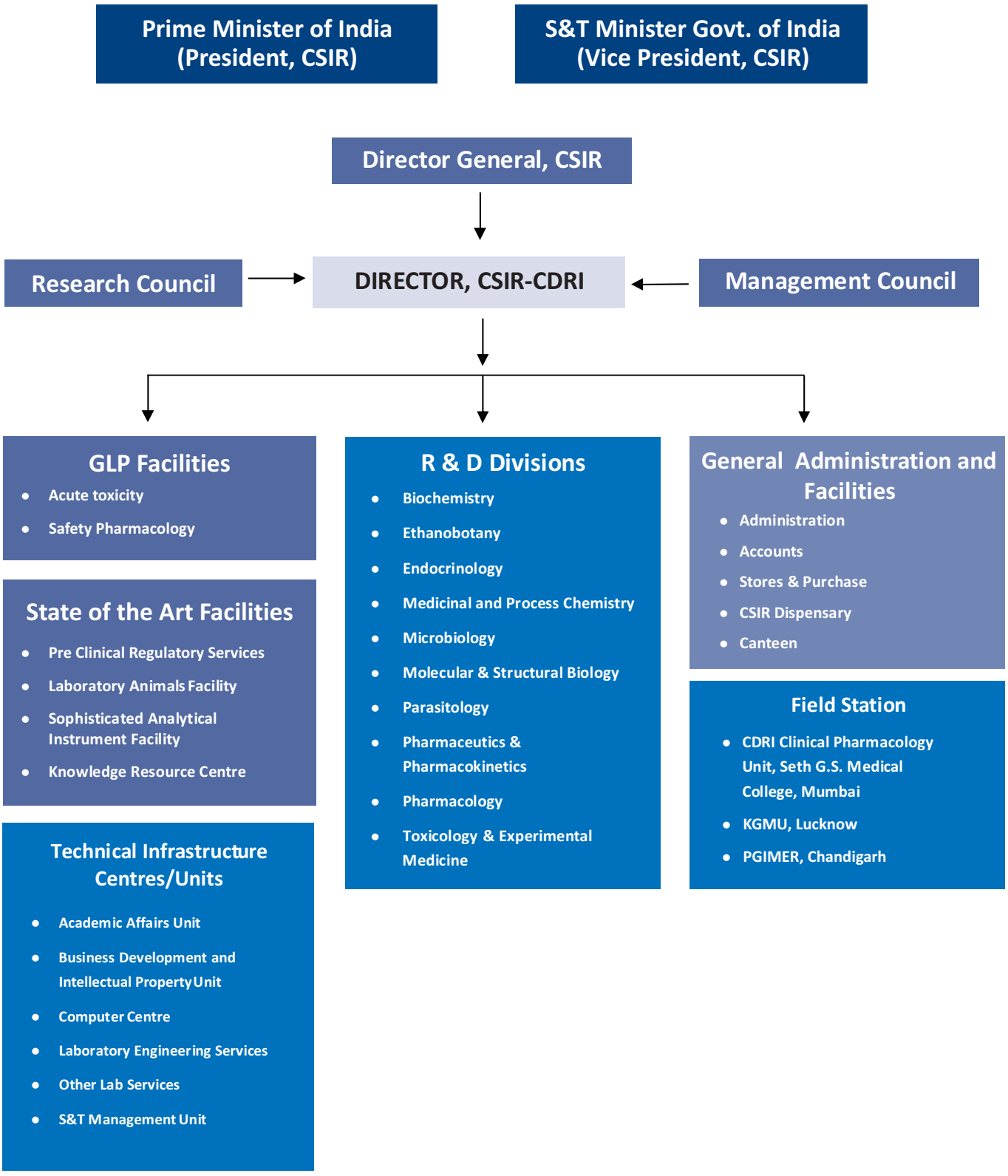
Organizational Structure



Highlights of Achievements

The Charter

- Development of new drugs and diagnostics;
- Cellular and molecular studies to understand disease processes and reproductive physiology;
- Development of contraceptive agents and devices;
- Systematic evaluation of medicinal properties of natural products;
- Development of technology for drugs, intermediates and biologicals;
- Dissemination of information in the field of drug research, development and production;
- Consultancy and development of technical manpower.

Thrust Areas of Research

1. **Translational Research**
   - Pre-clinical, clinical development and commercialization of new generation affordable drugs for diseases of national importance and relevance;
   - Creation of center of excellence in the field of clinical trials, regulatory toxicology, safety pharmacology, pharmaceutics & pharmacokinetics for catering to the needs of pharmaceutical industries.
2. **New Drug Discovery**
   - Rational design, synthesis and biological screening of synthetic compounds and natural products for discovery of new drug;
   - Repositioning of bioactives;
   - Maintenance of the repository of synthetic and pure natural compounds for identification of ligands for new biochemical targets;
   - Recruiting compounds from other institutions for assessment of bioactivity.
3. **Basic Research Areas for Advancing the Knowledge Frontiers**

   i. Malaria and other Parasitic Diseases
   - Development of new drugs/drug combinations as therapeutic interventions for malaria, leishmaniasis and filariasis;
   - Establish novel target based drug assay protocols for identification of new leads;
   - Knowledge generation on parasite biology and host parasite interactions.

   ii. Reproductive and Bone Health Research
   - Development of novel agents for fertility regulation (male/female) and management of endocrine disorders through modern drug design, scientific validation of traditional remedies and generation of new knowledge.

   iii. Tuberculosis and Microbial Infections
   - Simplification and shortening of treatment for drug-sensitive tuberculosis and search of new treatments for MDR-TB;
   - Development of new drugs for bacterial, fungal, viral (HIV & JEV) infections and tuberculosis.

   iv. CVS, CNS and Related Disorders
   - Development of new target based drugs to alleviate CVS, CNS and related disorders;
   - Carry out excellent basic research to delineate the molecular mechanisms of these pathologies so as to identify suitable targets for drug discovery, as well as to analyze the possible mechanism(s) of action of the candidate drugs.

   v. Cancer and Related Areas
   - Lead identification/optimization to obtain drug-like molecules;
   - Creation of appropriate platform for interdisciplinary collaborative research;
   - Creation of knowledge base in cancer biology.

Contents

From the Director's Desk

It gives me immense pleasure to present the Annual Report of CSIR – Central Drug Research Institute, Lucknow on its 67th Annual Day. I feel it is a privilege to lead a glorious institute like CSIR-CDRI, which has made outstanding contributions in the service of the nation in pharma sector and has set global standards in making drugs accessible and affordable.

CSIR-CDRI is a unique R&D Institution in the country with state-of-the-art infrastructure for new drug discovery and development from 'Concept to Commercialisation'. It is poised to become a global leader through cutting edge science & technology. For New India, the institute is re-orienting itself into a multidisciplinary nodal centre for development of drugs for the unmet medical needs as well as the expectations of the industry. While focussing on the discovery and development of drugs, the institute is aligned and contributing towards the national missions programmes such as Make in India, Swasth Bharat, Skill India, Digital India, Start-up India, Accessible India and Sashakt Bharat.

It was a indeed a privilege to have the Hon'ble Prime Minister of India, Shri Narendra Modi, visit CSIR-CDRI and see the labs to get a first hand knowledge of the work being conducted at the institute. This happens to be his first visit to any of the CSIR laboratory. His visit and appreciation really motivated and instilled renewed enthusiasm in the CSIR-CDRI family as well as CSIR.

In a first ever breakthrough in the area of osteo-arthritis, scientists at CSIR-CDRI developed a standardized formulation from Spinacea oleracea commonly known as Palak for treatment. It exhibits anti-osteoarthritis activity by preventing cartilage degradation and has been licensed to M/s Pharmanza Herbal Pvt Ltd., Gujarat for commercialization. Two NCE's, viz. S-007-867 (anti-thrombotic) and S-007-1500 (Fracture healing) are in advanced stage of IND enabling studies. Antimalarial lead S-011-1793 and anti-leishmanial lead 96/261 are under preclinical investigation. Under the ambitious phytopharmaceutical mission, the institute is developing three phytopharmaceuticals for the disease indications viz. (i) Glucocorticoid induced osteoporosis, (ii) Dementia and (iii) Non-alcoholic fatty liver disease (NAFLD).

CSIR-CDRI is making strident progress in drug R&D with in-house capability as well as in collaboration with academia & industries. CSIR-CDRI joined hands with Dr Reddy's Laboratories Ltd. and Dr Reddy's Institute of Life Sciences to jointly develop PAM of 5-HT2C as a therapeutic for obesity. A team of CSIR-CDRI has designed and developed a 15-residue novel peptide S-016-1271, which is non-cytotoxic to human RBCs and murine 3T3 cells and possesses significant antimicrobial and anti-endotoxin activities. In a breakthrough research in the area of Malaria, first experimental evidence has been provided for a functional SUF pathway for [Fe-S] biogenesis in the *Plasmodium falciparum* apicoplast. The structure and dynamics of peptidyl-tRNA hydrolase from Vibrio cholera has been characterised to help in identification of drug candidates. In the area of cancer, a Smac mimetic peptide and an anti-angiogenic compound has been identified. Anti-angiogenic

lead is the outcome of Ministry of Earth Sciences funded project on Drugs from sea. Institute has also received approval from the Biotechnology Industry Research Assistance Council (BIRAC) for the project on 'Development of small molecule inhibitor of PCSK-9, a new target for LDL receptor and atherosclerotic cardiovascular disease'.

CSIR-CDRI produced 82 PhDs and imparted training to 143 post graduates. Three patents were filed in India, and one abroad. Nine Indian patents and Nine foreign patents were granted. The institute published a total of 357 publications with an average IF of 3.66. In terms of societal programs, institute conducted more than 21 student motivation program and a health awareness program. I congratulate the team CSIR-CDRI for their outstanding accomplishments.

With the accreditation by the National GLP Compliance Monitoring Authority of India in October 2017, CSIR-CDRI became the first government organization in India having the GLP test facility for safety pharmacology, and the second among the CSIR labs in having GLP toxicity test facility. CSIR-CDRI GLP test facility leverages from in vivo rodent models to enable safety of suitable products in pharma, and biotech sectors. The institute also initiated work towards the NGCMA certification for the complete range of IND enabling studies as per Schedule 'Y'.

CSIR-CDRI organised an industry-academia conclave with an aim to engage drug researchers in the pharmaceutical industry and academic institutions, along with higher-level policymakers and administrators in the government. Fifty-two industry participants attended the conclave. It provided an excellent platform for both Industry and Academia to share views and unexplored avenues for working together. Outcomes and lessons from the conclave are being pursued at multiple forums.

Aligned with the CSIR Skill Initiative, four courses were started. They were, advanced spectroscopic techniques; microscopy and flow cytometry; regulatory safety studies and animal experimentation; computational approaches to drug design & development. The first batch of students has already graduated while the second batch is currently undergoing training.

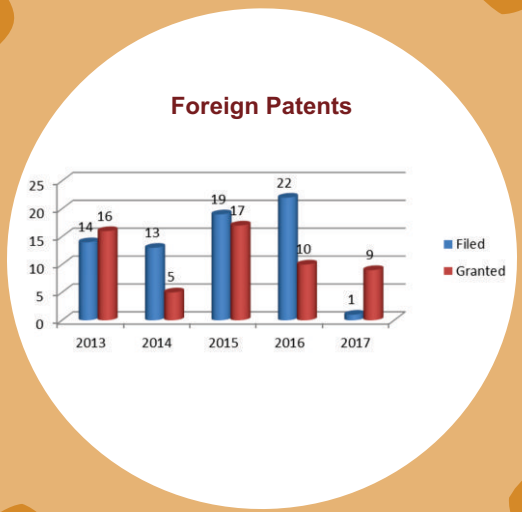
With a vision to strengthen and leverage the cutting-edge platform technologies into an overarching innovation platform for drug discovery and development in collaboration with academia and industry, CSIR-CDRI has set up an “Advanced Platform for Research and Innovation (AMRIT)”.This will stimulate the pharma start-up ecosystem in areas of national priorities. The cohort of technology platforms made available through AMRIT will be deployed for discovery in selected key areas of communicable and non-communicable diseases and reproductive health. In the coming year, Institute will also strive to strengthen the medicinal & natural product chemistry, bio-therapeutics and linkages with industries.

CSIR-CDRI gratefully acknowledges the patronage received from the Hon'ble Prime Minister of India and President of CSIR, Shri Narendra Modi, Dr Harsh Vardhan, Union Minister for Science & Technology and Earth Sciences and Vice President CSIR as well as Mr Y.S. Chowdary, Minister of State for Science & Technology, Government of India. The invaluable guidance and encouragement provided by Dr Girish Sahni, Director General, CSIR as well as Members of the CSIR-CDRI Research Council is highly appreciated. I am thankful to all my staff and their families who are supporting and contributing to the progress of the institute in the service of the Nation.

Dated: 17 February, 2018

(Alok Dhawan)

Performance Report



CSIR
सी एसआईआर
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CSIR INDIA

Breakthrough in 2017-18

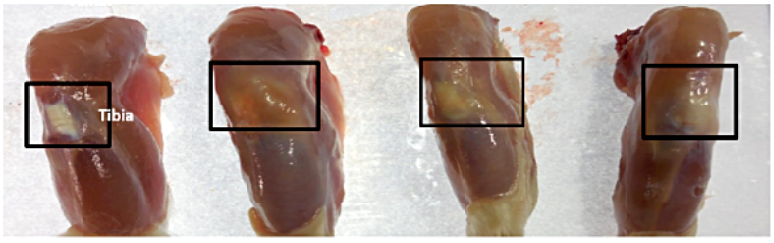
CDR2492/C003 – A standardized formulation for the management of osteoarthritis

A first ever breakthrough in the area of osteoarthritis, a most common chronic condition of the joints that afflicts mainly the weight-bearing joints such as hips and knees, and causes physical disabilities. At present there is no viable treatment available for osteoarthritis. CDRI Scientists have developed a standardized nano-formulation from *Spinacea oleracea* commonly known as 'Palak' for treatment of osteoarthritis.

Product not only has the ability to form bone but it also possesses an intrinsic ability to bed more of cartilage cells at affected site. It has been observed that in the osteoarthritis model of rodents, *Spinacea oleracea* repaired and cured the degenerated cartilage.

In India ~39% people suffer from Osteoarthritis. Out of this 45% of women above 65 years' experience symptoms and 70% of them have x-ray evidence of Osteoarthritis. Postmenopausal women with osteoarthritis have a 20% increased risk of fracture.

Prevention of cartilage atrophy at knee joints



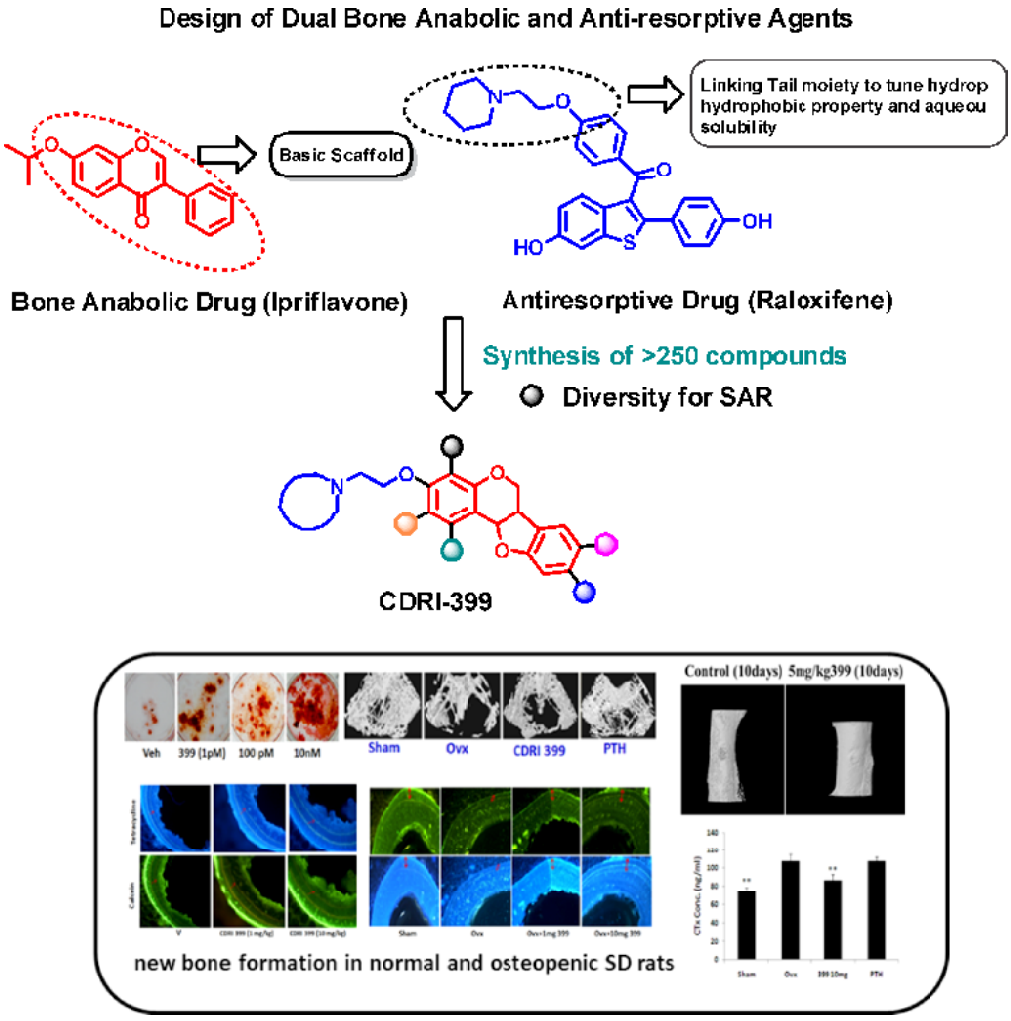
The Lab scale technology has been demonstrated and transfered to M/s. Pharmanza Herbal Pvt. Ltd., Gujarat during 8-12th Jan. 2018 at CSIR-CDRI, Lucknow. Product is expected to reach market very soon.

Breakthrough in 2017-18

CDRI S-008-399 as potent anti-osteoporotic agent

According to the global status report on road safety by World Health Organization, India has the worst traffic accident rates worldwide with over 130,000 deaths annually. Many of these accidents lead to fractures of delayed union or non-union type that can result in multiple surgeries and cause significant patient morbidity and loss of limb function. With increasing burden of trauma identifying therapeutics for enhancing fracture healing has remained paramount. CSIR-CDRI has discovered a novel compound CDRI S-008-399, which remarkably promoted osteoblast differentiation and new bone formation in osteopenic Sprague Dawley rats.

- Currently there is no FDA approved drug available for fracture healing and thus an oral fracture healing agent is very much needed. Design, synthesis and extensive biological studies with CDRI-S008-399 established its dual anabolic and anti-catabolic effects in ovariectomized osteopenic Sprague Dawley rats.
- CDRI-S008-399 enhanced new bone formation and decreased the level of CTX, a collagen breakdown product and bone resorption marker.
- The compound acted via the stimulation of ER/p38MAPK/p-Smad signalling pathway. Most importantly, CDRI-S008-399 promoted rapid fracture healing in mice femur osteotomy model (Mol. Cell. Endocrinol. 2017 Jun 15;448:41-54.)



The lead compound S-008-399 has been licensed to M/s Ortho Regenics Pvt. Ltd. Hyderabad, (ORPL), a start-up company that is focused on making osteo-inductive bone implant material.

Breakthrough in 2017-18

NGCMA certified GLP test facility for safety pharmacology and toxicology

CSIR-CDRI received GLP compliance certificate from NGCMA in November 2017 for conducting safety pharmacology and acute toxicity studies. It is the second laboratory of the CSIR family to receive this International accreditation. The GLP certification is the testimony of the high quality research work that is being carried out in the Institute.

CSIR-CDRI GLP facility leverages from *in vivo* rodent models to enable safety of suitable products in pharma, and biotech sectors. Experienced team with vast knowledge in the domain of regulatory toxicology and safety pharmacology and other areas at the GLP Test Facility is committed to realize its mission towards serving national as well as global needs in the area of toxicology and safety pharmacology. This facility has the distinction of being the only government laboratory with all knowledge of drug discovery and development.

Good Laboratory Practice ensures generation of high quality and reproducible data required for global acceptance. The principles have been created in the context of harmonizing testing procedures for the Mutual Acceptance of Data (MAD) among the OECD countries.

सत्यमेव जयते

GOVERNMENT OF INDIA

Department of Science and Technology

National Good Laboratory Practice (GLP) Compliance Monitoring Authority (NGCMA)

Certificate of GLP Compliance

Based on the Inspection and the subsequent follow-up actions

CSIR-Central Drug Research Institute

Sector 10, Jankipuram Extension

Lucknow – 226031 (Uttar Pradesh)

is certified capable of conducting the below-mentioned tests/studies in compliance with Organization for Economic Co-operation & Development (OECD) Principles of GLP:

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

The specific areas of expertise, types of chemicals and test systems are listed in annexure overleaf.

Validity: October 18, 2017 – October 17, 2020

This certificate is subject to the condition that the test facility complies 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.

Certificate No.: GLP/C-108/2017
Issue Date : 18-10-2017

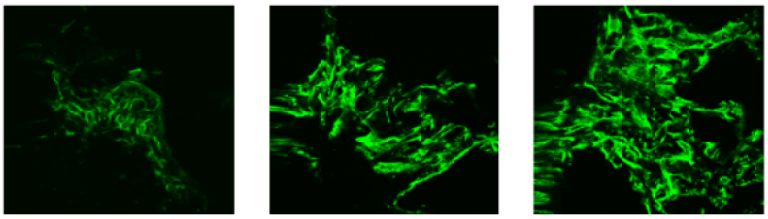
(Dr. Neeraj Sharma)
Head, NGCMA

Other Key Achievements

Standardized fraction 219 C002 for the treatment of glucocorticoid-induced osteoporosis

A team of scientists from CSIR-CDRI has developed a standardized fraction 219 C002 for the treatment of glucocorticoid-induced osteoporosis and muscular atrophy. Millions of people in India suffer from pulmonary, rheumatologic, gastrointestinal, dermatologic and autoimmune diseases and have to be treated with chronic glucocorticoid. Globally glucocorticoid is the third biggest cause of osteoporosis. Therefore, an osteogenic (bone forming) therapy such as standardized extract 219C002 will benefit a vast population across all ages in reducing the risk of fracture caused by the use of synthetic glucocorticoids. Moreover, long-term use of glucocorticoid is also detrimental to muscle and the standardized extract 219C002 protects against such insult.

Formulation to Enhance Bone Regeneration



Vehicle 219/C002 219/C002-F

M/s Pharmanza Herbal Pvt. Ltd., Gujarat has shown keen interest in this knowledgebase for further development and commercialization of this product to the Indian & US market after getting necessary clearances from the regulatory authorities. It is proposed to license the KNOW-HOW to M/s Pharmanza in the month of February 2018.

Novel donor-acceptor fluorene scaffolds

Team of scientists from CSIR-CDRI has discovered novel donor-acceptor fluorene compounds, which can be used as for the fabrication of electroluminescent devices. This discovery relates to amine donor and nitrile/ ester acceptor fluorenes, fluorenones their π-conjugated systems and related compounds, processes for preparing the said compounds including oxidation of fluorenes to corresponding fluorenones and their use in preparing organic electronic devices such as organic light emitting diodes (OLEDs), photovoltaic/solar cell, Field effect transistors and other useful electroluminescent devices.

The compounds are prepared by reacting 2H-pyran- 2-ones in isolated or rigid conformations with cyclic ketones containing methylene carbonyl moiety in the presence of a base in an organic solvent. This discovery is a new concept and approach to overcome the problem of 'Green emission defect' in 9- unsubstituted fluorene-based organic light emitting diodes which occurs due to the conversion of fluorenes to fluorenones that show emission mainly in green-yellow region. In the present invention, donor-acceptor substituent have been placed in such a way that donor- acceptor fluorenones show emission in the blue region (instead of green-yellow region) thus improving the blue colour purity and overcoming the problem of green emission defect.

Academia-Industry joint program to develop 5-HT2C agoPAM for the treatment of obesity

CSIR-CDRI has joined hands with Dr. Reddy's Lab and DRILS to jointly develop 5-HT2C ago PAM as a thereapeutic for obesity. This project has been approved and total funds of Rs. 145 lakhs has been released by DST. In this program two different chemical scaffold (one from CDRI **S016-0867** and one from DRILS) has been identified which exhibit high affinity agoPAM activity at 5-HT2c receptor. Further studies are going on to optimize this scaffold and determine the *in vivo* efficacy of the identified molecules.

Other Key Achievements

Novel oral combination formulation as platform technology for malaria

A team of scientists at CSIR-CDRI has developed process-cum-product technology packages for oral combination formulation containing sulfadoxine-pyrimethamine and α/β-arteether for the management of various medical indications associated with malaria in humans and animal such as *P. falciparum, P. vivax*, MDR *P. falciparum,* XDR *P. falciparum*, MDR- *P. vivax*, XDR *P. vivax*, for a period of two to five days schedule and process of preparation of this formulation.

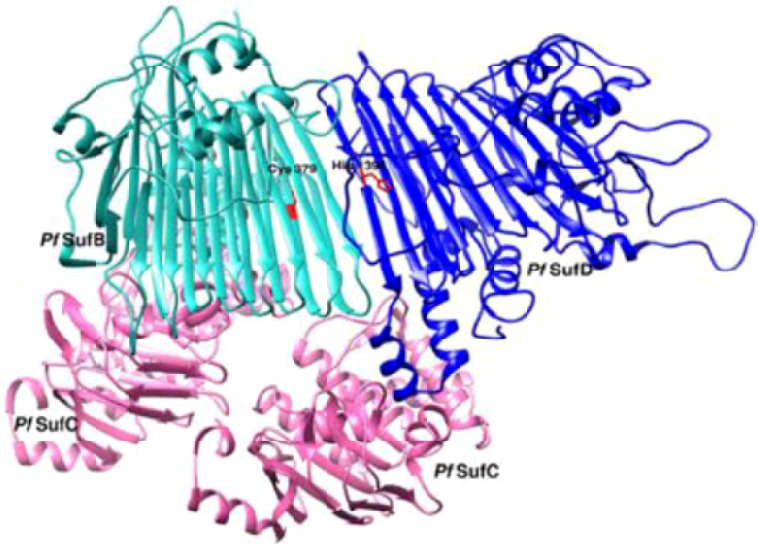
- *In vivo* studies on experimental animals showed that 100% curative effect with nearly one fourth of curative dose of α/β-arteether in combination with formulation.
- It clearly indicates the synergism between the proposed two drugs.
- This combination in SMEDDS can be given orally.
- This is likely to reduce the toxicity of individual drugs, if any, as their dose in combination is drastically reduced.

Further investigation on primate model is going on.

Design of novel antimicrobial and anti-endotoxin peptides for the development of new anti-infectives

A team of scientists at CSIR-CDRI have designed and developed a 15-residue novel peptide, S-016-1271, which is appreciably non-cytotoxic to human RBCs and murine 3T3 cells and possesses significant antimicrobial and anti-endotoxin activities. The peptide retains its antibacterial property in serum and physiological salts. The peptide is highly active against both Gram-positive and Gram-negative bacteria, fungi (*Candida albicans, Cryptococcus neoformans*, *Candida parapsilosis)* and methicillin, gentamicin and multidrug resistant strains of *S. aureus*. Treatment of this peptide (single dose of 7 mg/kg) to mice administered with *P. aeruginosa* (ATCC BAA-427) showed 60% survival indicating appreciable efficacy of this peptide in rescuing mice against this bacterial infection.

The [Fe-S] biogenesis SUF pathway as a validated target in malaria parasites



Post-translational assembly of [Fe-S] clusters is critical for function of many essential proteins. A team at CSIR-CDRI has provided the first experimental evidence for a functional SUF pathway for [Fe-S] biogenesis in the *Plasmodium falciparum* apicoplast (a relict plastid). Delineation of major steps and proteins of the pathway has been completed and conditional knockout of *sufS* has demonstrated that the SUF machinery is essential for parasite growth in the mosquito vector (Charan et al., *FEBS J*, 2017; PMID: 28695709). Essentiality of SufC in human blood stages of *P. falciparum* has been shown earlier. There are no known inhibitors of SUF proteins, necessitating a *de novo* approach to search for putative inhibitors for critical interactions such as those between desulfurase SufS and SufE, and scaffold components SufC and SufD. Molecular structure models for SUFs have been developed. It is being deployed in the drug discovery program at CSIR-CDRI.

Advances in Translational Research

Candidate Drugs / Leads under Advanced Stages of Development

Diseases / Disorders	Candidate Drugs	Status
Diabetes & Dyslipidemia	**CDR134D123** **Anti-hyperglycemic**	▪ Phase I Clinical trials completed ▪ Awaiting clearance from DG CCRAS New Expert committee for inclusion of the plant in the Extra Ayurvedic Pharmacopeia to avail marketing permission in herbal mode ▪ Licensed to TVC Skyshop Ltd, Mumbai
Malaria	**97-78** **Antimalarial**	▪ Phase-I Multiple dose Clinical Trial studies along with Human PK studies to be conducted at PGIMER, Chandigarh ▪ Synthesis of this compound in a cGMP facility is required. Discussion is in process with M/s. Gennova Bio Pharmaceuticals Ltd., Pune for the same ▪ Human Pharmacokinetic studies are to be carried out at CDRI on the samples collected at PGIMER ▪ Multiple dose studies are planned to be conducted at the Centre in Chandigarh'. Permission from DCGI received on 17 March 2017 ▪ Open for licensing
Osteoporosis	**99-373** **Anti-osteoporotic**	▪ Phase-I single and multiple doses Clinical Trial studies are planned to be conducted at KEM Hospital Mumbai. Permission from DCGI received on 14 March 2017 ▪ Human Pharmacokinetic studies are to be carried out at CDRI ▪ Open for licensing
	CDR2492/C003 **Anti-Osteoarthritic** **Food supplement**	▪ Licensed to Pharmanza Herbal Pvt. Ltd., Gujarat on 31st July, 2017, after establishing preclinical efficacy for osteoarthritis ▪ Neutraceutical launch expected by March 2018 ▪ AYUSH clinical trial to be started by June 2018 ▪ AYUSH mode launch 2 years from beginning of AYUSH mode trial
	CDRI219/C002-F **Osteoprotective**	▪ Licensing negotiation on with interested industries ▪ Open for licensing

Leads under Pre-clinical studies

Diseases / Disorders	Candidate Drugs/ Leads	Status
Malaria	**S-011-1793** **Antimalarial**	▪ Stability studies and regulatory toxicology studies are due to be carried out with this compound in its salt form ▪ Parallel studies are to be conducted in mice and rats ▪ Safety pharmacology studies have been completed and PK studies has to be confirmed ▪ The synthesis of this compound in a cGMP facility is being planned ▪ RBC uptake and metabolic stability of salt form studied ▪ 10 day DRF to be initiated in rats.
Osteoporosis	**CDR914K058** **Osteogenic**	▪ One synthetic lead (KM-B011) having rapid fracture healing effect being jointly developed with Kemxtree under DBT-BIRAC funding
	S-007-1500 **Rapid fracture healing**	▪ 28 days repeat dose rodent toxicity studies completed
Thrombosis	**S-007-867** **Antithrombotic**	▪ 28 days repeat dose Monkey toxicity studies completed ▪ Histopathology studies completed
	S-002-333 **Antithrombotic**	▪ 28 days repeat dose rodent toxicity studies completed ▪ This has been put in low-priority list
Diabetes & Dyslipidemia	**CDR267F018** **Antidyslipidemic**	▪ Experiments to confirm vasoprotective effect are in progress. Isolation of marker compounds for Pharmacokinetic & Metabolism studies is proposed
Malaria	**SMEDDS Formulation**	▪ Mutagenicity studies completed
Leishmaniasis	**96/261**	▪ Reverse mutagenicity studies completed ▪ Process of obtaining IAEC permission for single dose toxicity studies, initiated
Major depression	**S-015-2448**	▪ *In vivo* efficacy studies in stress induced depression model, completed ▪ hERG studies completed

Potential New Leads/Hits

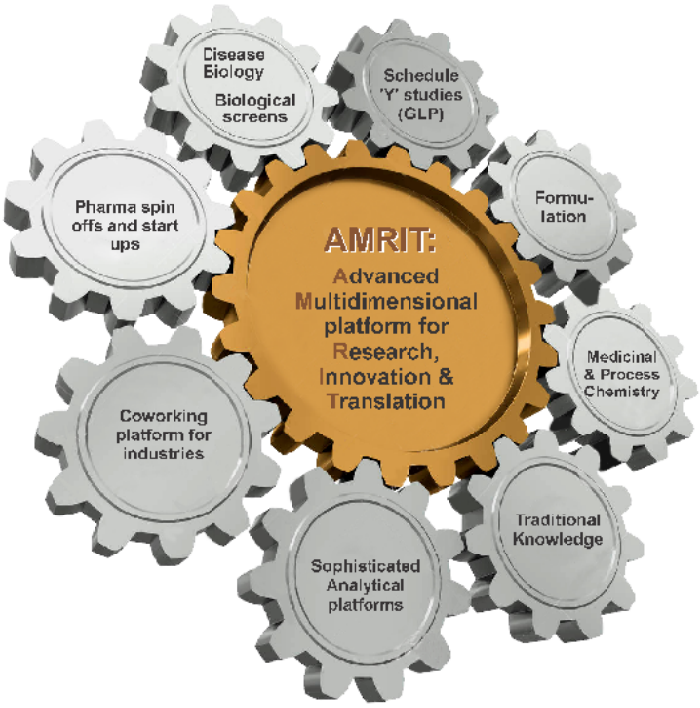
Diseases / Disorders	New Leads/Hits
Obesity	**S016-0867, Lead optimization going on**
Cancer	**SMAC Mimetics, *in vivo* studies completed**
	mTORC2 inhibitor

New Facilities Created

AMRIT: Advanced Multidimensional platform for Research, Innovation and Translation

CSIR-CDRI over six decades of its service to the nation has changed the pharma landscape in the country and has made the pharma industry not only self-reliant but also globally competitive. It is aptly positioned to take advantage of the new policy initiatives of the Government/ CSIR to advance all aspects of healthcare.

There has been an exponential growth seen globally in the healthcare sector. New enterprises exploiting innovations are now coming up in India in various sectors of healthcare. This has been further strengthened by the various policies of the government of India to promote entrepreneurship and ensure that innovation in this sector reaches the masses at affordable prices. AMRIT is centrally located in CSIR-CDRI, Lucknow, the capital of Uttar Pradesh. The city has many research institutes like CSIR-CDRI, IITR, NBRI, CIMAP, hospitals and medical research centres like KGMU, SGPGI, etc. This will provide extensive linkages for pharmaceutical start-ups and entrepreneurs. With proper incentives like the present incubator proposal, there is a good potential for development in these under-represented areas of our country.







AMRIT is set for dedication in the service of nation on February 17, 2018 - Annual Day of CSIR-CDRI

Some Important Publications - 2017

Chemical Sciences

Author	Title	Journal	IF
Kumar Amrendra, Ramanand and Tadigoppula Narender	Metal-free synthesis of polysubstituted pyrroles using surfactants in aqueous medium	**Green chemistry**, 19 (22), 5385-5389	9.125
Maurya Shivam, Yadav Dhiraj, Pratap Kemant and Kumar Atul	Efficient atom and step economic (EASE) synthesis of the smart drug Modafinil	**Green chemistry**, 19 (3), 629-633	9.125
Das Dipendu and Chakraborty TK	Radical Approach to the Chiral Quaternary Center in Asperaculin A: Synthesis of 9-Deoxyasperaculin A	**Organic Letters**, 19 (3), 682-685	6.579
Gupta Ekta, Kant Ruchir and Mohanan, Kishor	Decarbethoxylative Arylation Employing Arynes: A Metal-Free Pathway to Arylfluoroamides	**Organic Letters**, 19 (21), 6016-6019	6.579
Srinivas K, Singh N, Das D and Koley D	Organocatalytic, Asymmetric Synthesis of Aza-Quaternary Center of Izidine Alkaloids: Synthesis of (-)-Tricyclic Skeleton of Cylindricine	**Organic Letters**, 19 (1), 274-277	6.579
Bhatia Anil, Meena Baleshwar, Shukla S K, Sidhu O P, Upreti D K, Mishra, Anuradha Roy, Raja Nautiyal and Chandra Shekhar	Determination of Pentacyclic Triterpenes from Betula utilis by High-Performance Liquid Chromatography and High-Resolution Magic Angle Spinning Nuclear Magnetic Resonance Spectroscopy	**Analytical Letters**, 50 (1), 233-242	6.32
Dwivedi V, Rajesh M, Kumar R, Kant R and Reddy MS	A stereoselective thiocyanate conjugate addition to electron deficient alkynes and concomitant cyclization to N,S-heterocycles	**Chemical Communications**, 53, 11060	6.319
Hari Babu M, Ranjith Kumar G, Kant R and Reddy MS	Ni-Catalyzed regio- and stereoselective addition of arylboronic acids to terminal alkynes with a directing group tether	**Chemical Communications**, 53 (27), 3894-3897	6.319
Harioudh MK, Sahai Rohit, Mitra, Kalyan and Ghosh, JK	A short non-cytotoxic antimicrobial peptide designed from A beta(29-40) adopts a nanostructure and shows in vivo anti-endotoxin activity	**Chemical Communications**, 53 (97), 13079-13082	6.319
Anand Devireddy, Yadav PK, Patel OPS, Parmar Naveen, Maurya RK, Vishwakarma, Preeti, Raju KSR,Taneja Isha, Wahajuddin M, Kar Susanta and Yadav Prem P	Antileishmanial Activity of Pyrazolopyridine Derivatives and Their Potential as an Adjunct Therapy with Miltefosine	**Journal of Medicinal Chemistry**, 60 (3), 1041-1059	6.259
Bhunia SS, Misra A, Khan IA, Gaur S, Jain M, Singh S, Saxena A, Hohlfield T, Dikshit M, Saxena AK	Novel Glycoprotein VI Antagonists as Antithrombotics: Synthesis, Biological Evaluation, and Molecular Modeling Studies on 2,3-Disubstituted Tetrahydropyrido (3,4-b) indoles	**Journal of Medicinal Chemistry**, 60 (1), 322- 337	6.259
Ravilla L, Venkata Subba Naidu N, Dogra S, Umrao D, Yadav PN, Biswas A, Michael D, Sekar K and Nagarajan K	Opioid Receptor Modulators with a Cinnamyl Group	**Journal of Medicinal Chemistry**, 60 (15), 6733-6750	6.259
Thompson AM, O'Connor PD, Marshall AJ, Yardley V, Maes L, Gupta S, Launay D, Braillard S, Chatelain E, Franzblau SG, Wan B, Wang Y, Ma Z, Cooper CB and Denny WA	7-Substituted 2-Nitro-5,6-dihydroimidazo [2,1-b] [1,3] oxazines: Novel Antitubercular Agents Lead to a New Preclinical Candidate for Visceral Leishmaniasis	**Journal of Medicinal Chemistry**, 60 (10), 4212-4233	6.259

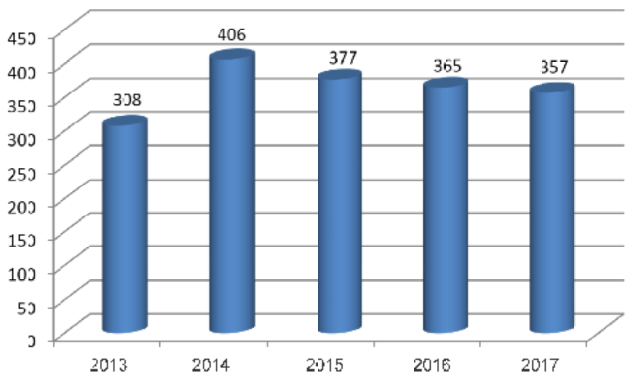
Some Important Publications - 2017

Biological Sciences

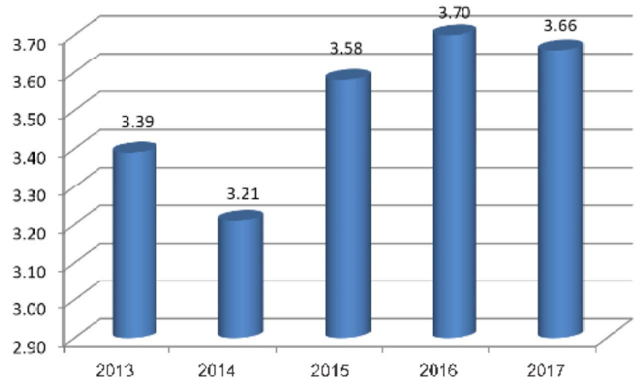
Author	Title	Journal	IF
Ghosh E, Srivastava A, Baidya M, Kumari P, Dwivedi H, Nidhi K, Ranjan R, Dogra S, Koide A, Yadav PN, Sidhu SS, Koide S and Shukla AK	A synthetic intrabody-based selective and generic inhibitor of GPCR endocytosis	**Nature Nanotechnology**, 12, 1190-1198	38.986
Muthusamy Nagendran, Zhang Xuying, Johnson CA, Yadav PN and Ghashghaei HT	Developmentally defined forebrain circuits regulate appetitive and aversive olfactory learning	**Nature Neuroscience**, 20 (1), 20-23	17.839
Troger J, Theurl M, Kirchmair R, Pasqua T, Tota B, Angelone T, Cerra MC, Nowosielski Y, Matzler R, Troger J, Gayen JR, Trudeau V, Corti A and Helle KB	Granin-derived Peptides	**Progress in Neurobiology**, 154, 37-61	13.217
Singh Manohar, Trivedi Rachana and Mishra DP	The eukaryotic translation initiation factor 4H regulates proliferation, migration, and invasion in cancer cells	**Clinical Cancer Research**, 23 (24), 66-67	9.619
Rajawat J, Shukla N and Mishra DP	Therapeutic Targeting of Poly(ADP-Ribose) Polymerase-1 in Cancer: Current Developments, Therapeutic Strategies, and Future Opportunities.	**Medicinal Research Reviews**, 37 (6), 1461-1491	8.763
Singh Y, Meher JG, Raval K, Khan FA, Chaurasia M, Jain NK and Chourasia MK	Nanoemulsion: Concepts, development and applications in drug delivery	**Journal of Controlled Release**, 252, 28-49	7.786
Singh Y, Pawar VK, Meher JG, Raval K, Kumar A, Shrivastava R, Bhadauria S and Chourasia MK	Targeting tumor associated macrophages (TAMs) via nanocarriers	**Journal of Controlled Release**, 254, 92-106	7.786
Lone MUD, Baghel KS, Kanchan RK, Shrivastava R, Malik SA, Tewari BN, Tripathi C, Negi MPS, Garg VK, Sharma M, Bhatt MLB and Bhadauria S	Physical interaction of estrogen receptor with MnSOD: implication in mitochondrial O-2 (center dot-) upregulation and mTORC2 potentiation in estrogen-responsive breast cancer cells	**Oncogene**, 36 (13), 1829-1839	7.519
Phukan UJ, Jeena GS, Tripathi V and Shukla RK	MaRAP2-4, a waterlogging-responsive ERF from Mentha, regulates bidirectional sugar transporter AtSWEET10 to modulate stress response in Arabidopsis	**Plant Biotechnology Journal**, 16 (1), doi: 10.1111/pbi.12762. [Epub ahead of print]	7.443
Dyawanapelly Sathish, Kumar Animesh and Chourasia MK	Lessons Learned from Gemcitabine: Impact of Therapeutic Carrier Systems and Gemcitabine's Drug Conjugates on Cancer Therapy	**Critical Reviews™ in Therapeutic Drug Carrier Systems**, 34 (1), 63-96	6.667
Hopp CS, Bennett BL, Mishra S, Lehmann C, Hanson KK, Lin JW, Rousseau K, Carvalho FA, van der Linden WA, Santos NC, Bogyo M, Khan SM, Heussler V and Sinnis P	Deletion of the rodent malaria ortholog for falcipain-1 highlights differences between hepatic and blood stage merozoites	**PLOS Pathogens**, 13 (9), e1006586	6.608
Tripathi AK, Kumari T, Tandon A, Sayeed M, Afshan T, Kathuria M, Shukla PK, Mitra K and Ghosh JK	Selective phenylalanine to proline substitution for improved antimicrobial and anticancer activities of peptides designed on phenylalanine heptad repeat	**Acta Biomaterialia**, 57, 170-186	6.319

Publications

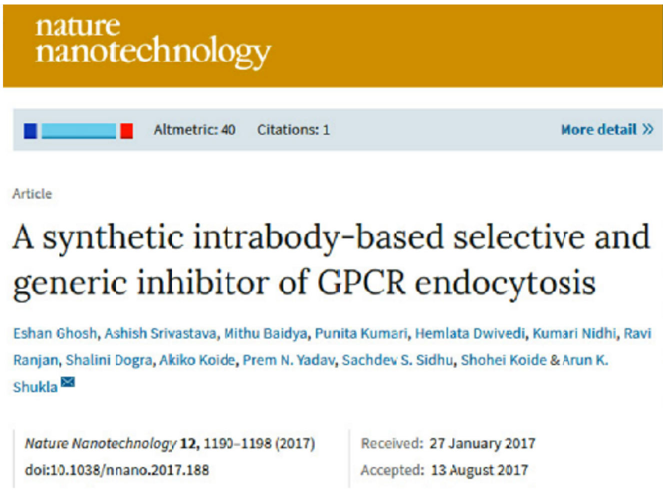
Total Number of SCI Publications



Average Impact Factor



Provisional data as on 31/01/2017



nature nanotechnology

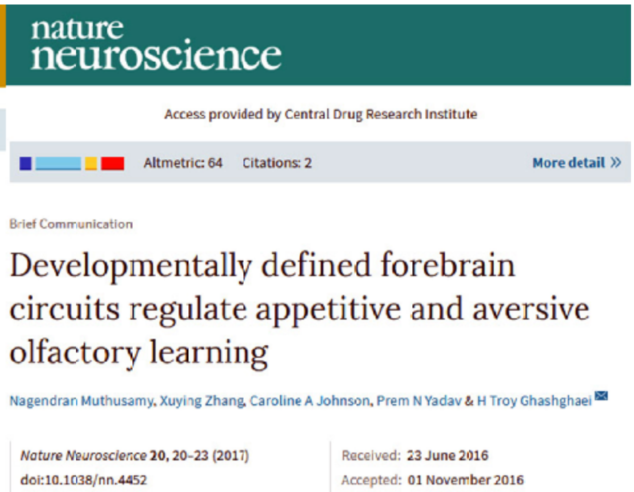
Altmetric: 40 Citations: 1 More detail »

Article

A synthetic intrabody-based selective and generic inhibitor of GPCR endocytosis

Eshan Ghosh, Ashish Srivastava, Mithu Baidya, Punita Kumari, Hemlata Dwivedi, Kumari Nidhi, Ravi Ranjan, Shalini Dogra, Akiko Koide, Prem N. Yadav, Sachdev S. Sidhu, Shohei Koide & Arun K. Shukla

Nature Nanotechnology 12, 1190–1198 (2017) doi:10.1038/nnano.2017.188 Received: 27 January 2017 Accepted: 13 August 2017



nature neuroscience

Access provided by Central Drug Research Institute

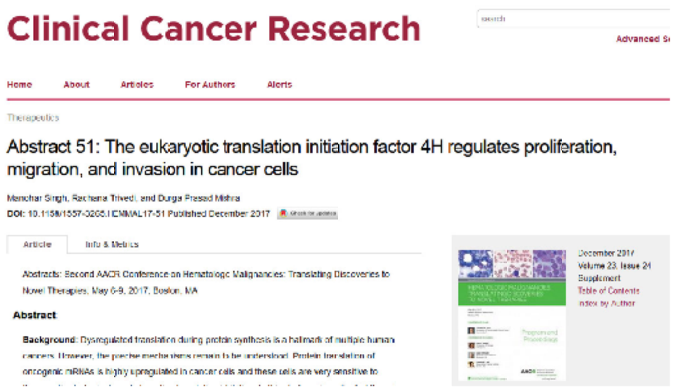
Altmetric: 64 Citations: 2 More detail »

Brief Communication

Developmentally defined forebrain circuits regulate appetitive and aversive olfactory learning

Nagendran Muthusamy, Xuying Zhang, Caroline A Johnson, Prem N Yadav & H Troy Ghashghaei

Nature Neuroscience 20, 20–23 (2017) doi:10.1038/nn.4452 Received: 23 June 2016 Accepted: 01 November 2016



Clinical Cancer Research

Home About Articles For Authors Alerts

Therapeutics

Abstract 51: The eukaryotic translation initiation factor 4H regulates proliferation, migration, and invasion in cancer cells

Manohar Singh, Rachana Trivedi, and Durga Prasad Mishra

DOI: 10.1158/1557-3265.HEMMAL17-51 Published December 2017

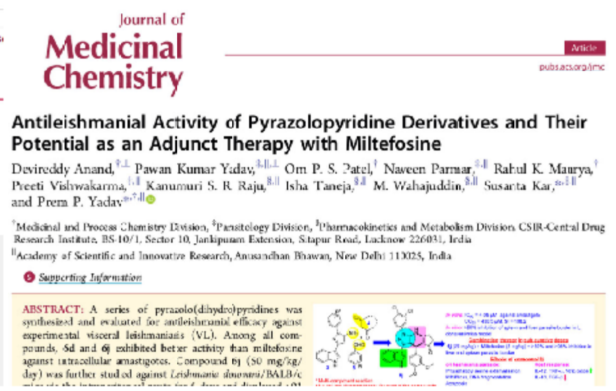
Article Info & Metrics

Abstracts: Second AACR Conference on Hematologic Malignancies: Translating Discoveries to Novel Therapies; May 6-9, 2017; Boston, MA

Abstract

Background: Dysregulated translation during protein synthesis is a hallmark of multiple human cancers. However, the precise mechanisms remain to be understood. Protein translation of oncogenic mRNAs is highly upregulated in cancer cells and these cells are very sensitive to

December 2017 Volume 23, Issue 24 Supplement Table of Contents Index by Author



Journal of Medicinal Chemistry

Article

pubs.acs.org/jmc

Antileishmanial Activity of Pyrazolopyridine Derivatives and Their Potential as an Adjunct Therapy with Miltefosine

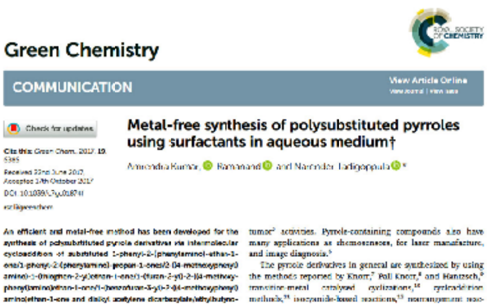
Devireddy Anand, Pawan Kumar Yadav, Om P. S. Patel, Naveen Parmar, Rahul K. Maurya, Preeti Vishwakarma, Kanumuri S. R. Raju, Isha Taneja, M. Wahajuddin, Susanta Kar, and Prem P. Yadav

Medicinal and Process Chemistry Division, Parasitology Division, Pharmacokinetics and Metabolism Division, CSIR-Central Drug Research Institute, BS-10/1, Sector 10, Jankipuram Extension, Sitapur Road, Lucknow 226031, India

Academy of Scientific and Innovative Research, Anusandhan Bhawan, New Delhi 110025, India

Supporting Information

ABSTRACT: A series of pyrazolo(dihydro)pyridines was synthesized and evaluated for antileishmanial efficacy against experimental visceral leishmaniasis (VL). Among all compounds, 6d and 6j exhibited better activity than miltefosine against intracellular amastigotes. Compound 6j (50 mg/kg/day) was further studied against Leishmania donovani/BALB/c



Green Chemistry

COMMUNICATION

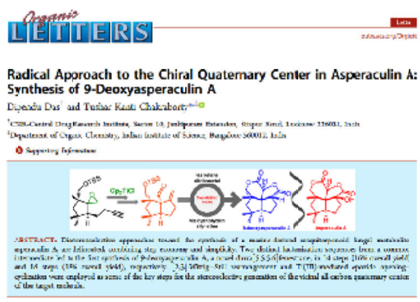
View Article Online

Check for updates

Metal-free synthesis of polysubstituted pyrroles using surfactants in aqueous medium†

Amrendra Kumar, Ramanand and Narender Tadigoppula

An efficient and metal-free method has been developed for the synthesis of polysubstituted pyrrole derivatives via intermolecular cycloaddition of substituted 1-phenyl-2-(phenylamino)-ethan-1-one/1-phenyl-2-(phenylamino)-propan-1-one/2-(4-methoxyphenyl)amino)-1-(thiophen-2-yl)ethan-1-one/1-(furan-2-yl)-2-((4-methoxyphenyl)amino)ethan-1-one/1-(benzofuran-2-yl)-2-((4-methoxyphenyl)amino)ethan-1-one and dialkyl acetylene dicarboxylate/ethylbutynoate



Organic Letters

Radical Approach to the Chiral Quaternary Center in Asperaculin A: Synthesis of 9-Deoxyasperaculin A

Dipendu Das and Tushar Kanti Chakraborty

CSIR-Central Drug Research Institute, Sector 10, Jankipuram Extension, Sitapur Road, Lucknow 226031, India

Department of Organic Chemistry, Indian Institute of Science, Bangalore 560012, India

Supporting Information

Issue 22, 2017

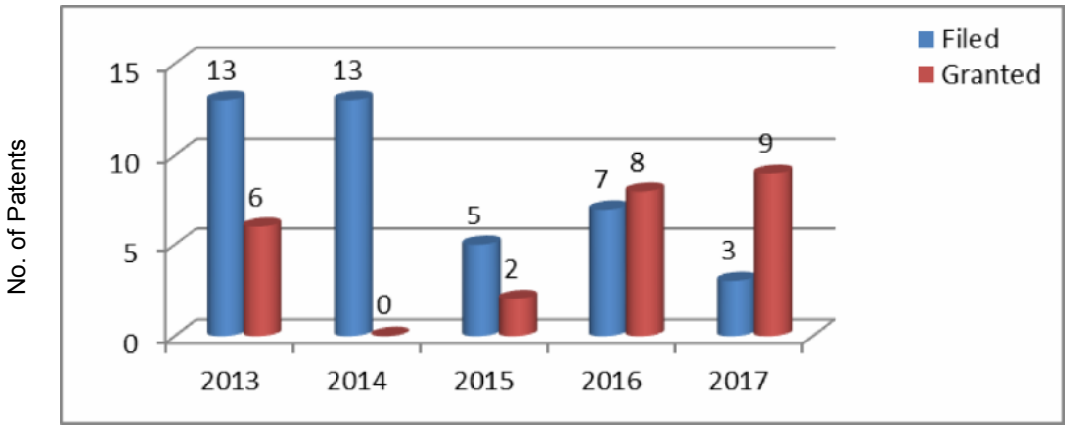
From the journal: Green Chemistry

Metal-free synthesis of polysubstituted pyrroles using surfactants in aqueous medium

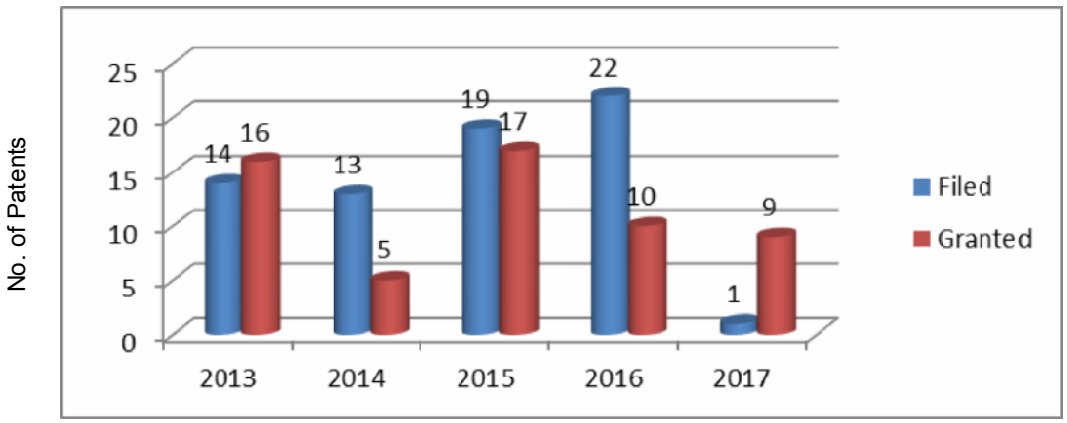
Amrendra Kumar, Ramanand and Narender Tadigoppula

Intellectual Property

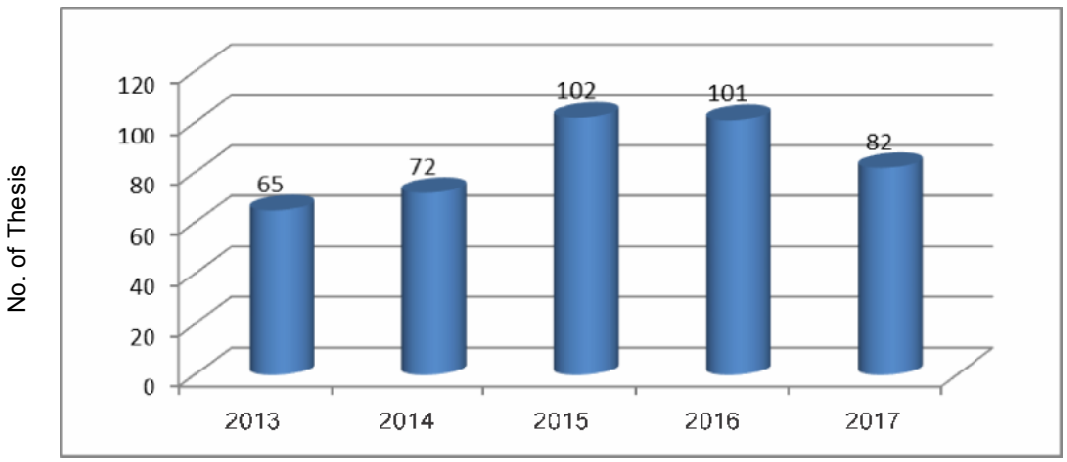
Indian Patents



Foreign Patents



Ph.D. Thesis Submitted



*Provisional data as on 31.01.2018

Industry / Academia Partnership

Number of Agreements Executed

National	**43**
International	**19**
University/Institution	**34**
Pharmaceutical Industry	**20**
Funding Agency	**8**

Nature of Agreements Executed

Agreement	Nos
Agreement	01
Amendment Agreement	01
Memorandum of Understanding	17
Letter of Agreement	01
License Agreement	02
Secrecy Agreement	14
Material Transfer Agreement	10
Memorandum of Agreement	08
Collaboration Agreement	01
Sponsored Agreement	04
Technical Service	01
Renewal Agreement	02

Some of our Academia Partners

Some of our Industry Partners

Agreements with Industry / Academia

Licensing agreeemnt for new Drug to cure osteoarthritis with Pharmanza Herbal Pvt. Ltd., Gujarat

Technology transfer team with representatives of Pharmanza Herbal Pvt. Ltd., Gujarat

Agreement signed with Dr. Reddy's Lab, DRILS, Hyderabad and DST, New Delhi with CSIR-CDRI

Secrecy Agreement signed with Tata Chemical Ltd., Pune

MoU signed with NIPER, Mohali

MoU signed with Dr. RML Avadh University, Faizabad

CSIR-CDRI and ICMR-NITM Singed MoU for translating indian traditional knowledge into affordable healthcare

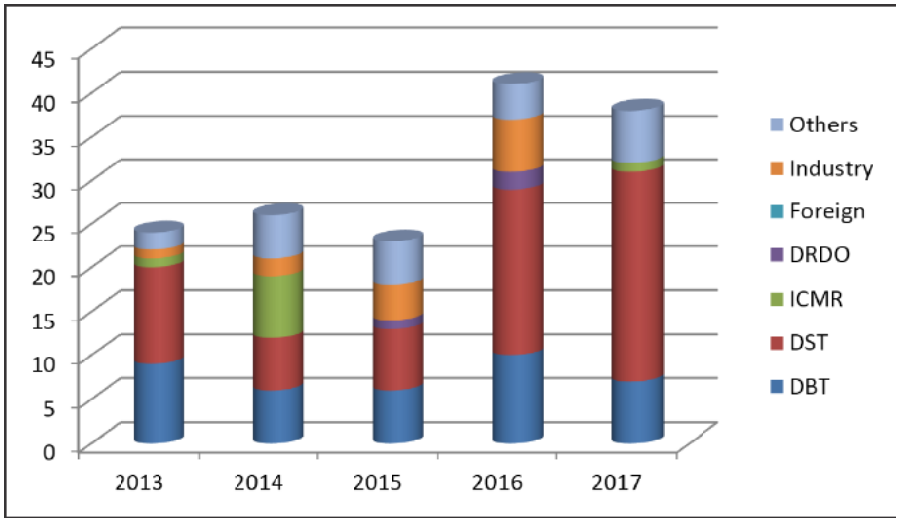
Budget

₹ In Lakh

	Heads	2013-14	2014-15	2015-16	2016-17	2017-18* (Allocated)
(A)	**Recurring**					
	Pay and Allowances	4631.798	4834.234	4916.152	4920.500	5770.700
	Contingencies	910.384	1011.075	1386.000	1018.000	1459020
	HRD	-	-	-	0.800	-
	Maintenance	416.574	560.000	732.000	718.000	988.800
	Chemical and Consumables	260.000	860.000	1189.152	1323.000	1194.000
	Sub-Total	**6218.756**	**7265.309**	**8223.304**	**7980.300**	**9412.520**
(B)	**Capital**					
	Works and Services/ Electrical Installation	96.326	7.189	56.547	200.000	170.000
	Apparatus and Equipments/ Computer Equipments	286.834	650.000	1183.946	1203.000	1338.000
	Office Equipments, Furniture and Fittings	4.019	-	3.825	-	-
	Library Books and Journals	75.469	250.000	250.488	75.000	270.224
	Sub-Total	**462.648**	**907.189**	**1494.806**	**1478.000**	**1778.224**
	Total (A+B)	**6681.404**	**8172.498**	**9718.11**	**9458.300**	**11190.744**
(C)	**Special Projects SIP / NWP / IAP / HCP/ BSC/CSC**	**3543.532**	**2199.945**	**3662.966**	**2060.318**	**280.100**
(D)	**CMM0015 (New CDRI)**	**-**	**4000.000**	**1097.000**	**-**	**-**
(E)	**CSIR-800 (Societal Activities) P-14**	**-**	**-**	**-**	**100.00**	**-**
	Grand Total (A+B+C+D)	**10224.936**	**14372.443**	**14478.076**	**11618.618**	**11470.844**

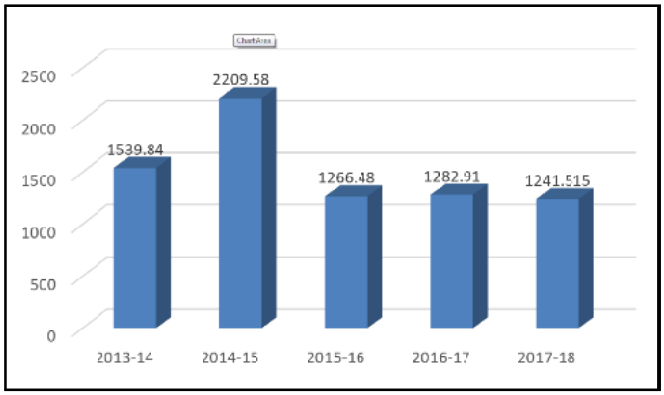
**Provisional data as on 31.01.2018, included expenditure against LRF*

New Inter-Agency Projects Initiated

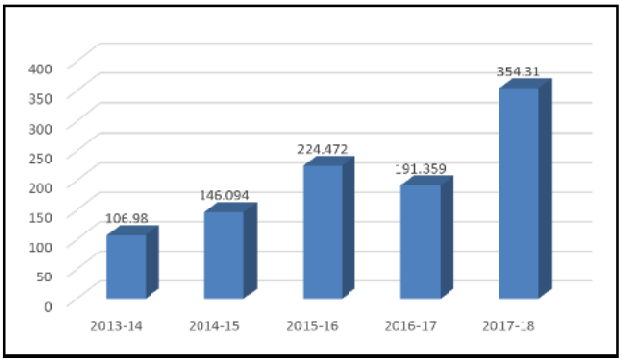


External Budgetary Resources

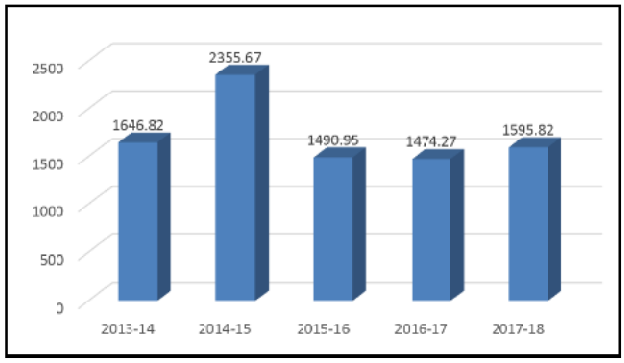
External Cash Flow



Lab Reserve Fund Generated



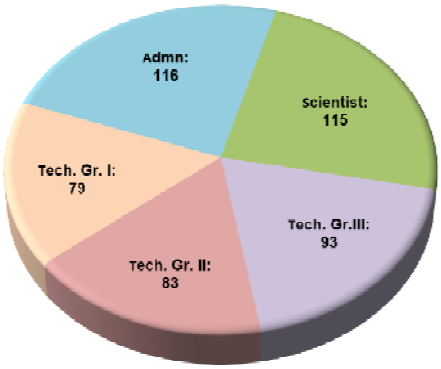
Total External Budgetary Resources



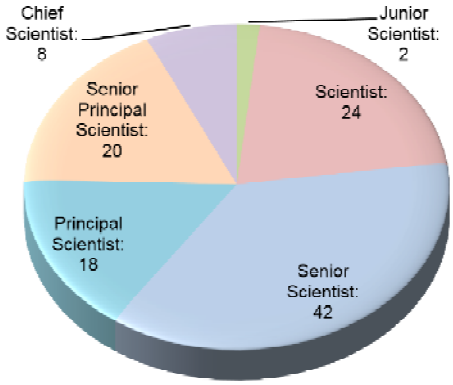
Provisional data as on 31.01.2018

Manpower

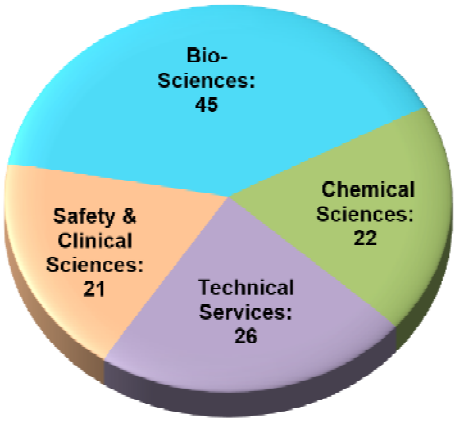
Total Staff (486)



Desgination-wise strength of Scientists



Area-wise strength of Scientists



CSIR-CDRI Family

Societal Activities

Activity	Numbers of Programs	Beneficiaries (Persons)
Health awareness programs	**01**	**>1000**
Showcasing of Institute's achievements in various Festival & Exhibitions	**10**	**>5000**
Programs for Motivation of Students and faculties at CSIR-CDRI	**21**	**>2500**
Popular Lecture by CDRI Scientist at Schools/ Colleges	**03**	**>1200**
Open-Day for public to connect common man with Institute	**02**	**>2600**
CSIR-800 exploratory societal projects initiated at rural areas under AcSIR program	**10**	**>2000**
Advance Training and skill development programs	**10**	**>250**
Technical Support in biological activity screening to Universities and colleges from different areas of country	**105 Samples**	**24 Beneficiaries**












Visit of Honourable Prime Minister of India

Glimpses of Hon'ble Prime Minister of India Shri Narendra Modiji's visit to the Institute (20 June 2017)

Visit of Honourable Chief Minister of UP

Glimpses of visit of Hon'ble Chief Minister of UP Yogi Adityanathji (9 June, 2017)

Visit of Ambassador of India to Ethiopia

Glimpses of CSIR-CDRI visit of H.E. Mr. Anurag Srivastava, Indian Ambassador to Ethiopia (24 July 2017)

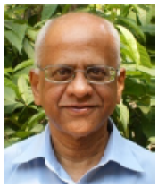
Research Council

Chairman

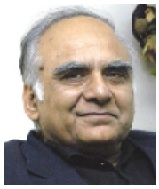
Dr Rajiv I. Modi
Chairman & Managing Director, Cadila Pharmaceuticals Ltd.,
Cadila Corporate Campus
Sarkhej - Dhokla Road, Bhat, Ahmedabad - 382 210

Members

Dr G. N. Qazi
Director General
Hamdard Institute of Medical Science & Research, Mehrauli-Badarpur Road,
Near Batra Hospital, Hamdard Nagar
New Delhi-110062



Professor Gautam R. Desiraju
Professor
Solid State and Structural Chemistry Unit,
Indian Institute of Science,
Bangalore 560 012, India



Professor N. K. Ganguly
Former DG, ICMR & Visiting Professor of Eminence, Translational Health Science & Technology Institute, Faridabad

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Drug Controller General of India
Directorate General of Health Services
Central Drugs Standard Control Organization, FDA Bhavan, Kotla Road
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Dr Altaf Lal
Senior Advisor,
Global Health & Innovation,
Sun Pharmaceutical Industries Limited
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DG, CSIR Nominee
Professor Ashwini Kumar Nangia
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Director, Sister Laboratary
Dr Anil Koul
Director
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Professor Alok Dhawan
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Secretary
Dr Aamir Nazir
Senior Scientist
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Chairman

Professor Alok Dhawan
Director
CSIR-Central Drug Research Institute
Lucknow

External Member

Dr Ram A. Vishwakarma
Director
CSIR-Indian Institute of Integrative Medicine, Jammu

Members

Mr. C.P. Arunan
Controller of Administration
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Toxicology & Experimental Medicine Division

Dr Baisakhi Moharana
Scientist,
Pharmacology Division

Dr Rajdeep Guha
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Scientist,
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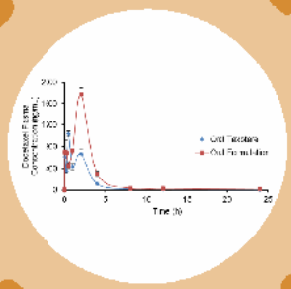
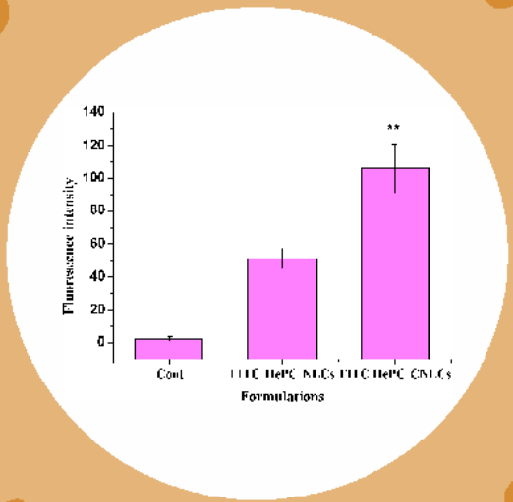
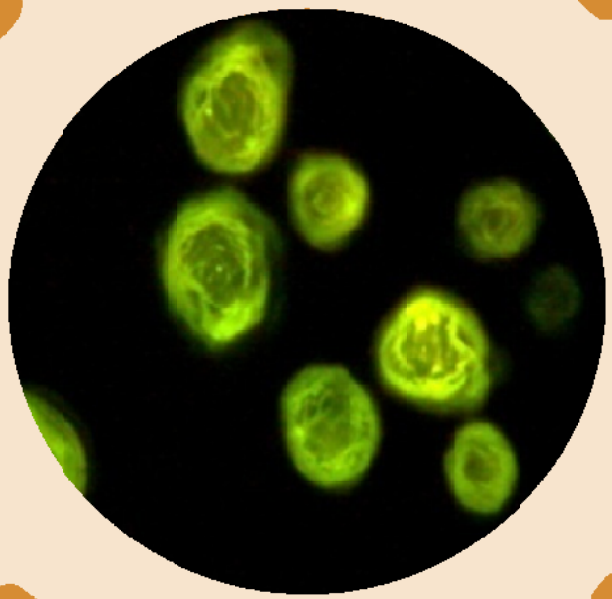
Dr Bidyut Purkait
Scientist
Parasitology Division

Dr Damodara Reddy N
Scientist,
Medicinal Process Chemistry Division

Translational Research







Chairman

Professor Alok Dhawan

Research Team

First Row : S K Rath, R K Tripathi, S Sharma, S Shukla, M K Barthwal, K Hanif, Sarika
Second Row : P P Yadav, A Nazir, K Jagavelu, A K Gaikwad, M N Mugale

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Translational Research

Chairperson: Director, CSIR-CDRI

Members: Dr Naibedya Chattopadhyay, Dr W Haq, Dr Jawahar Lal, Dr Sharad Sharma, Dr SK Rath, Dr Amit Misra, Dr MK Barthwal

1. Pharmaceutics
2. Pharmacokinetics
3. Regulatory Toxicology & Safety Pharmacology
4. GLP Facility

1. Pharmaceutics

1.1. Generation and Compilation of Data Required for Regulatory Approval

Before a compound is designated as a "drug", it must be tested for safety and efficacy in humans. Permission for such testing is granted by the Drugs Controller General of India, after perusal of results of physicochemical properties and results of tests conducted in animals. Regulatory data on specifications of physico-chemical properties (Chemistry, Manufacturing and Controls, CMC) of three CSIR-CDRI candidate drugs: S006-867, S-007-1500 and NMITLI-118RT+ were compiled. Investigative New Drug Applications to the Drugs Controller General of India for clinical testing of these candidate drugs are ready for submission, pending identification of an Industry partner.

1.2. Development, Validation and Deployment of Methods of Pharmaceutical Analysis

Analytical methods for eight CSIR-CDRI candidates that were selected for secondary screening were developed and validated according to regulatory guidelines. These compounds are: S-006-1712, S-007-1500, S-008-399, BBK-NTb2, S-011-1559, S-016-1436, S-016-867, S-017-0674. This year, pharmaceutical analysis of 44 different kinds of samples of synthetic compounds, plant products and industrial production batches were analysed, down from 110 analysed in the previous year. In addition, >2200 samples were analysed for drug content, drug release, stability and impurity profiling in formulation development activities. The average time from receipt of sample to filing an analytical report this year was 12.8 days (range: 0 to 52 days), up from 10.3 days in the previous year.

Drug Delivery

1.3. Mission Mode Project: Inhalable particles containing anti-tuberculosis agents

This project was taken up in Mission Mode during 2016 and included in the India TB Consortium in 2017. Additional preclinical experiments were suggested by the Consortium, funds for which were sanctioned by the Indian Council of Medical Research in December 2017. These experiments will be conducted in the Animal Biosafety Level 3 lab in the National JALMA Institute of Leprosy and Other Mycobacterial Diseases, Agra. The India TB Consortium expert panel will oversee the development of a Clinical Testing Plan for this product.

1.4. Inhalable particles containing drugs used in multi-drug resistant (MDR) tuberculosis

Experiments on systemic administration of efficacious doses of second-line anti TB drugs were initiated. Because TB, including MDR TB is never treated using a single drug, three different combinations of agents were prepared. The processes for all these were optimized with the objective of engineering "Quality by Design" (QbD). An Indo-Norway bilateral cooperation project with an outlay of ₹ 7880428 for utilisation at CSIR-CDRI was sanctioned. This project is in collaboration with Prof. Gareth Griffiths at the University of Oslo, and will be pursued by an international team including stalwarts such as Prof. David Russell from Cornell University, Prof. Andrew Thompson from The University of Auckland, and young scientists from Mainz, Germany; Ghent, Belgium and Groningen, The Netherlands over the next three years.

1.5. Inhalable particles for host-directed therapies of tuberculosis—induction of autophagy

Dr Rany Condos at New York University has successfully treated pulmonary tuberculosis by administering inhalations of recombinant gamma interferon (IFNγ). The mechanism of action of this protein isby stimulating immune cells to mount bactericidal responses, including autophagy. Because IFNγ is prohibitively expensive, she has expressed interest in our proposal to attempt transient transfection of the lung and airway epithelim with IFNγ gene delivery. We have therefore undertaken preparation of plasmid DNA delivery systems using non-viral, polymeric vectors. *In vitro*

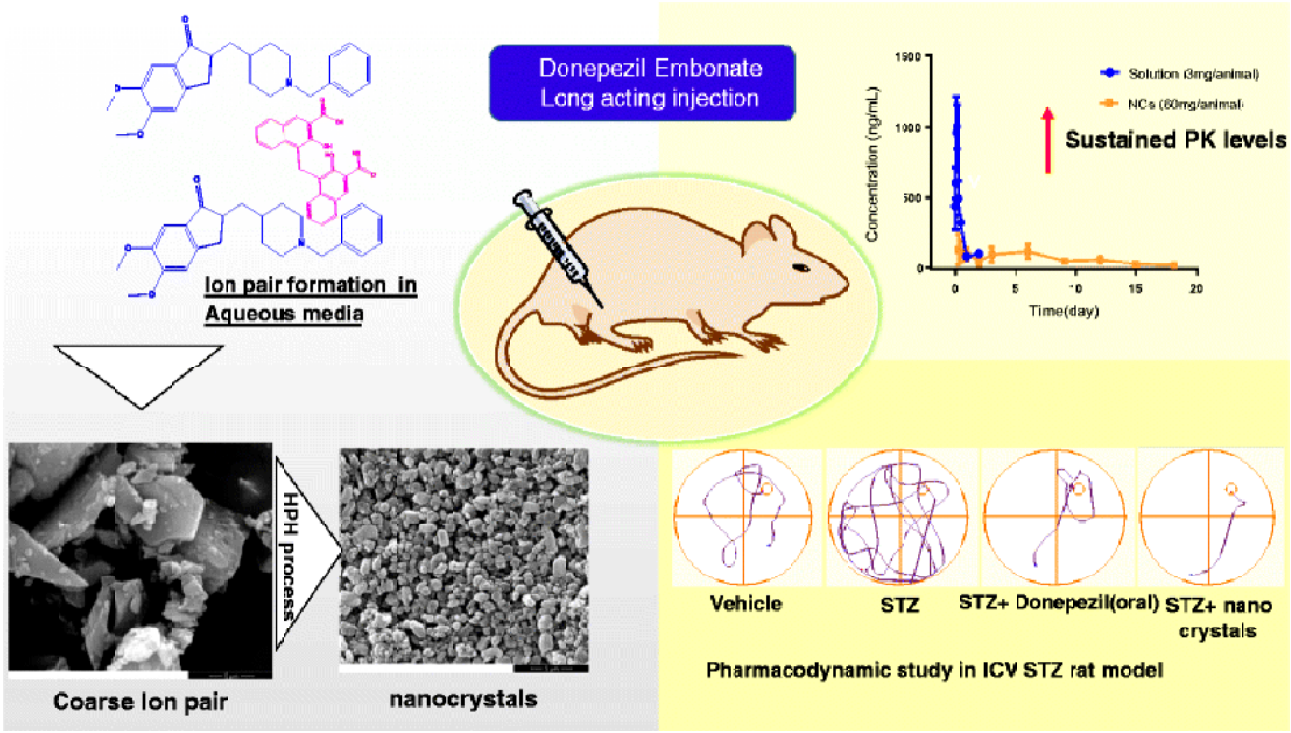
transfection of the lung cell line with a reporter gene has been studied and permission for animal experimentation has been sought.

1.6. Ion-Paired Embonate-Donepezil Nanocrystals for Alzheimer's Disease

To to prepare a long acting formulation of donepezil with a high payload, the small polar anion of the drug was replaced with embonic acid, a relatively hydrophobic counter ion. A 2:1 complex of donepezil:embonic acid led to the highest drug content: ~66%. The hydrophobic complex was 11000-fold less soluble in water as compared to the marketed hydrochloride salt of donepezil. Differential scanning calorimetry and powder X-ray analysis confirmed the crystalline nature of the ion pair. The complex was characterized using Fourier transformation infrared spectroscopy (FT-IR), and proton-NMR. The coarse powder was nanosized bymicro-fluidization. The particle size and size distribution, surface morphology, *in vitro* cytotoxicity, in vitro dissolution and *in vivo* toxicity of the nanocrystals were studied. The nanocrystals continuous and controlled release of the drug *in-vitro*. The nanocrystals were less cytotoxic than donepezil *in vitro* against 3T3 cell line. Following intramuscular administration of a single dose of nanocrystals, donepezil plasma level were detectable up to 18 days. The nanocrystals did not induce tissue damage to vital organs on intramuscular administration, as revealed by histological examination. *In vivo* pharmacodynamic studies revealed that a single dose improved spatial memory, learning and retention in streptozotocin induced memory impairment model. Therefore, the results suggest that long acting injectable nanocrystals could be an interesting and better therapeutic approach for the treatment of Alzheimer's and related dementia.

1.7. Enhanced killing of Leishmania parasites using a drug to stabilize a chitosan-lipid nanostructured carrier

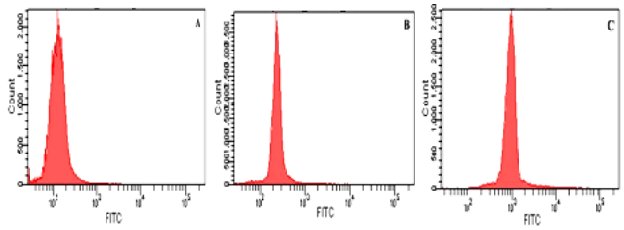
Lipid nanoparticles are stable, biodegradable and biocompatible carriers offering excellent therapeutic efficacy. In the area of leishmaniasis, we used the drug Miltefosine to stabilis echitosan-anchored hexadecylphosphocholine nanostructures containing a second leishmanicidal drug, Amphotericin B (AmB).Such nanostructured lipid carrier (NLC) preparations can thus deliver two drugs simultaneously to macrophages where the parasite resides. The NLCs entrapAmB with an efficiency of 85.3%.The mean particle sizes are ~150 nm, and the particles are positively charged (zeta potential is +28.2 ± 1.1 mV). The NLCs retain AmB well, releasing less than 65% even after the 24 h when studied *in vitro*. Intravenous administration of NLCs to rodents resulted in significantly increased localization of AmB in macrophage-rich organs like the liver and spleen. Flow cytometry confirmed enhanced uptake of NLCs by J774A.1 macrophages. Compared to Tween-80, a common surface-active stabilizer used in formulations, Miltefosine not only stabilized NLC, but also significantly enhanced *in vitro* and *in vivo* anti-leishmanial activity. NLCs incorporating these drugs displayed very little propensity to lyse red blood cells and kill epithelial cells. These findings suggested that it would be preferable to



Improved pharmacokinetic and pharmacodynamic profile after administration of single dose donpezilembonate nanocrystals in rats.

deliver AmB and Miltefosine together through NLC for rapid and effective treatment with fewer adverse effects.

(i)



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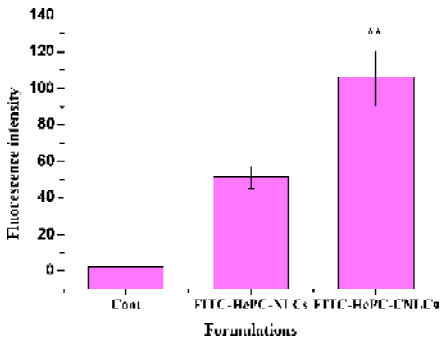

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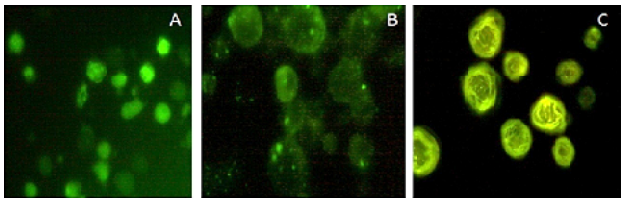


Fig.: (i) Histogram showing uptake by J774 A.1 macrophages. X-axis represents florescence associated with (A) control cells (B) FITC-HePC-NLCs, (C) FITC-HePC-CNLCs. **(ii)** Bar graph represents the mean fluorescent intensity in control cells, FITC–HePC-NLCs and, FITC–HePC-CNLCs (**p<0.01). Values shown are means and standard deviations (n = 3). **(iii)** Fluorescence microphotographs of (A) control (B) FITC-HePC-NLCs (C) FITC-HePC-CNLCs.

1.8. P-gp Modulatory Acetyl-11-keto-β-boswellic acid based nano emulsified carrier system for augmented oral docetaxel chemotherapy

In spite of being a very potent and promising drug against many types of cancer, docetaxel, an approved drug for many cancers suffers the disadvantage of low solubility and poor bioavailability rendering it unsuitable for oral administration. Also, the available marketed formulation for intravenous administration has its inherent drawbacks like hypersensitivity reactions owing to the presence of polysorbate 80. Here, we exploited the anticancer and P-gp inhibitory potential of active constituents (boswellic acids) of naturally occurring frankincense oil to fabricate a stable docetaxel loaded nanoemulsified carrier system for oral delivery. The nanoemulsion possessing desirable particle size (122 ± 12 nm), polydispersity (0.086 ± 0.007) and zeta potential (-29.8 ± 2.1mV) was stable against different kinds of physical stress (centrifugation, heat-cold and freeze-thaw) and simulated physiological conditions (gastric and intestinal). The formulation showed high uptake in Caco-2 cells and inhibited P-gp transporter significantly ($P<0.05$). In MDA-MB-231 cells, it showed lower IC_{50}, arrested cells in G2-M phase and induced more apoptosis than the marketed formulation Taxotere®. The 182.58 ± 4.16% increment in relative oral bioavailability led to higher *in vivo* anti-proliferative activity manifesting 19% more inhibition than Taxotere®. The nanoemulsion is a potentially superior formulation than the market leader in docetaxel therapy.

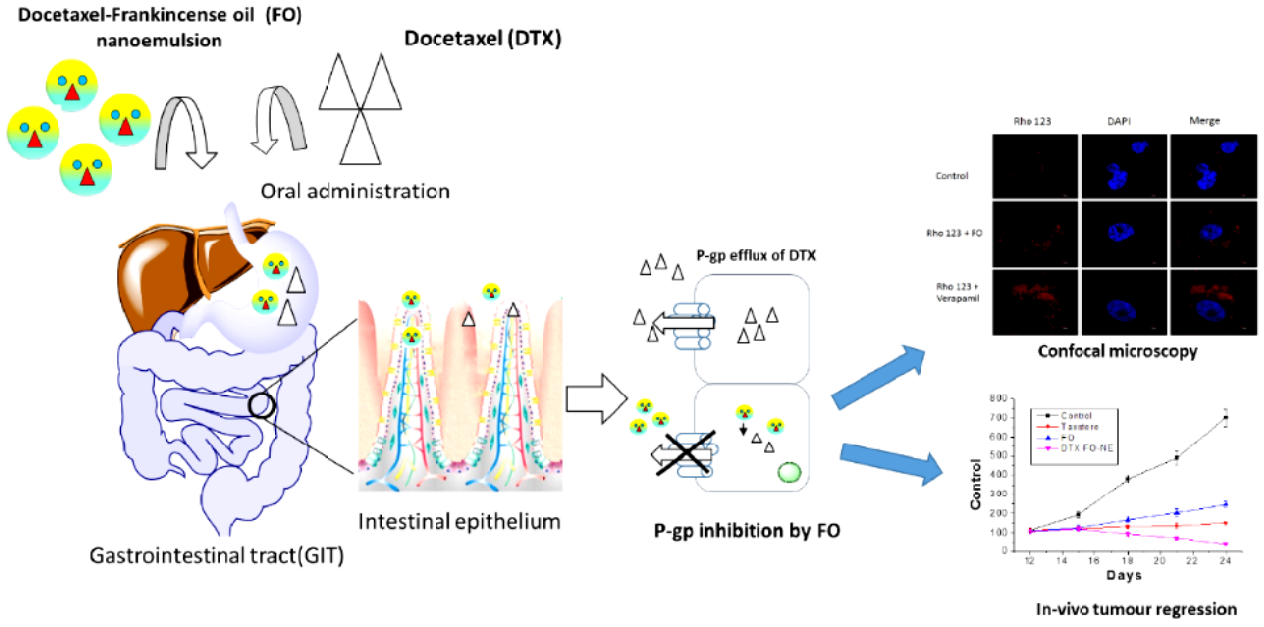
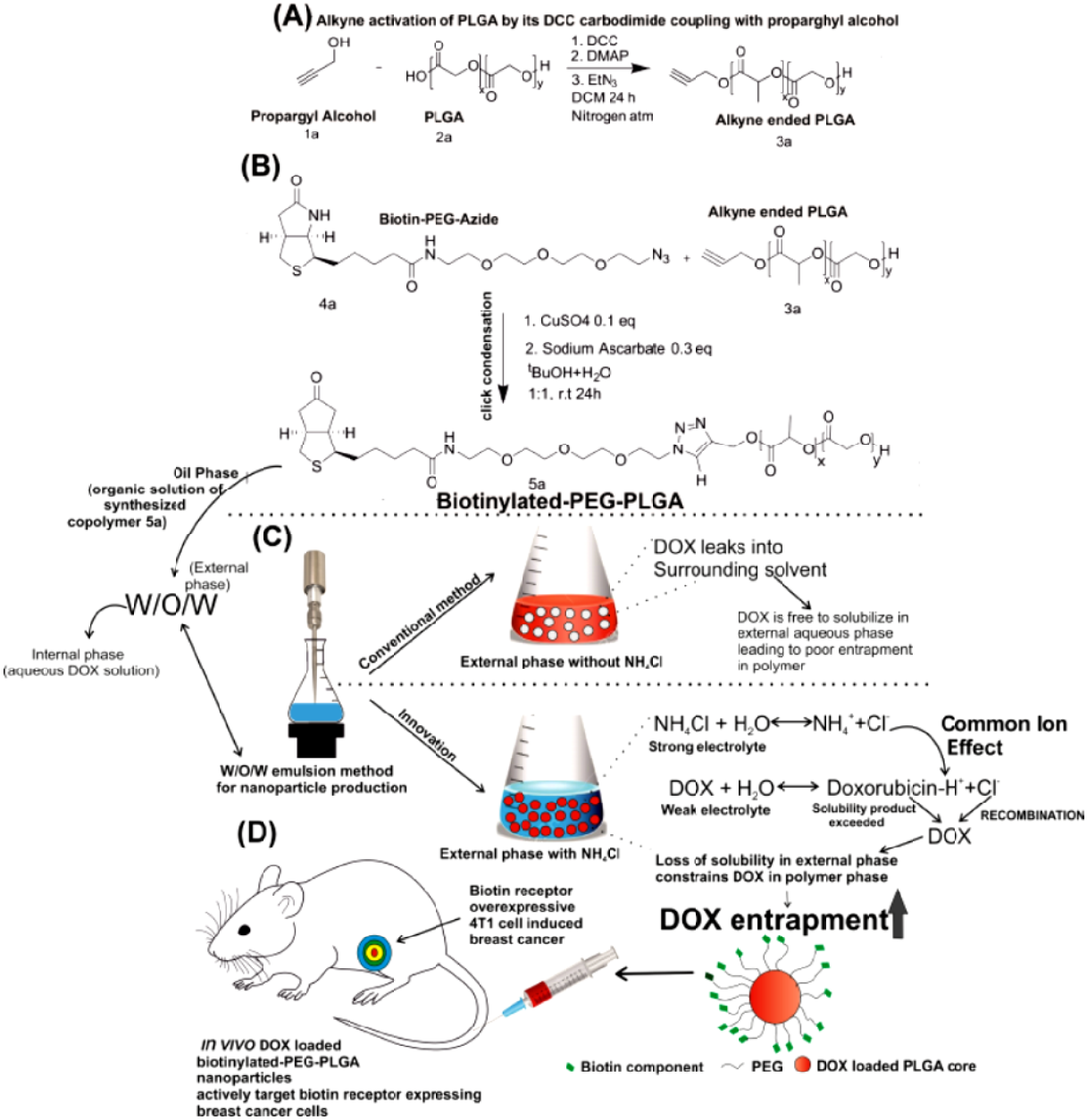


Fig.: P-gp blockade by FO leads to Enhanced DTX efficacy

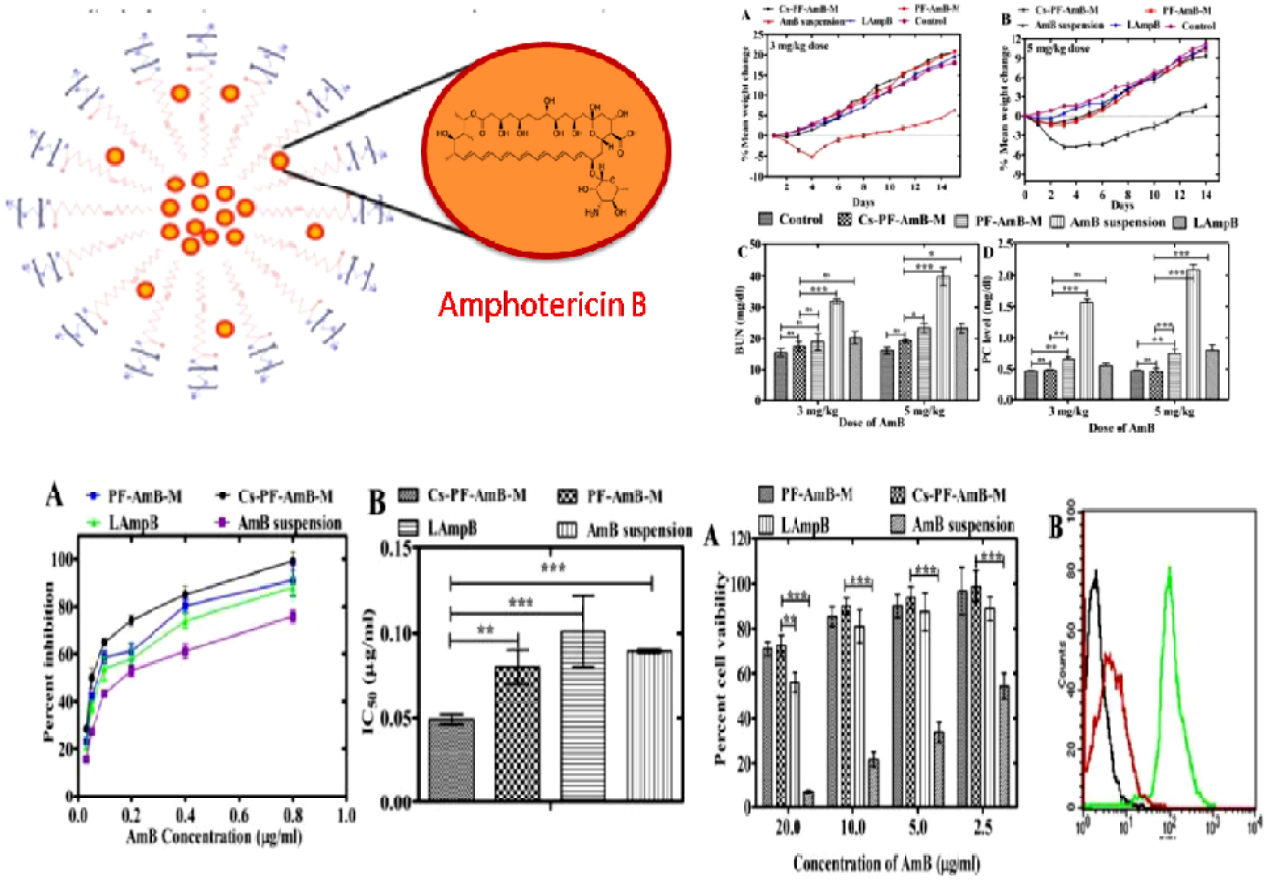
1.9. Clickable PLGA template with ultrahigh payload of hydrophilic bioactive for targeted delivery against breast cancer

PLGA was functionalized with PEG and biotin using click chemistry to generate a biotin receptor targeted copolymer (Biotinylated-PEG-PLGA) which in turn was used to fabricate nanoparticles (BPNP) of doxorubicin hydrochloride (DOX). Adequate entrapment of a hydrophilic bioactive like DOX in a hydrophobic polymer system like PLGA is not usually possible. We therefore modified a conventional W/O/W emulsion method by utilizing ammonium chloride in the external phase to constrain DOX in the dissolved polymer phase by supressing its inherent aqueous solubility via the common ion effect. This resulted in over eight fold enhancement in entrapment efficiency of DOX inside BPNP, which otherwise is highly susceptible to leakage due to its relatively high aqueous solubility. TEM and DLS established BPNP to be sized below 100 nm, storage stability studies showed that BPNP were stable for one month at 4 °C, and *in vitro* release suggested significant control in drug release. Extensive *in vitro* and *in vivo* studies were conducted to propound anticancer and antiproliferative activity of BPNP. Plasma and tissue distribution study supplemented by pertinent *in vivo* fluorescence imaging mapped the fate of DOX contained inside BPNP once it is administered intravenously. A comparative safety profile via acute toxicity studies in mice was also generated to establish usefulness of BPNP. Results suggest that BPNP substantially enhance anticancer activity of DOX while simultaneously mitigating its toxic potential due to altered spatial and temporal presentation of drug and consequently deserve further allometric iteration.



1.10. Chitosan coated PluronicF127 micelles for effective delivery of Amphotericin B in Experimental Visceral Leishmaniasis

The goal of the study was to develop a micellar formulation of Amphotericin B (AmB) to improve its macrophage targeting potential. AmB loaded pluronic F127 (PF 127) micelles were developed and coated with chitosan (Cs-PF-AmB-M) to accord immunomodulatory and macrophage targeting properties. Cytotoxicity studies demonstrated that Cs-PF-AmB-M were 9.35 fold less cytotoxic in comparison to AmB suspension. Flow cytometry studies indicated that Cs-PF-FITC-M was 21.97 fold higher internalized byJ774A.1 macrophage in comparison to PF-FITC-M. Cs-PFAmB-M exhibited good *in-vitro* and *in-vivo* activity compared to native drug. Chitosan coating stimulated a Th1 immune response mediating auxiliary immunotherapeutic action as judged by *in-vitro* and *in-vivo* cytokine and mRNA expression. Pharmacokinetic profiling and tissue distribution studies indicated that AmB was preferentially localized in macrophage harboring tissues instead of kidney, thereby circumventing the characteristic nephrotoxicity.



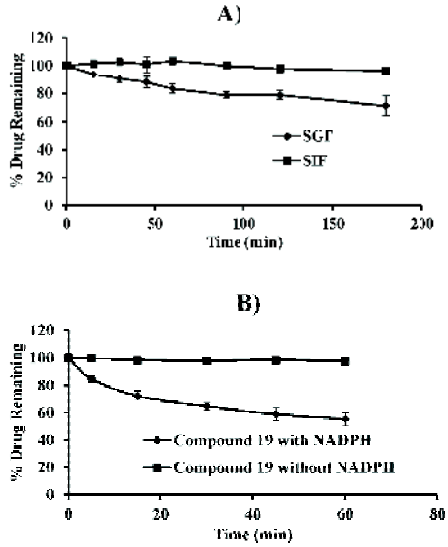
1.11. Nano-formulations of Ormeloxifine and Lapatinib as Anticancer Agents

Hyaluronic acid (HA) coated polycaprolactone nanoparticles (NPs) of Ormeloxifene, with median size 113.4 ±6.3 nm and HA conjugation 68.36 ±2.47 µg/mg were prepared and their activity was tested against triple-negative breast cancer; both *in vitro* and *in vivo*. NPs arrested the cell cycle at G0/G1 phase more efficiently than free drug or uncoated NP. Similar results were observed with MDA-MB-231 breast cancer cells in migration assay, ROS generation, apoptosis induction and regulation of TDT, caspase-10, cyclin-D1, and C-jun. Tumor regression of 4T-1 cells xenografted in female BALB/c mice demonstrated superior activity and targeting ability of HA coated NP containing either ormeloxifine or lapatinib nanocrystals (NCs) coated with HA. Pharmacokinetics after intravenous administration of free lapatinib, coated and uncoated NCs at 25 mg/kg indicated that the NCs prolonged the residence of the drug in circulation. HA coated NCs increased the $t_{1/2}$ by ~7 folds compared to free drug and 1.36 fold over uncoated NCs. The MRT was similarly increased by 6.63 and 1.6 fold. The AUC_{last} was increased and clearance reduced by almost 4 folds and 1.40 folds respectively, over free drug and uncoated nanocrystals. NCs of Lapatinib and genestein were also prepared by high pressure homogenizer and its comparative activity was evaluated with free Lapatinib and/or Free Genestein in MDA-MB-231 cell lines by performing MTT cytotoxicity, apoptosis and mitochondrial membrane depolarization assays. The nanocrystals formulation exhibited higher anticancer activity as compared to the crude form of these drugs.

2. Pharmacokinetics

2.1. *In vitro* Pharmacokinetics

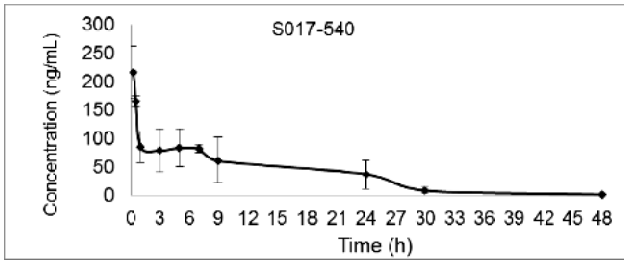
Early *in vitro* assessment of likely pharmacokinetics is useful in arriving at decisions about whether or not to pursue detailed investigations on drug candidates. For this purpose, the solubility and stability of the compound of interest in simulated gastric fluid (SGF), simulated intestinal fluid (SIF), blood plasma and in the presence of liver microsomal enzymes is assessed. S017-0536 was soluble to 0.23µg/mL in water, 47.22±2.00% unstable in SGF and 52.03±0.87% unstable in SIF at the end of two hours. The compound was 71.56±5.49% stable in plasma after 2 hours, exhibiting a half-life of 37.62 min. S017-0594 was soluble at 60 µg/ml and stable for two hours to the extent of 90.86%, 89.17% and 83.34±2.85% in SGF, SIF and blood plasma, with a half-life of 81.04 ± 17.60%.S012-1332 showed 83.19±3.22 % stable in SGF and 96.45±0.79 % stable in SIF up to 180 min. The S012-1332 was suitable for oral administration as it was stable in SGF and SIF. S012-1332 was stable in the presence of rat liver microsomes in the control reaction in the absence of cofactor NADPH confirmed the chemical stability as well as cofactor dependent degradation, as shown in the graphs below. The compound was stable to 55.5 ± 4.77 % up to 60 min.



A compound being developed jointly with Dr. Reddy's Institute of Life Sciences, DRILS 1726, was 95.33±1.73%stable in SGF, 85.29±5.22% stable in SIF and 87.13±2.08% stable in blood plasma after 2 hours. The half-life of the compound was 35.53min.S017-0540 was stable to the extent of 86.45±5.24%, 94.18±0.01% and 86.61±4.63% stable in SGF, SIF and plasma, respectively. Its plasma half-life was 39.85 min.

2.2. Preclinical Pharmacokinetics of Synthetic Molecules

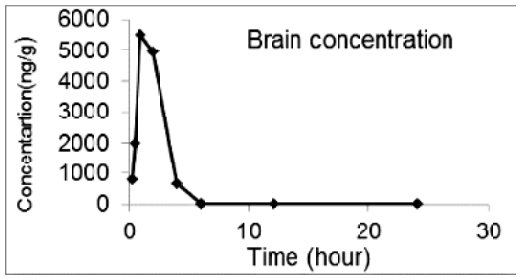
The concentration-time profiles of novel molecules in the blood and tissue(s) of interest were determined by

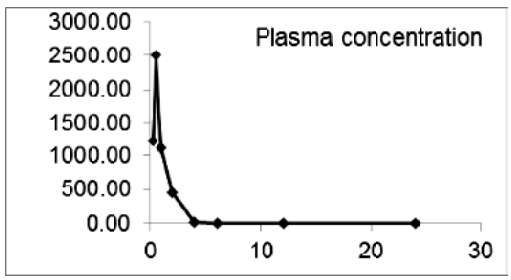


developed and valdated LC-MS/MS methods. After oral dosing, S017-540 displayed a blood profile as shown below:

The maximum concentration Cmax and overall systemic exposure, i.e. AUC (0-") of S017-540 was 237±77.31 ng/mL and 1794.49±581.06 h*ng/mL, respectively. The time taken for the systemic levels to reduce to half (half-life, t1/2) and elimination rate constant (Ke) were 8.16±1.15h and 0.09±0.013 h^{-1} respectively, after oral administration (100 mg/kg dose). However, the apparent volume of distribution (Vd) and clearance (Cl) were 740.12±390.43L/kg and 60.96±24.27L/h/kg, respectively. The higher value of Vd of S017-540 compound indicates greater peripheral distribution of the compound.

The results in respect of DRILS 1715 are shown in the graph below, while the Table depicts pharmacokinetic parameters calculated for this compound.





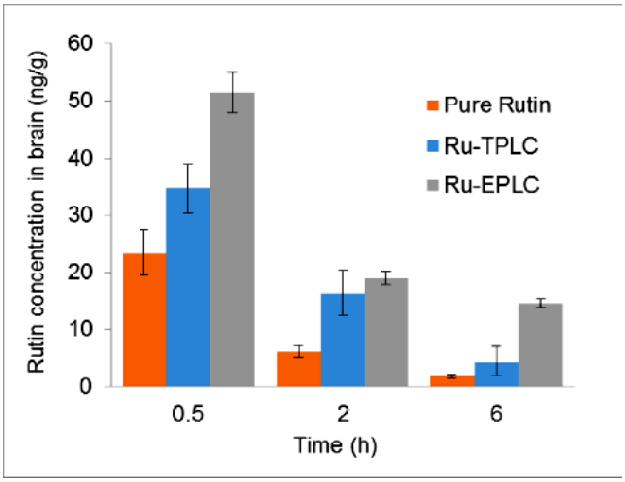
Parameters	Brain	Plasma
$T_{1/2}$ (h)	4.72 ± 0.06	3.26±0.19
T_{max} (h)	1.00± 0.00	0.50±0.00
C_{max} (ng/ml)	8653.33± 476.82	2496.67±197.01
AUC_{0-t} (ng/ml*h)	9790.54± 415.47	2822.43± 488.61
Vz/F_{obs} (mg/kg)/(ng/ml)	0.03± 0.01	0.05± 0.01
Cl/F_{obs} (mg/kg)/(ng/ml)/h	0.003± 0.0001	0.01±0.002

2.3. Pharmacokinetics of Phytopharmaceutical Marker Compounds

Oral administration of *Eclipta* extract not only offers potential anti-breast cancer effects *in vivo* but also mitigates tumor induced hepato-renal toxicity. To find out the main active ingredient, mass spectrometric detection was performed. Marker compounds like Wedelolactone, Luteolin and extract at a concentration of 1:1 and 300 µg/ml respectively were analyzed, as shown in the Table below. Luteolin was detected in mouse blood after 50 mg/kg of body weight oral dose of extract. Mass finger printing studies have identified luteolin as the major effective component of the chloroform fraction.

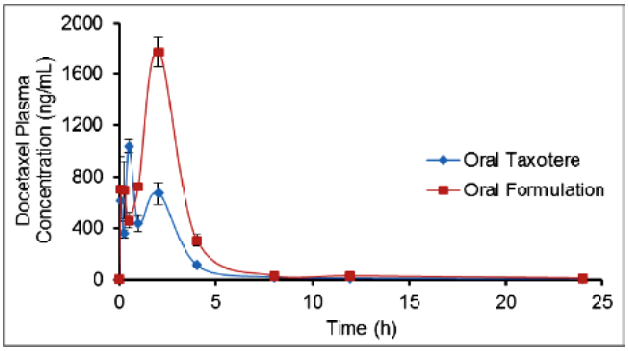
Sl. No.	Standard Marker Compounds	Mobile Phase Composition (for HPLC)	R_t (min)	Lambda Max (nm)	Percentage (% w/w) of markers in extract		
					Chloroform Extract	Hexane Extract	Butanol Extract
1	Wedelolactone	MeOH: 10mM phosphate buffer (30:70, V/V)	21	364	0.3845	0.0679	0.0378
2	Luteolin	Acetonitrile: Ammonium formate 10mM (50:50, V/V)	3.3	347	0.2317	-	-

Rutin is a an active glycoside that has potent neuroprotective, anticonvulsant and antioxidant acitvity. To find out the brain distribution of rutin and its formulations, the following study was conducted. For brain distribution, 27 rats were randomly divided into 3 groups for 3 formulations (9 rats in each group). Pure rutin suspended in 0.5% w/v sodium carboxymethyl cellulose (SCMC) andrutin in phospholipid carrier and Ru-PLCs dispersed in water and the suspensions were administered orally at the equivalent dose of 100 mg/kg to each rat. Rats were sacrificed at predetermined time points (0.5, 2 & 6h) and brain samples were collected, washed with normal saline solution and further diluted with Tris buffer (pH 7.4) at 1:1 (w/v) ratio based on brain weight and then homogenised. Rutin was extracted from the samples by liquid-liquid extraction The homogenised samples were processed by LLE method as described for rat plasma and further analysed by LC-MS/MS method. The concentrations of Rutin in rat brain were expressed in ng/g. The rutin brain concentrations were achieved higher for Ru-EPLC as compared to Ru-TPLC and pure rutin at each time point.



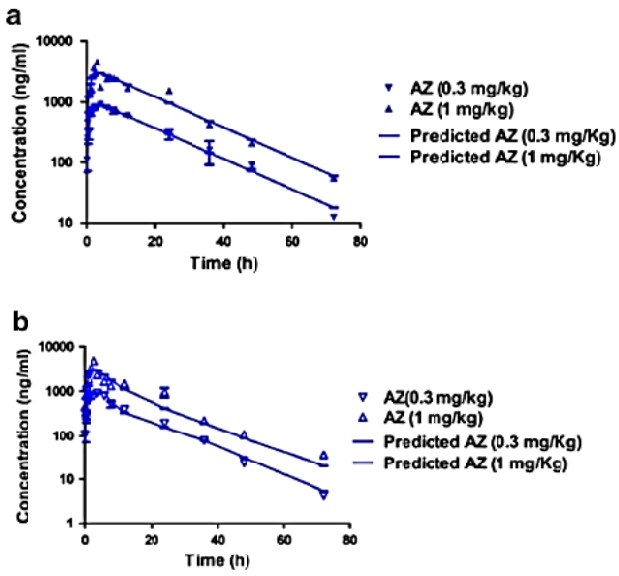
2.4. Preclinical Pharmacokinetics of Docetaxel formulation

Docetaxel (DTX) is an anticancer agent that is rapidly cleared from blood circulation. A nano emulsion formulation was prepared to increase the bioavailability in comparison to a marketed formulation. The marketed formulation Taxotere® and the developed formulation were both well tolerated when administered orally to rodents and no signs of toxicity were observed for the entire duration of the study. The blood plasma concentrations of DTX were measured by LC-MS/MS and are plotted in the Figure below. A non-compartment pharmacokinetic model was fitted to the data and various pharmacokinetic parameters were calculated. It was observed that the maximum plasma concentration (C_{max}) achieved was 1038 ± 50.62 ng/mL and 1775.00 ± 118.39 ng/mL at a T_{max} of 0.75 ± 0.20 h and 1.50 ± 0.41 h respectively for Taxotere® and the formulation. There was near about two fold increment in the $AUC_{0-\infty}$ (4474.51 ± 79.21 h*ng/mL) with the formulation as compared to Taxotere® (2450.63 ± 19.04 h*ng/mL). The mean residence time (MRT) was increased and clearance of DTX was slower from the prepared nanoemulsion formulation in comparison to the marketed formulation.



2.6. Pharmacokinetic-pharmacodynamic modeling of antihypertensive interaction

A pharmacokinetic-pharmacodynamic (PK-PD) model was developed to describe the time course of blood pressure following oral administration of azilsartan medoxomil (AZ) and/or chlorthalidone (CLT) in spontaneously hypertensive (SH) rats. The drug concentrations were measured by LC-MS/MS) and pharmacological effects, including systolic blood pressure (SBP) and diastolic blood pressure (DBP) tail-cuff manometry. Sequential PK-PD analysis was performed, wherein the plasma concentration-time data was modeled by one compartmental analysis. Subsequently PD parameters were calculated to describe the time-concentration-response relationship using



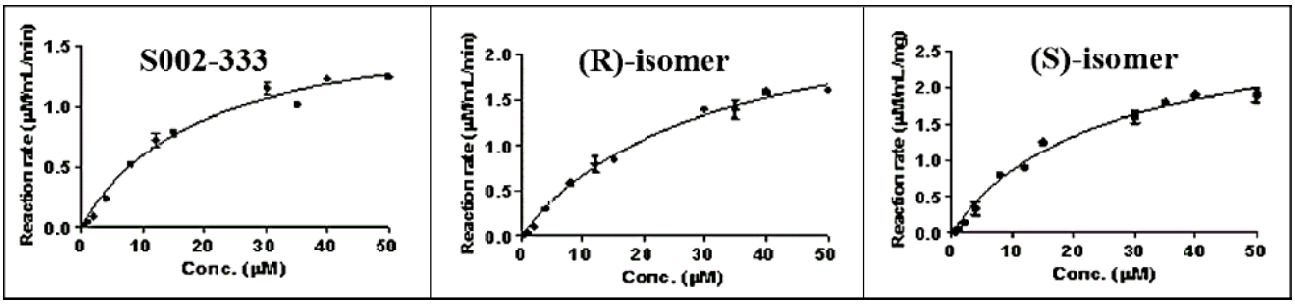
indirect response (IDR) PK-PD model. The combination of AZ and CLT had greater BP lowering effect compared to AZ or CLT alone, despite of no pharmacokinetic interaction between two drugs. These findings suggest synergistic antihypertensive pharmacodynamic interaction between AZ and CLT noncompetitively, which was simulated by inhibitory function of AZ and stimulatory function of CLT after concomitant administration of the two drugs. The present model was able to capture the turnover of blood pressure adequately at different time points at two different dose levels. The current PK-PD model was successfully utilized in the simulation of PD effect at a dose combination of 0.5 and 2.5 mg/kg for AZ and CLT, respectively. The developed preclinical PK-PD model may provide guidance in the optimization of dose ratio of individual drugs in the combined pharmacotherapy of AZ and CLT at clinical situations.

2.6. Insight into stereo selective disposition of enantiomers of a potent antithrombotic agent, S002-333 following administration of the racemic compound to mice

S002-333 [2-(4-methoxy-benzenesulfonyl)-2,3,4,9-tetrahydro-1H-b-carboxylic acid amide], a potent antithrombotic agent developed by CSIR-CDRI, is a racemic mixture of two enantiomers (S004-1032 (*R*)-isomer and S007-1558 (*S*)-isomer). Despite extensive research, little is known about the pharmacokinetics of S002-333 enantiomers. Given that mouse is an established model for anti-platelet/antithrombotic activity and interspecies differences exists in the direction of stereoselectivity in pharmacokinetic processes, we investigated the pharmacokinetic disposition of S002-333 enantiomers in mice. Whereas the pharmacokinetics of S002-333 was non-stereoselective after intravenous (i.v.) administration, substantial stereoselectivity was observed after oral administration of the racemate. The oral $AUC_{0-\infty}$ of (*R*)-isomer (1228.21 ± 97.55 h^{-1} ng/mL) was higher than that of (*S*)-isomer (861.55 ± 182.07 h^{-1} ng/mL) whereas it was comparable after i.v. administration. The absolute oral bioavailability of (*R*)-isomer was ~ 1.7 times higher. On incubating the racemic mixture or individual isomers with mice liver microsomes, the (*S*)-isomer depleted significantly faster than the (*R*)-isomer. Thus, low absolute oral bioavailability of (*S*)-isomer in comparison to (*R*)-isomer could be associated to stereoselective hepatic metabolism of (*S*)-isomer. Furthermore, no metabolic interaction between the enantiomers was observed. Tissue distribution analysis revealed that the highest amount of the enantiomers was localized in small intestine and liver, which could be due to first pass metabolism in these organs. Stereoselectivity in the distribution of S002-333 was observed in liver, kidney, spleen and brain; however, no significant differences between the plasma protein binding of the enantiomers were observed. The information revealed in the present work might prove valuable in deciding the development of S002-333 as racemic mixture and/or single enantiomer.

2.7. Assessment of clinical pharmacokinetic drug-drug interaction of antimalarial drugs alpha/beta-arteether and sulfadoxine-pyrimethamine.

Antimalarial drug combination therapy is now being widely used for the treatment of uncomplicated malaria. The objective of the present study was to investigate the effects of coadministration of intramuscular alpha/beta-arteether (alpha/beta-AE) and oral sulfadoxine-



pyrimethamine (SP) on the pharmacokinetic properties of each drug as a drug-drug interaction study to support the development of a fixed-dose combination therapy. A single-dose, open-label, crossover clinical trial was conducted in healthy adult Indian male volunteers (18 to 45 years, n = 13) who received a single dose of AE or SP or a combination dose of AE and SP. Blood samples were collected up to 21 days postadministration, and concentrations of alpha-AE, beta-AE, sulfadoxine, and pyrimethamine were determined by using a validated liquid chromatography-tandem mass spectrometry method. Pharmacokinetic parameters were calculated and statistically analyzed to calculate the geometric mean ratio and confidence interval. Following single-dose coadministration of intramuscular AE and oral SP, the pharmacokinetic properties of alpha/beta-AE were not significantly affected, and alpha/beta-AE had no significant effect on the pharmacokinetic properties of SP in these selected groups of healthy volunteers. However, more investigations are needed to explore this further. This study has been registered in the clinical trial registry of India under approval No. CTRI/2011/11/002155

3. Regulatory Toxicology & Safety Pharmacology

3.1. Regulatory Toxicology:

3.1.1. S-007-1500: Single dose toxicity study in rat by oral route.

Dose levels of 3.125, 6.25, 12. 5 and 25 mg/kg were tested by oral route and the maximum tolerated dose was found to be 25 mg/kg.

3.1.2. S-007-1500: 28 days repeat dose toxicity study in rat by oral route.

Dose levels of 6.25, 12.5 & 25 mg/kg doses were tested by oral route. The experiment has been completed. No mortality has been observed. The histology is completed-NOAEL is 25 mg/kg body weight.

3.1.3. 219/C003: Single dose toxicity study in rat by oral route.

Dose levels of 0.62g, 1.25g, 2.5g/kg doses of 219/C003 were tested by oral route and the maximum tolerated dose was found to be 2.5g/kg. 28 days repeat dose studies have been planned. Mutagenicity & genotoxicity studies are in progress.

3.1.4. S-007-867: 28 day repeat dose toxicity study by oral route in non human primates

S-007-867: 28 day repeat dose toxicity study by oral route has been completed and data analysis is in progress.

3.1.5. 96/261: Mutagenicity studies

Mutagenicity studies using four testar strains of *Salmonella typhimurium* completed. Found safe.

3.2. Safety Pharmacology

3.2.2. S-007-1500: Essential Central Nervous System safety pharmacology

Essential central nervous system safety pharmacology of the compound S-007-1500 was performed as per requirements of schedule Y in Swiss albino mice at 2, 5, 10 and 20 mg/kg oral dose. The effect of this test item on sensory reflexes, neuromuscular coordination, body temperature, locomoter activity and Irwin's battery of gross behavior was investigated. No significant dose dependent pharmacological effect of this test item was observed.

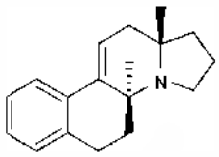
Cardiovascular effects like Heart rate, BP and QT interval of the test item S-007-1500 is being evaluated orally at 1,2.5, 5 and 10 mg/kg doses in transmitter implanted SD rats. This study may be able to predict cardiovascular liability in humans and its effects on QT interval through telemetry.

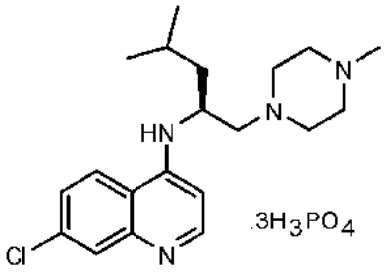
4. GLP Facility

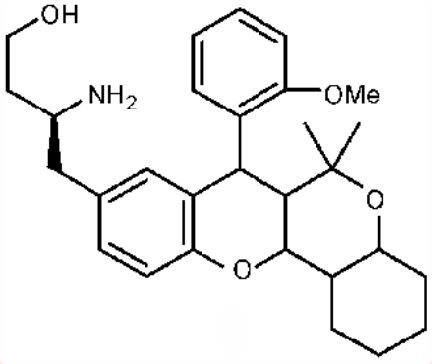
CSIR-CDRI received GLP compliance certificate from NGCMA in November 2017 for conducting **safety pharmacology** and **acute toxicity studies**. It is the second laboratory of the CSIR family to receive this International accreditation. The GLP certification is the testimony of the high quality research work that is being carried out in the Institute. CSIR-CDRI GLP facility leverages from *in vivo* rodent models to enable safety of suitable products in pharma, and biotech sectors. Experienced team with vast knowledge in the domain of regulatory toxicology and safety pharmacology and other areas at the GLP Test Facility is committed to realize its mission towards serving national as well as global needs in the area of toxicology and safety. This facility has the distinction of being the only government laboratory with all knowledge of drug discovery and development. Good Laboratory Practice ensures generation of high quality and reproducible data required for global acceptance. The principles have been created in the context of harmonizing testing procedures for the Mutual Acceptance of Data (MAD) among the OECD countries.

Notes

New Drug Discovery







Area Coordinators

Dr Sanjay Batra

Dr Sabyasachi Sanyal

Research Team

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2

New Drug Discovery

Coordinators: Dr Sanjay Batra & Dr Sabyasachi Sanyal

Members: Dr Md. Imran Siddiqi, Dr Manish Chourasia, Dr RS Bhatta

Vision and Goal

- Rational design, synthesis and biological screening of synthetic compounds and natural products for discovery of new drug
- Repositioning of bioactives
- Maintenance of the repository of synthetic and pure natural compounds for identification of ligands for new biochemical targets
- Recruiting compounds from other institutions for assessment of bioactivity

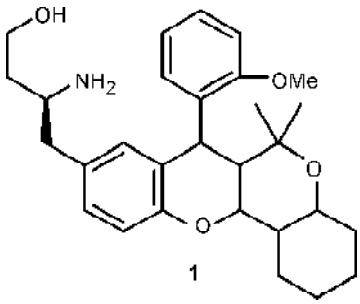
Core Competencies and Activities

- Rational design and synthesis of novel organic compounds
- Bio-evaluation of synthetic molecules and natural compounds for different disease areas via *in vitro* and *in vivo* models
- Computational approaches toward identification of new ligands for different targets
- Maintenance of records of the attributes of each compound with respect to analytical, spectroscopic and biological screening data via the Online Compound Submission and Bioassay Reporting System (CBRS)
- Maintenance of SOPs for all bioassays listed and formulation of decision trees for taking the bio-actives to translational mode
- Recruiting of organic molecules from other academic institutions for maintenance and bioevaluation as prelude to discover new bioactives
- Analysis of PK parameters of Hits

1. Chemistry for New Leads

1.1 Diversity oriented synthesis of chromene-xanthene hybrids as anti-breast cancer agents

Chroman is considered to be a privileged structure in the realms of medicinal chemistry as compounds containing it are endowed with a variety of bioactivities. In pursuit to identify novel anticancer agents, a diverse library of chromene-xanthene hybrids was synthesized via intramolecular Friedel-Crafts reaction of the arenoxycarbinols prepared from Grignard reaction of an appropriately substituted chroman aldehyde. Examples included first incorporation of amino acid tyrosine into xanthene skeletons with polar functionalities. Bio screening of the compounds revealed that tyrosine crafted chromene-xanthene hybrids exhibited good activities against breast cancer cell lines MCF-7, MDA-MB-231. The lead compound **1** bearing IC_{50} of 2.6 ± 0.667 mM and 2.5±0.181mM against MCF-7 and MDA-MB-231 cell-lines displayed significant cell cycle arrest at G1 phase and induces apoptosis in MDA-MB-231 cells. (*Bioorg. Med. Chem. Lett.* https://doi.org/10.1016/j.bmcl.2017.12.065)



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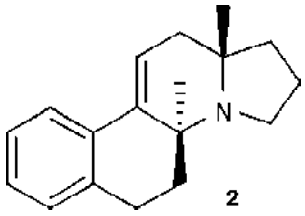
1.2 Targeting progesterone metabolism in breast cancer with L-proline derived new 14-azasteroids

Proliferation of breast cancer cells is promoted by a several mitogenic signals of which estrogen is considered to predominate in hormone-dependent breast cancer whereas progesterone isconsidered to have protective effect. However, progesterone metabolites like 5a-pregnane and 4-pregnene could serve as regulators of estrogen-responsiveness of breast cancer cells thereby promoting cancer. In an attempt to estimate the potential to target the breast cancer via progesterone signalling, L-Proline derived novel 14-azasteroid compounds were synthesized and evaluated against MCF-7 and MDA-MB-231 cell lines. *In silico* studies, cell cycle, Annexin-V-FITC/PI, JC-1 mitochondrial assay, ROS analysis were performed to analyse the efficacy of the most active analogue from the series against breast cancer cells. Further, the impact of the hit compound **2** on the

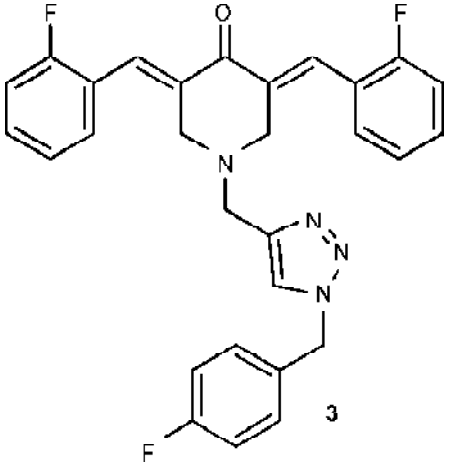


2

progesterone, its metabolites and enzymes responsible for the conversion of progesterone and its metabolites using ELISA was also investigated. From the results it was apparent that **2** binds and down regulates of 5a-reductase by specifically inhibiting production of progesterone metabolites that are capable of promoting breast cancer proliferation, epithelial mesenchymal transition and migration. The study established the proof of concept and generation of new leads for additional targeting of breast cancer. (*Bioorg. Med. Chem*. 2017, 25, 4452–4463)

1.3. New Orally Active DNA Minor Groove Binding Small Molecule CT-1 Acts Against Breast Cancer by Targeting Tumor DNA Damage Leading to p53-Dependent Apoptosis

A curcumin-triazoleconjugate **3** with remarkable anti-cancer activity was identified earlier (*Bioorg. Med. Chem. Lett.* **2016**, *26*, 4223-4232). Detailed assessment towards mechanism of action of this compound indicated that it selectively and significantly inhibits viability of breast cancer cell lines; retards cells cycle progression at S phase and induce mitochondrial-mediated cell apoptosis. Compound **3** selectively binds to minor groove of DNA and induces DNA damage leading to increase in p53 along with decrease in its ubiquitination. Inhibition of p53 with pharmacological inhibitor as well as siRNA revealed the necessity of p53 in **3**-mediated anti-cancer effects in breast cancer cells. Studies using several other intact p53 and deficient p53 cancer cell lines further confirmed necessity of p53 in **3**-mediated anti-cancer response. Pharmacological inhibition of pan-caspase showed **3** induces caspase-dependent cell death in breast cancer cells. Most interestingly, oral administration of **3** induces significant inhibition of tumor growth in LA-7

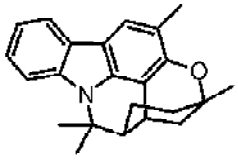


3

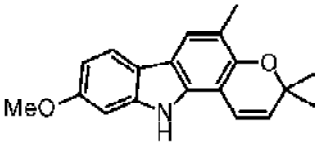
syngeneic orthotropic rat mammary tumor model. Compound **3** treated mammary tumor shows enhancement in DNA damage, p53 upregulation, and apoptosis. Collectively, **3** exhibits potent anti-cancer effect both *in vitro* and *in vivo* and could serve as a safe orally active lead for anti-cancer drug development. (*Mol. Carcinog*. 2017, 56, 1266–1280)

1.4. Anti-colon cancer activity of *Murrayakoenigii* leaves is due to constituent murrayazoline and *O*-methylmurrayamine A induced mTOR/ AKT down regulation and mitochondrial apoptosis

The exploration of natural products and their derivatives for identifying leads in different disease areas is a continuous process in drug discovery program. In this context, the pyranocarbazole alkaloids were isolated from leaves of *Murraya koenigii* and their anti-cancer potential was investigated in different cancer cell lines. Among all tested compounds, murrayazoline **(4)** and *O*-methylmurrayamine A **(5)** demonstrated potent anti-cancer activity against DLD-1 colon cancer cells with the IC_{50} values of 5.7 mM and 17.9 mM, respectively, without anynon-specific cytotoxicity against non-cancer HEK-293 and HaCaT cells. Further, studies of pure compounds revealed that the anti-cancer activity of compounds corresponds with altered cellularmorphology, cell cycle arrest in G2/M phase, reactive oxygen species level and mitochondrial membrane depolarization of colon cancer cells. In addition, these compounds activated caspase-3 protein and upregulated Bax/Bcl-2 protein expression ratio leading to induction of caspase-dependent apoptosis in



Murrayazoline **(4)**



O-methylmurrayamine A **(5)**

DLD-1 cells. These event induced by carbazole alkaloids also coincides with down regulation of Akt/ mTOR suggesting downstream targeting of cell survival pathway. Thus, the *in vitro* studies provideda scientific rationale tothe use of *M. koenigii* leaves in the traditional Indian Ayurveda medicines together with exploring the possibility of medicinal uses of *M. koenigii* leaves against colon cancer. In particular, the study endorses the use of murrayazoline and O-methylmurrayamine A as the chemistry starting point for developing new leads for the treatment of colon cancer. (*Biomed. Pharmacother.* **2017**, 93, 510-512)

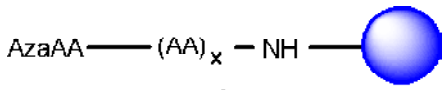
1.5 Chebulinic acid isolated from the fruits of *Terminalia chebula* specifically induces apoptosis in acute myeloid Leukemia cells

Chebulinic acid, an ellagitannin found in the fruits of *Terminalia chebula*, have various biological activities

including antitumor activity. To investigate the cytotoxic potential of chebulinic acid in human myeloid leukemia cells, a study was initiated. It was discovered that chebulinic acid caused apoptosis of acute promyelocytic leukemia HL-60 and NB4 cells but not K562 cells. Chebulinic acid treatment to HL-60 and NB4 cells induced caspase activation, cleavage of poly (ADP-ribose) polymerase, DNA fragmentation, chromatin condensation, and changes in the mitochondrialmembrane permeability. Further inhibition of caspase activation drastically reduced the chebulinic acid induced apoptosis of acute promyelocytic leukemia cells. The study also demonstrated that chebulinic acid induced apoptosis in HL-60 and NB4 cells involved activation of extra cellular signal-regulated kinases, which, when inhibited with ERK inhibitor PD98059, mitigates the chebulinic acid-induced apoptosis. These findings exhibited a selective potentiation of chebulinic acid-induced apoptosis in acute promyelocytic leukemia cells. (*Phytotherp. Res*. 2017, 31, 1849-1857)

1.6 AzaGly-Appended Peptidomimetics Structurally Related to PTR6154 as Potential PKB/Akt Inhibitors.

A side-reaction-free synthesis of a new series of azaGly appended peptidomimetics on solid support was developed. The design was inspired by azaGly scan of hepta-peptide, Arg-Pro-Arg-Nle-Tyr-Dap-Nle (Akt-01), a GSK3â derived Akt-inhibitor. The azaGly appended peptides **(6)** displayed significant improvement of biological activity, serum stability with retention of conformation as evident from NMR and CD studies. The results of this study suggested that azaGly appended peptides could be useful for development of novel peptidomimetics with therapeutic potential. (*Chem Bio Chem* 2017, 18,1061 –1065)



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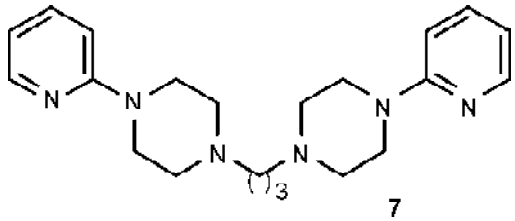
1.7 Novel aryl piperazines for alleviation of 'andropause' associated prostatic disorders and depression

A series of piperazine derivatives was synthesized and assessed for the management of andropause-associated prostatic disorders and depression. A few compounds significantly inhibited proliferation of androgen-sensitive LNCaP prostatic cell line with EC_{50} values in the range of 10-12mM and decreased Ca^{2+} entry through adrenergic-receptor a_{1A} blocking activity. Anti-androgenic behaviour of compounds was evident by decreased luciferase activity whereas the high EC_{50} value in AR-negative cells PC3 and DU145 suggested that the cytotoxicity of compounds was due to AR down regulation. The most active analogue **7** reduced the prostate weight of rats by 53.8%. Further, forced-swimming and tail-suspension tests revealed antidepressant-like activity, lacking effects on neuromuscular co-ordination. In silico ADMET predictions revealed that this compound had good oral absorption, aqueous solubility, non hepatotoxic and good affinity for plasma protein binding. Pharmacokinetic and tissue uptake with it at10 mg/kg demonstrated an oral bioavailability of 35.4%. *In silico* docking studies predicted similar binding pattern of the compound on androgen receptor as that of hydroxyflutamide. It is therefore a promising lead with promising activities against androgen associated prostatic disorders in males like prostate cancer and BPH and associated depression. (*Eur. J. Med. Chem*. 2017, 132, 204-218)



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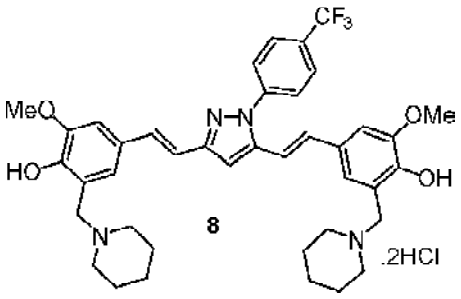
1.8 Ethyl acetate fraction of *Eclipta alba*: a potential phytopharmaceutical targeting adipocyte differentiation

Eclipta alba, a medicinal herb has long been used in traditional medicine for curing several pathologies. It has been shown tohave anti-diabetic effect as well as hepato-protective activity. In order to address the metabolic derangements, the efficacy of *E. alba* and its fractions in adipogenesis inhibition and dyslipidemia was investigated. Of the crude extract and fractions screened, ethyl acetate fraction of *E. alba* inhibited adipocyte differentiation in 3T3-L1 pre-adipocytes and hMSC derived adipocytes. It inhibited mitotic clonal expansion and caused cell cycle arrest in G1 and S phase and was shown to have lipolytic effects. Oral administration of ethyl acetate fraction of *E. alba* to hamsters unveiled its anti-adipogenic as well as anti-dyslipidemic activity in-vivo. Mass spectrometry analysis of ethyl acetate fraction confirmed the presence of several bioactive components, projecting it as an effective phyto-pharmaceutical agent. Therefore, it was concluded that the ethyl acetate fraction of *E. alba* possesses potent anti-adipogenic as well as anti-dyslipidemic activity which could be useful for formulating herbal preparation for treating obesity. (*Biomed. Pharmacother*. 2017, 96, 572–583)

1.9 Biological evaluation of novel curcumin–pyrazole–Mannich derivative active against drug-resistant *Mycobacterium tuberculosis*

In the objective to identify a more potent curcumin derivative with specific activity against *Mycobacterium tuberculosis* a library of new curcumin derivatives was synthesized and assessed for its static/cidality, synergistic activity with front-line antituberculosis drug. The efficacy in the murine model of *M. tuberculosis* infection was also investigated. Compound **8** was identified to CPMD-6d dihydrochloride exhibit concentration-dependent bactericidal activity against *M. tuberculosis* (MIC 2 µg/ml

drug-resistant strains. The compound was also found to display synergistic activity with front-line anti-tuberculosis drugs and significantly reduced the bacterial load in mice lungs and spleen at 25 mg/kg as compared with ethambutol at 100 mg/kg. (*Fut. Microbiol*. 2017, 12, 1349-1362)



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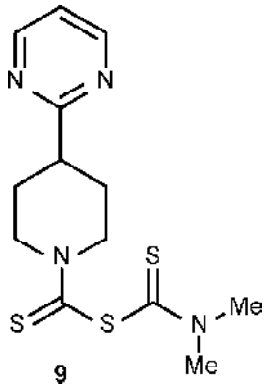
1.10 Substituted carbamothioic amine-1-carbothioic thioanhydrides as novel trichomonicidal fungicides: Design, synthesis and biology

In search for new leads against sexually transmitted disease such as trichomonias is together with opportunistic fungal infections like candidias is a series of novel non nitroimidazole class of substituted carbamothioic amine-1-carbothioic thioanhydride was



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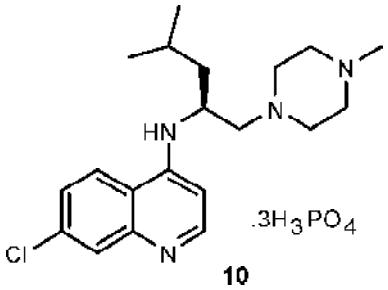
synthesized and evaluated. A few of the compounds were found to display better activity as compared to the standard drug Metronidazole (MTZ) against MTZ-susceptible and -resistant strains. Indeed, the most active compound from the series was 3.8 and 9.5 folds more active than the MTZ against the two Trichomon as strains tested. This compound also significantly inhibited the sulfhydryl groups present over *Trichomonas vaginalis* and was found to be more active than the MTZ *in vivo*. A preliminary pharmacokinetic study showed good distribution and systemic clearance for this compound.

1.11 Synthesis and Evaluation of Chirally Defined Side Chain Variants of 7-Chloro-4-Aminoquinoline to Overcome Drug Resistance in Malaria Chemotherapy

A novel series of chirally pure 4-aminoquinoline derivatives by using amino acids as building blocks for



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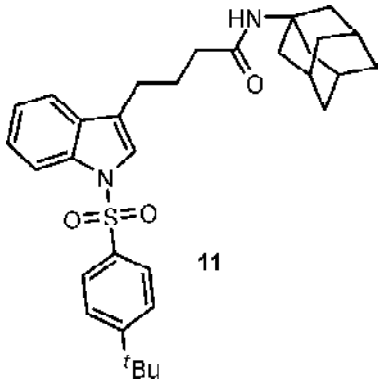
the side chain modifications was synthesized and evaluated for its antimalarial efficacy. The an alogues from the series displayed excellent *in vitro* antimalarial activities against *P. falciparum* and *in vivo* oral efficacy against chloroquine-resistant parasites in a *P. yoeli inigeriensis* mouse model. Based on detailed evaluation, the rate of parasitic reduction upon administration of the compound (*in vitro*), the propensity of the parasites to recrudesce following administration (measured over 28 days), and efficacy validation of the active compounds in a *P. falciparum*-simian model, compound **10** was identified as apreclinical candidate. Furthermore, *in vitro* and *in vivo* absorption, distribution,metabolism, and excretion (ADME) assays carried out with compound **10** showed that it has excellent physicochemical properties, an acceptable pharmacokinetic profile, and moderate metabolic clearance in rat liver microsomes. The results were in consonance with the *in silico* ADME predictions and Medicines for Malaria Venture (MMV) criteria for selection of antimalarial compounds. The compound is being pursued further for toxicological and regulatory pharmacologicale valuations. (Antimicrob. Agents Chemotherap. 2017, 61, e01152-16)

1.12. Synthesis and antiplasmodial activity of novel indoleamide derivatives bearing sulfonamide and triazole pharmacophores

A series of adamantyl/cycloheptylindoleamide derivatives bearing sulfonamide and triazole pharmacophores were synthesized and evaluated for the antiplasmodial activity *in vitro*. Although a few indoleamides, with sulfonamide pharmacophore showed promising activity with IC_{50} between 1.87-2.17 mM against CQ sensitive *Pf*3D7 strain, no compound was found better than the standard chemotherapy. (*Eur. J. Med. Chem*. 2017, 131, 171-184)



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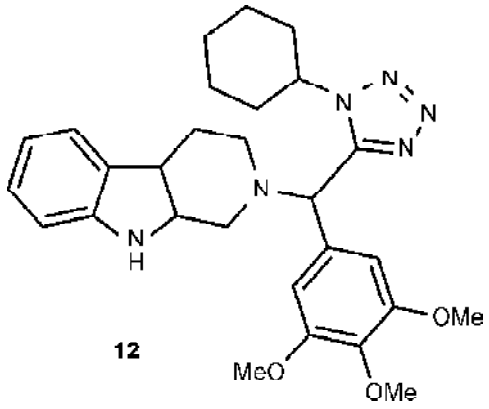
1.13 An insight into tetrahydro-β-carboline–tetrazole hybrids: synthesis and bioevaluation as potent antileishmanial agents

A series of 2,3,4,9-tetrahydro-β-carbolinetetrazole derivatives utilizing the Ugi multicomponent reaction were synthesized and examined as potential antileishmanial agents. Most of the screened compounds exhibited significant *in vitro* activity against the promastigote (IC_{50} from 0.59 ± 0.35 to31 ± 1.27 μM) and intracellular amastigote forms (IC_{50} from 1.57 ± 0.12 to 17.6 ± 0.2 μM) of *L. donovani*. The most active analogue **12** was studied *in vivo* in the hamster model at a dose of 50 mg kg^{-1} and was found to display 75.04 ± 7.28% inhibition of splenic parasite burden. Preliminary PK profile indicated that the compound was detected in hamster serum for up to 24 h and exhibited a large volume of distribution (651.8 L kg^{-1}), high clearance (43.2 L h^{-1} kg^{-1}) and long mean residence time (10 h). (*Med. Chem. Commun.* 2017, 8, 1824–1834)



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2. Biological Screening

2.1 Cancer

In an effort to identify new compounds displaying anticancer activity, 527 new chemical compounds were screened under the *in vitro* assay. Around 38 compounds displayed activity in the initial screening however, only three compounds (S017-0218 (MDA-MB231), S016-0146 (DLD1) S017-0463 (MCF7)) showed selectivity index of more than 5 when screening performed in normal Vero cells. Further optimization of the series is under progress. Four compounds were submitted for specific activity against mTOR out of which one compound displayed promising response.

2.2 CNS and CVS

2.2.1 GPCR profiling of NCEs

During this year total 345 compounds were evaluated on panel of GPCRs targeting various facets CVS and CNS disorders, such as Obesity, depression and cognitive impairments. In this profiling we have obtained two new hits S-017-0602 (pIC_{50}<6.5) and S-017-0603 (pIC_{50}<6.5) were identified as 5-HT2C agonists. These hits are being further optimized to identify a lead candidate for obesity. Profiling of more than 200 compounds on 8 GPCRs, resulted in identification of a series of highly biased kappa opioid receptor (KOR) agonist possessing analgesic properties without any adverse effect profile. SAR for the series is being studied for identifying an optimized lead for the treatment of pain disorders.

Besides the ongoing program for screening of NCEs against various targets, two lead molecule: 1) S015-2448 for treatment resistant depression; 2) S013-1593 for obesity, are preclinical stage of development.

2.2.2 Discovery of Small Molecule PCSK9 Inhibitors

Around 120 compounds were screened for PCSK9 inhibitory activity. Two compounds S-017-540 and S-017-594 were identified ashits as they significantly attenuated LDL uptake and PCSK9- LDLR interaction in a phenotypic and binding assay, respectively. These hits are being pursued to develop more potent analogues towards development of lead in the area.

2.2.3 Anti-inflammatory Screening

A total of 28 compounds were evaluated for the anti-inflammatory activity but none displayed significant activity. In a specific project (MoES), 310 compounds were submitted for assessment of anti-TNF activity out of which two compounds at 10 μM significantly inhibited LPS-induced TNF production. The validation of the activity is underway.

2.2.4. Anti-Angiogenesis Screening

Out of 210 compounds evaluated for their effect on angiogenesis, 8 hits were identified in the primary screening assay where endothelial tube formation was monitored in culture. Further validation studies of these hits are in progress.

2.3 Tuberculosis and Microbial Infections

2.3.1 Tuberculosis

A total of 732 compounds were screened against *M. tuberculosis* by MABA (Resazurin) assay in which 712 compounds did not show any response within the prescribed cut off limit of 50 mM. Nonetheless, 9 compounds displayed inhibition at a concentration of 50 mM whereas 5 and 4 compounds showed inhibition at 25 mM and 12.5 mM, respectively. However, there was no compound which displayed inhibition at a lower concentration beyond this.

2.3.2 Antimicrobial

A total of 2065 compounds/extracts were evaluated for *in vitro* antifungal and antibacterial activity by micro-broth dilution method using standard protocol (as per CLSI guide lines) initially against 7 human pathogenic bacteria viz. 1. *E. coli* (ATCC 9637), 2. *Pseudomonas aeruginosa* (ATCC BAA-427), 3. *Staphylococcus aureus* (ATCC 25923), 4. *Klebsiella pneumoniae* (ATCC 27736), 5. *S. aureus* (ATCC 700699 MRSA), 6. *S. aureus* (ATCC

29213), 7. *S. aureus* (ATCC 33592 Gentamycin resistant) and six human pathogenic fungi viz., 1.*Candida albicans* (ATCC 10231), 2.*Cryptococcus neoformans*, 3. *Sporothrixschenckii*, 4.*Trichophyton mentagrophytes* (ATCC 9533), 5. *Aspergillus fumigatus*, and 6. *Candida parapsilosis* (ATCC-22019). A total of 11 synthetic compounds exhibited antibacterial activity (MIC range 0.39-6.25 µg/ml) against *S. aureus* (including resistant) strains whereas four extracts displayed antibacterial activity in the range of 3.90-62.50 µg/ml.

2.4 Parasitic Infections

2.4.1 Malaria

Synthetic compounds (*In-vitro*) Screening

A total of 552 synthetic compounds prepared at the institute and 101 compounds received from different research organizations across the country, were screened against *P. falciparum*in cell-based assay. Out of these, 31 in-house compounds and 4 compounds from external source elicited promising antiplasmodial activity. These compounds belonged to diverse chemical classes such as 7-chloro-4-aminoquinoline, glyocongugated, oxopropylidene oxindoles, isoxazoles, purine based homologous nucleosides and aminopropanol derivatives.

Six compounds of 7-chloro-4-aminoquinoline derivatives were found to exhibit the IC_{50} between 0.06- and 0.39µM against CQ sensitive (*Pf*3D7) strain and 0.60 to 0.06µM, against CQ resistant (*Pf*K1) strain. Eleven glyocongugated oxopropylidine oxindoles derivatives exhibited IC_{50} values between 0.18 and 0.95 µM against CQ sensitive (*Pf*3D7) strain and 0.15, to 1.19 µM against CQ resistant (*Pf*K1) strain. Two purine based homologous nucleosides derivatives exhibited IC_{50} values 0.88 and 1.01 µM against CQ sensitive (*Pf*3D7) strain and 1.13 and 2.57 µM, respectively against CQ resistant (*Pf*K1) strain. Several compounds belonging to aminopropanol class displayed antiplasmodial effect with IC_{50} ranging from 0.04 to 1.18 µM against *Pf*3D7 and 012 to 1.73 µM against *Pf*K1 strain. These molecules were also evaluated for cytotoxic profile against VERO cell line.

Natural Products (*In-vitro*) Screening

Extracts of 101 plants received from KIET School of Pharmacy, IGNTU, IISER Mohali, IIT-Bombay, Nirmala College of Pharmacy and CSIR-NCL were screened for antiplasmodial efficacy against *Pf*3D7 and *Pf*K1 strains of *Plasmodium falciparum*. Four extracts showed moderate effect only.

***In-vivo* Screening**

A total of fourteen compounds displaying significant *in vitro* antiplasmodial effect were subjected to *in vivo* evaluation against were tested against *P yoelii* N67 in Swiss mice at a dose of 100 mg/kg dose. Although a few compounds displayed activity at the 4th day of administration, none of them had curative effect after 28 days.

2.4.2 Leishmania

***In-vitro* Screening**

274 Novel synthetic moieties representing several prototypes viz., Quinolines, flavonoids, diverse azoles, dihydropyridine, chalcones, β-amido derivatives, β–carbolines and their hybrids, allyl alcohol derivatives, pyridoimidazolephen antherenes and sulfonyl benzamides were screened *in vitro* against promastigotes and amastigotes from which 17 compounds exhibited IC_{50}< 10 µM and SI index > 5 which was set to be the cut-off.

***In-vivo* Screening**

These 17 compounds were evaluated for *in vivo* efficacy against *L. donovani* in hamster model at 50 mg/kg intra peritoneal. However, none of the compound showed potent effect as compared to the standard drug.

2.5 Reproductive health and endocrine disorders

2.5.1 Osteoporosis

A total of 81 compounds were evaluated for alkaline phosphatase activity in osteoblast cell of which 26 were found to be active. A few of these compounds were checked further for their efficacy in mineral nodule formation assay by Alizarin staining method. Whereas two compounds were found to be active, five compounds display formidable activity.

3. Hit to Lead Identification Program

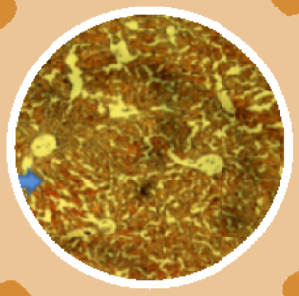
3.1 Lead optimization of CDRI 98-288 for anti-Leishmanial activity

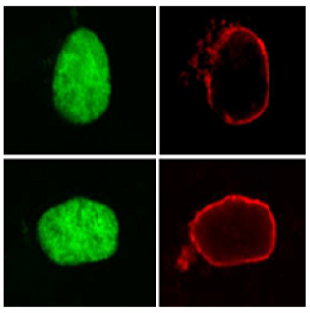
An organized program to study the structure activity relation of the new analogues of compound **98-288** was taken. From this study it was delineated that compound **96-261** was relatively better than the original compound. Detailed evaluation of the efficacy revealed that 96-261 has better solubility and shows remarkable *in vivo* efficacy in a dose schedule of 100 mg/kg bid for 5 days. The ED_{50} was observed to be 41.50 mg/kg whereas compound was observed to be free of any hERG liability and does not show mutagenicity. The compound was observed to be safe at a dose of 50 x ED_{50}. The detailed pharmacokinetic and tissue distribution studies are underway.

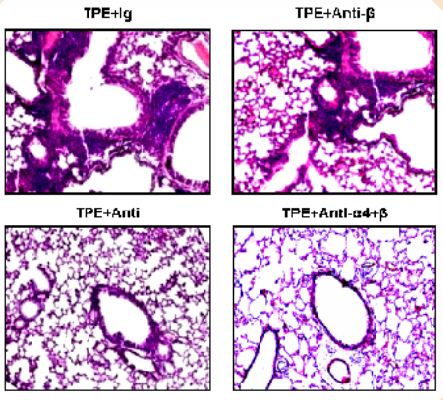
3.2 Lead optimization of CDRI S-017-540 as PCSK-9 inhibitor

In an effort to develop SAR for the identified hits as PCSK9 inhibitors from a commercial library, compound S-017-540 was identified as potent inhibitor from one of the series. In view of developing SAR around this molecule a project has been secured under which more analogues are being prepared and evaluated to identify a novel dyslipidemic agent.

Malaria and Other Parasitic Diseases







Area Coordinators

Dr Saman Habib

Dr Neena Goyal

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1

Malaria and other Parasitic Diseases

Area Coordinators: Dr Saman Habib & Dr Neena Goyal

The project area cover investigations on three vector-borne parasitic infections that are a public health concern in the country- malaria, leishmaniasis and filariasis. The CSIR-CDRI programme is geared to understand metabolic pathway and processes in the parasites to identify and validate novel putative intervention sites, explore host-parasite interaction and drug resistance and address immunoprophylaxis approaches for vaccine design.

1.1 Malaria

1.1.1 [Fe-S] cluster assembly and transfer via the apicoplast SUF pathway of cluster biogenesis

[Fe-S] clusters are critical modifications that mediate electron transfer reactions in important catalytic proteins. The SUF pathway of [Fe-S] biogenesis is localized to the apicoplast and experimental evidence for its function in the organelle was provided by us earlier. We delineated the pathway from the first step of sulphur mobilization to cluster assembly onto a SufB-C-D complex and characterized transfer of assembled [4Fe-4S] onto a target apoprotein. Two transfer proteins, *Pf*SufA and *Pf*Nfu, could serve as carriers of the cluster with the *Pf*Nfu dimer having higher transfer efficiency. A conditional knockout of *Pf*SufS caused a severe sporozoite development defect in the mosquito vector and inhibition of *Pf*SufS-*Pf*SufE activity was detrimental to parasite growth. The SUF pathway is absent in the human host, is essential for parasite survival in human blood stages and in the vector, and is thus a possible intervention site against malaria (Charan et al., 2017, *FEBS Journal* 284: 2629-2648).

1.1.2 Assembly GTPases in biogenesis of mitoribosomes of the malaria parasite

Apicoplast and mitochondria of the malaria parasite are sites of active protein synthesis but exhibit differences in translation factor requirement and ribosome composition in comparison with organelles of other eukaryotes (Habib et al., 2016, *Trends in Parasitology* 32: 940-952). *Plasmodium* mitochondria have highly fragmented rRNA and are predicted to carry a reduced ribosomal protein repertoire. Thus, ribosome biogenesis in the parasite mitochondrion is of interest. Two nuclear-encoded putative ribosome assembly GTPases- *Pf*EngA and *Pf*Obg1 were localized to the organelle; their *in vitro* and *in vivo* interaction with the mitoribosome was confirmed, GTPase activity was established, and the influence of nucleotide on ribosome interaction and the role of ribosome-mediated conformational change on GTP hydrolysis by the factors was investigated. In addition to its ribosome association, *Pf*Obg1 also exhibited DNA-binding activity and interacted with the mitochondrial genome suggesting moonlighting function(s) of the factor.

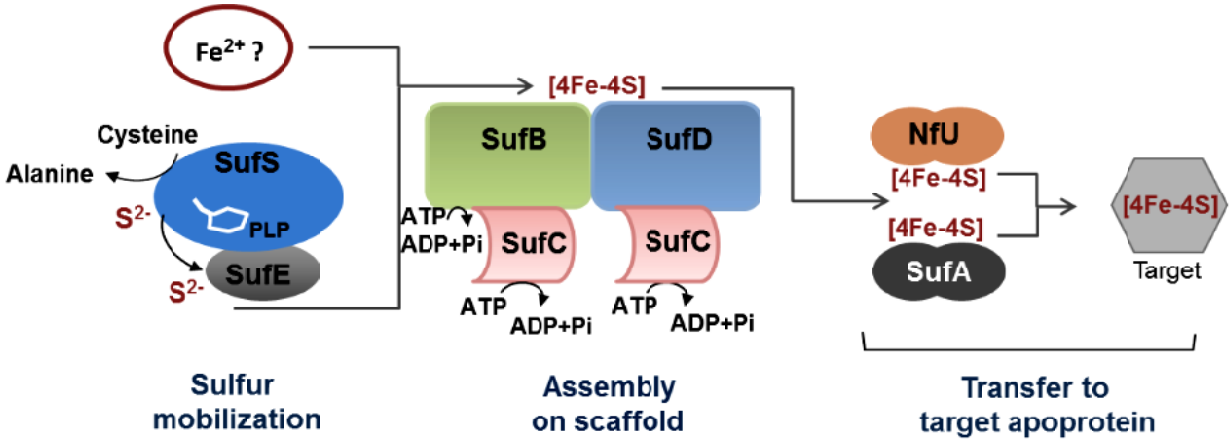


Fig. : The SUF pathway of [4Fe-4S] biogenesis in the apicoplast of *Plasmodium falciparum* (Charan *et al.*, 2017)

1.1.3 Understanding the role of non-canonical nucleic acid structures in human malaria parasite *Plasmodium falciparum*

High predominance of non-canonical structures like quadruplexes in telomeric and subtelomeric regions in *P. falciparum* provides hints about their critical roles in telomere architecture and function. We focused our efforts on pharmacological targeting of telomeric quadruplexes to selectively disturb parasite's telomere homeostasis. We observed that bisquinolinium derivatives of 1,8-naphthyridine and pyridine affected the stability and molecular recognition properties of telomeric quadruplex. This quadruplex–ligand interaction disturbs telomeric/subtelomeric chromatin organization and induces DNA damage that consequently leads to parasite death with minimal toxicity in human cells. Our study draws attention towards exploration of pharmacological targeting of noncanonical structures in the parasite's telomeres as a potential antimalarial strategy. This approach may also help in combatting emerging drug resistance problems, because acquiring random mutations to disrupt the secondary structures in its telomeric region will dramatically reduce the survival fitness of the parasite. (Anas et al, *Biochemistry* 2017, DOI: 10.1021/acs.biochem.7b00964)

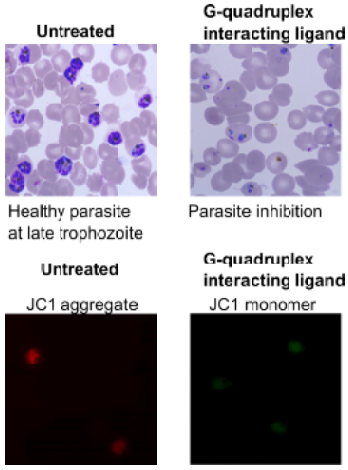
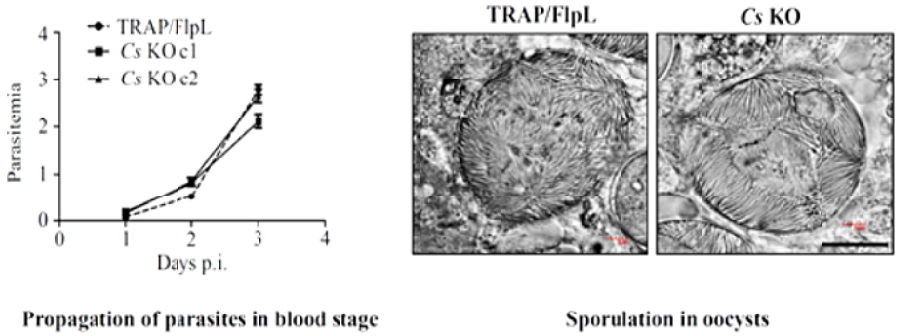


Fig. : Microscopy images of giemsa and JC1 dye stained smears of untreated and G-quadruplex interacting ligand treated *P. falciparum*.

1.1.4 Reverse genetics approaches for the development of novel therapies against malaria

Characterization of two novel targets using reverse genetics approaches is completed. Owing to essential nature of chorismate synthase (CS) and cysteine desulfurase SufS, we generated conditional knockouts of both the genes by utilising conditional mutagenesis system of yeast Flp/FRT in *Plasmodium berghei*. We demonstrate an unexpectedly dispensable role of CS in *Plasmodium*. Our studies reiterate the need to establish an obligate reliance on *Plasmodium* metabolic enzymes through genetic approaches before their selection as drug targets (accepted in International Journal for Parasitology). Conditional knockout of SufS, the enzyme catalysing the first step of sulfur mobilization, was severely impaired in the development of sporozoites in oocysts. Our findings establish essentiality of SUF machinery in the mosquito vector (*FEBS J*, 2017, 284:2629-2648).



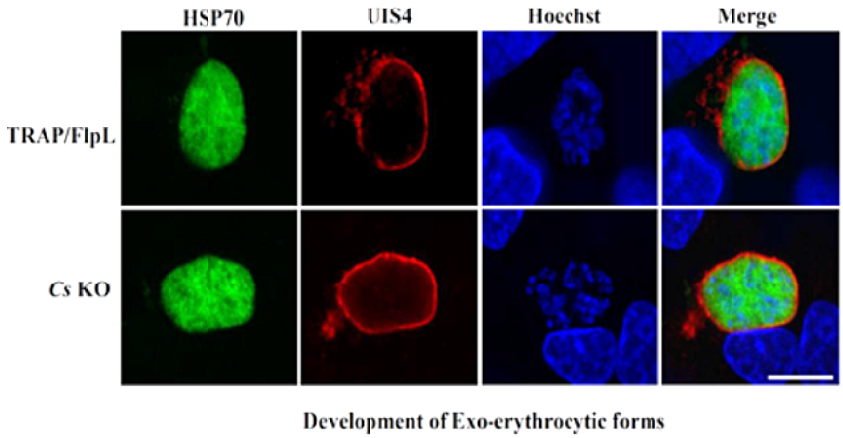


Fig.: Phenotypic characterisation of *Cs* KO parasites.

1.1.5 Identification of a new protein as target for antimalarial drug development:

Oxidative stress is a state of redox imbalance in various diseases is caused by increased reactive oxygen species (ROS). The disease malaria is caused by deadly protozoan parasite *Plasmodium sp.* is also exceedingly receptive to oxidative stress during their intra erythrocytic life stages. In *Plasmodium sp.* ROS modulating protein-1 is distinct from host, due to its ~30% similarity with human and other eukaryotes, this protein could be considered as drug target and responsible for increasing the level of ROS in cells. Despite this, the detailed study of ROS modulating protein from malaria parasite has not been performed till date. In present study, we have cloned and sequenced ROS modulating protein from rodent malaria parasite *Plasmodium vinckei*. For detailed characterization, protein was over expressed and purified. Since direct or indirect sources of ROS generation cause excessive oxidative stress on malaria parasites and therefore are suggestive of a valid rationale to develop anti malarial drugs. We hypothesize that the existing drugs or new compounds against *Plasmodium* ROS modulating protein will not be toxic to host due to nonconserved structural and functional attributes of parasite and host ROS modulating protein. So, further exploration of this protein may help to understand the ROS mediated killing of parasite and might be a potential target for anti-malarial therapy.

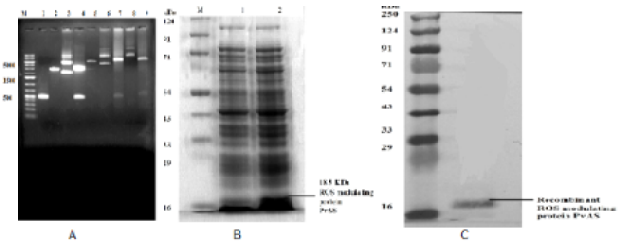


Fig.: Cloning, purification and Western immunoblot analysis of *P. vinckei 'ROS modulating'* protein.

1.1.6 Detection of proteins responsible for pathogenesis in MDR rodent malaria

In continuation of our earlier work where we had reported that the level of liver triglyceride and total lipid was increased during *Plasmodium yoelii* infection at high parasitaemia and it was hypothesized that some factors may be released in serum during infection, which may be responsible for this increase (Life Sciences 1990,47(1): 25-28). Further, we extended our studies to identify these factors and three parasitic proteins have been identified; flavoprotein, heat shock protein and hypoxanthine guanine phosphoribosyltransferase (HGPRT). Out of these three proteins, only flavoprotein and heat shock proteins had shown maximum sequence identity and these were further explored. In order to identify their role in liver lipid infiltration and ultimately in pathology, mice were immunized with 13 B-cell epitope (peptides) of flavoprotein and recombinant heat shock protein. After challenge with parasites, only four peptides had shown potent parasite inhibition i.e. P1, P6, P7, and P9 displayed 96.9%, 82.7%, 83.2% and 87.3% inhibition on day 4 respectively, relative to infected control. Out of 13 peptides P3, P6, P7, P8, P12 significantly inhibited liver TG concentration, inhibition was 8, 4, 4, 2.6, and 4.7 folds respectively as compared to infected control. Further, results were confirmed by histochemical staining of these liver sections with Oil Red O. While *Plasmodium* HSP immunized & challenged mice did not show effective parasite and liver triglyceride inhibition. Our study implies that both the proteins were released in serum but only some of the B-cell epitope of flavoprotein have a role in inducing liver triglyceride as their antibodies inhibited this particular pathology. This protein can be used in concoction vaccine with Plasmodium surface proteins and may augment their protective activity.

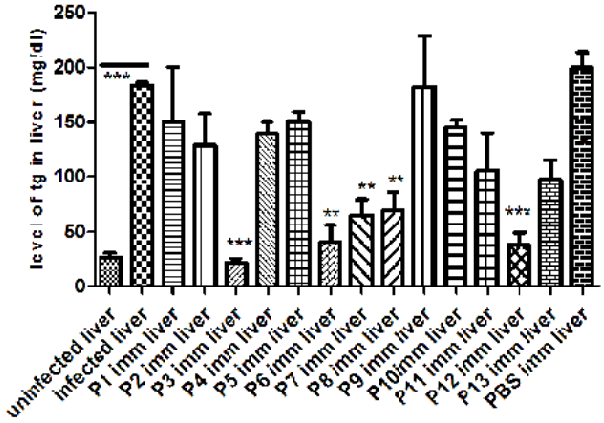


Fig.: Level of liver triglyceride after immunization with 13 B-cell epitopes of Plasmodiumflavoprotein

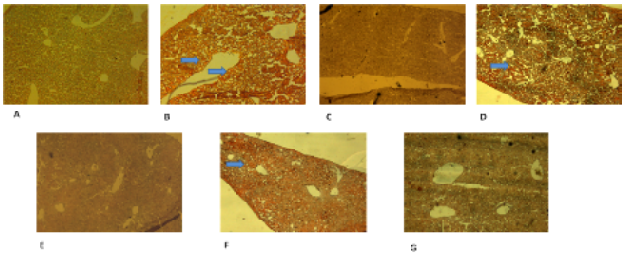


Fig. : Oil Red O stained liver section of flavoprotein immunized & challenged mice: (A) liver section of uninfected mouse, (B) liver section of *Py* MDR infected mouse, (C) liver section of P3 immunized mouse, (D) liver section of P6 immunized mouse, (E) liver section of P7 immunized mouse, (F) liver section of P8 immunized mouse and (G) liver section of P12 immunized mouse. (C, E, G) displayed very little deposition of triglyceride similar to uninfected liver (A).(D, F) displayed.

1.2 *LEISHMANIASIS*

1.2.1. Discovery and development of antileishmanials

274 Novel synthetic moieties representing several prototypes viz., Quinoline metronidazole, flavonoids, dihydro-pyridine, chalocone, indanone, pyrazoles, quinoline, β-amido derivatives, β–Carboline, triazole phenylthiazolidin, Hydrazine carbothioamide, Indole

acrylamide, Pyranoside triazole, Indenopyrazoles, Isoxazole, Isoflavono, Quinolone, Indole tetrazole, Qunizolin, Oxazole, Allyl alcohol, Pyridoimidazole, Imidazolidine acetamide, 9-ketparyl phenantherenes, α Bromo chalcones, Quinolines, 3-nitro-4-quinolone and quindolinone, Tetrazol sulfonyl benzamide were screened *in vitro* against promastigotes and amastigotes. Out of these, 17 compounds exhibited IC_{50} < 10μM and SI index > 5.

Total 17 compounds were evaluated for their *in vivo* efficacy in L. *donovani* / Hamster model at 50mg/Kg I.P. However, none of the compound showed potent anti-leishmanial activity.

1.2.2. Mechanism of Drug Resistance

1.2.2.1. MAPK1 of *Leishmania donovani* interacts and phosphorylates HSP70 and HSP90 subunits of foldosome complex

Mitogen-activated protein kinases (MAPKs) are well-known mediators of signal transduction of eukaryotes, regulating important processes, like proliferation, differentiation, stress response, and apoptosis. In *Leishmania*, MAPK1 has shown to be consistently down regulated in antimony-resistant field isolates, suggesting that it has a role in antimony resistance. It negatively regulates the expression of P-glycoprotein-type efflux pumps in the parasite thus results in increase in antimony accumulation in the parasite, making it more vulnerable to the drug (*Antimicrobial Agents and Chemotherapy* 2015, 59, 3853-3863). Aiming to identify the possible targets(s) of LdMAPK1, we sought to isolate interacting partners by co-immunoprecipitation, gel electrophoresis and mass spectrometry. Out of fifteen analyzed protein bands, four were identified as subunits of the HSP90 foldosome complex, namely HSP 90, HSP70, STI and SGT. The interaction between MAPK1 and HSPs is sensitive to treatment with AMTZD, a competitive ERK inhibitor. Western blot analysis not only confirmed that LdMAPK1 interacts with HSP70 and HSP90 but also demonstrated that MAPK1 abundance modulates their expression. Interestingly, MAPK1 also displayed kinase activity with HSP90 or HSP70 as substrates. The study has implicated that LdMAPK1is involved in the post-translational modification and possibly in regulation of heat shock proteins (Scientific reports 2017).

1.2.3. Immunobiology

1.2.3.1. Development of Leishmania vaccine

Several Th1 stimulatory proteins that have been identified earlier and have shown prophylactic potential are being evaluated for their therapeutic efficacy. Out of four evaluated proteins, three (enolase, TPI, aldolase) have shown moderate therapeutic efficacy. These selected proteins are being evaluated as combination and fusion proteins to optimize their therapeutic effect.

1.2.4. Drug Target Identification and Characterization

1.2.4.1. Role of actin and actin-related proteins in *Leishmania*

Leishmania-actin has been considered as promising drug target. Towards validation of the same, its gene has been replaced with neomycin resistance gene. The selected clones show significant phenotypes that suggest role in the survival of Leishmania parasites. An actin-related protein was found to be localized exclusively in the Leishmania mitochondrion. Genetic analysis of this protein may indicate its role in mitochondrial calcium homeostasis.

1.2.4.2. γ-Glutamyl cysteine synthetase (GCS)

γ-Glutamyl cysteine synthetase, the protein involved in the first and rate-limiting step of GSH synthesis pathway, has been functionally characterized and inhibitors identified and experimentally validated. Optimization of these leads are being explored, while structural characterization are in progress (*J. Chem. Inf. Model*, 2017, 57(4); 815 – 825). Previous work in the group had also identified two protein-protein complexes in this pathway and their characterization are in progress.

1.2.4.3. Coronin

The coiled-coil domain of *L. donovani* coronin, an actin binding. protein with distinct cyto-skeleton-dependent / independent functions, suggested an inherent asymmetry, in addition to a novel oligomer association and topology (Fig.). Mutants were designed to specifically alter the asymmetry inducing residues and

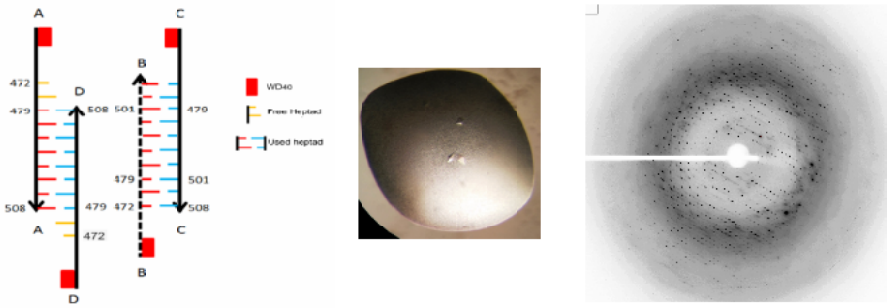


Fig.: Schematic representation of the asymmetry exhibited in the coiled-coil domain of the coronin tetramer (left). The N-terminal domain is represented as red rectangles. Crystal ofthe *T. brucei* coronin coiled-coil domain (middle) and its diffraction pattern (right).

diffraction data collected on three mutants. Crystals of the homolog from *T. Brucei* needs reframing 2 Å and structure solved.

1.2.4.4. Nucleoside diphosphate kinase

Structural and functional characterization of *L. amazonensis* Nucleoside Diphosphate Kinase were

followed with identification and validation of identified inhibitors (*J. Comput. Aided Mol. Des.* 31(6);547 – 562.

1.2.4.5. Molecular and biochemical Characterization of delta subunit of HSP60 (Chaperonins) of *L. donovani*

T-complex polypeptide-1 (TCP1), a group II chaperonin class of protein (HSP60 family) consists of 8 different subunits and is involved in intracellular assembly and folding of various proteins. In Leishmania, only the TCP1γ subunit has been cloned and characterized from our lab. LdTCP1γ formed high-molecular-weight complexes and is arranged into two back-to-back rings of seven subunits each and refolds luciferase in ATP dependent manner. LdTCP1γ interacts with actin and tubulin proteins, suggesting that the complex may have a role in maintaining the structural dynamics of the cytoskeleton of parasites [*FEBSJ*, 2015]. In present study another subunit of TCP1 of leishmania, TCP1δ was cloned and expressed. Complete ORF was PCR amplified, cloned and sequenced. The complete ORF was 1656 bp long that encodes for a protein of 551 amino acids with molecular weight of 59.6kDa. Protein domain search reveled that LdTCP1 δ has all the characteristic conserved domain of eukaryotic CCT4. However, LdTCP1 δ represent a distinct kinetoplastid group, clustered in a separate branch of the phylogenic tree. The recombinant protein was expressed in *E. coli.* and confirmed by western blot analysis with band at 60 kDa. Efforts are in progress to purified the recombinant protein in nation form and develop antibodies against it.

1.2.5. Targeted Drug Delivery

1.2.5.1 Hexadecylphosphocholine (Miltefosine) stabilized chitosan modified Ampholiposphere as prototype co-delivery vehicle for enhanced killing of *L. donovani*

In the area of leishmaniasis, we have developed Miltefosine (HePC -hexadecylphosphocholine) stabilized chitosan anchored nanostructured lipid carriers (NLC) of Amphotericin B (AmB) as co-delivery vehicle to enhance killing of *L. donovani*. Lipid nanoparticles are stable, biodegradable and biocompatible carriers offering excellent therapeutic efficacy. Here, a novel effort has been made to develop Miltefosine (HePC-hexadecylphosphocholine) stabilized chitosan anchored nanostructured lipid carriers (NLC) of Amphotericin B (AmB) as co-delivery vehicle to enhance killing of *L. donovani*. The entrapment efficiency of AmB was achieved upto 85.3% for HePC-AmB-CNLCs with mean particle size of 150.8 ± 8.4 nm, and zeta potential value of +28.2 ± 1.1 mV, respectively. The cumulative amount of AmB released at, even after the 24 h was less than 65% from HePC-AmB-CNLCs and Tween-80-AmB-CNLCs. Intravenous administration of HePC-AmB-CNLCs revealed the significantly increased localization of AmB in both liver and spleen when estimated. FACS study represented enhanced uptake of FITC-HePC-CNLCs over FITC-HePC-NLCs in J774A.1 cell lines. Highly significant *in vitro* and *in vivo* anti-leishmanial activity ($p < 0.05$ compared with Tween 80-AmB-CNLCs) was observed with HePC-AmB-CNLCs when tested against VL in *L. donovani*-infected hamsters. The haemolysis and cytotoxicity studies showed the safety of HePC-AmB-CNLCs and tween 80-AmBCNLCs. The findings suggested that it would be preferable to deliver AmB through HePC stabilized chitosan anchored nanostructured lipid carriers for rapid and effective treatment with decreased adverse effects.

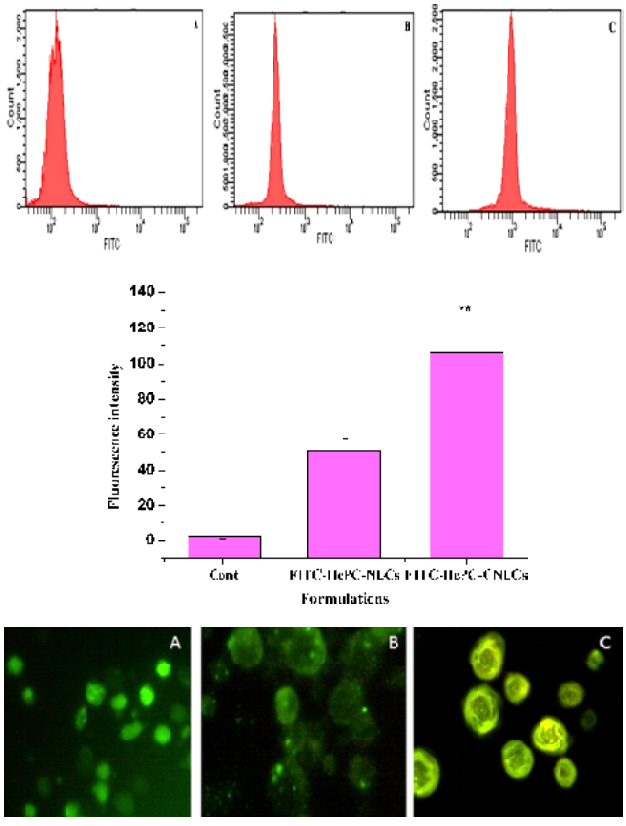
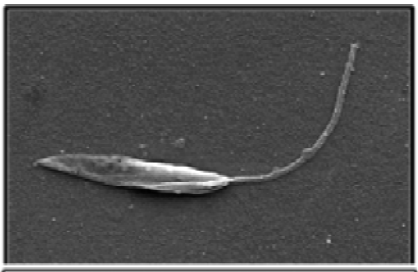
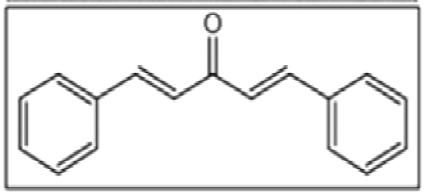


Fig. : (i) Flow cytometric diagram for uptake studies in macrophages J774 A.1cells. X-axis represents florescence inside the cells. Figure shows florescence in (A) control cells (B) FITC-HePC-NLCs, (C) FITC-HePC-CNLCs. (ii) Bar graph represents the mean fluorescent intensity in control cells, FITC–HePC-NLCs and, FITC–HePC-CNLCs (**p<0.01). Values shown are means and standard deviations (n = 3). (iii) Fluorescence microphotographs of (A) control (B) FITC-HePC-NLCs (C) FITC-HePC-CNLCs.

1.2.6. Mode of action of Dibenzalacetone (DBA)



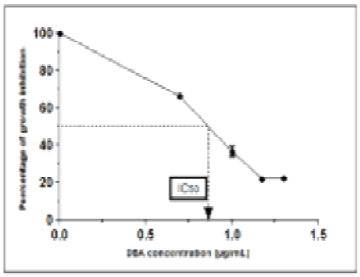
Leishmania donovani parasite



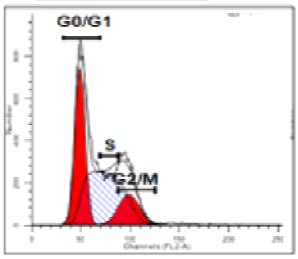
Dibenzalacetone (DBA)

Cell cycle analysis

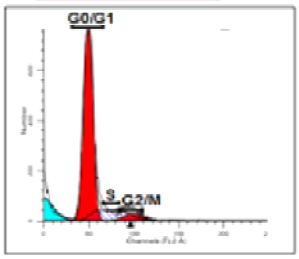
Antileishmanial activity of DBA in intracellular amastigotes



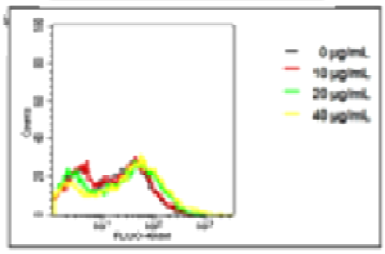
Wild type parasites



DBA treated parasites

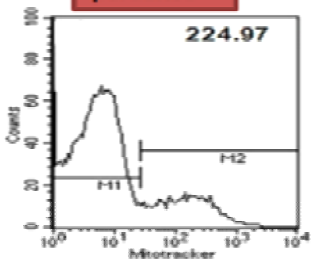


Intracellular Ca^{2+} level

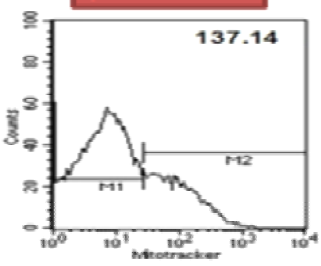


Mitochondrial membrane potential

Wild type parasites

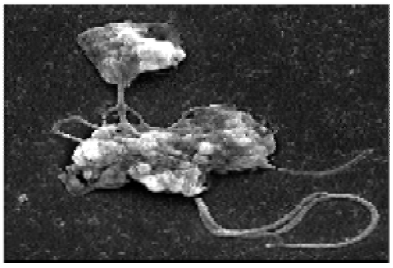


DBA treated parasites



Bioinformatics analysis (mirDIP http://ophid.utoronto.ca/mirDIP/)

ID	BI read count	CI read count	CPM BI	CPM CI	foldchange	log2FoldChange	P Value	Regulation
hsa-mir-15b	28	10	66.02	16.13	4.09	2.033	0	Down Regulated
hsa-mir-484	51	18	120.26	29.03	4.14	2.05	0	
hsa-mir-128-2	3	1	7.07	1.61	4.39	2.133	0.043	
hsa-mir-1470	8	2	18.86	3.23	5.85	2.548	0	



Cell -Death

1.2.7. Combination Therapy

1.2.7.5. Development of potential combination for the treatment of experimental visceral Leishmaniasis

Leishmaniasis chemotherapy remains very challenging due to high cost of the drug and its associated toxicity and drug resistance which develops over a period of time, therefore combination therapies (CT) are encouraged to be used for many diseases including Leishmania. In the present work, we have adopted a rational approach, to investigate the effect of combination of nanoformultaion of traditional Indian medicine (Ayurveda), a natural product curcumin and miltefosine, the only oral drug for visceral leishmaniasis (VL) using *Leishmania (Leishmania) donovani*/hamster model. Nanoformulation of curcumin alone exhibited significant leishmanicidal activity both *in vitro* and *in vivo*. In combination with miltefosine, it exhibited synergistic effect on both promastigotes and amastigotes under *in vitro* condition. The combination of these two also exhibited increased *in vivo* leishmanicidal activity which was accompanied with increased production of toxic reactive oxygen/nitrogen metabolites and enhanced phagocytosis activity. The combination also exhibited increased lymphocyte proliferation. The present study thus establishes the possible use of nanocurcumin as an adjunct to antileishmanial chemotherapy [Antimicrob. Agents Chemother. 2017].

1.3. *FILARIASIS*

1.3.1. Immunobiology of Lymphatic Filariasis

1.3.1.1. Role of α4 and β7 integrins in regulating Eosinophil trafficking into the lungs during Tropical Pulmonary Eosinophilia

Integrins regulate leukocyte trafficking during homeostasis and inflammatory conditions. We explored the role of α4 and β7 integrins in guiding eosinophil transmigration into the lungs during filarial manifestation of Tropical Pulmonary Eosinophilia (TPE). Mice exhibiting TPE manifestations were administered *in vivo* neutralizing antibodies against integrins α4 and β7 or their combination and immuno-pathological parameters were evaluated. Results showed an intact lung barrier, significantly lower lung inflammation and reduced eosinophil counts in the Bronchoalveolar lavage (BAL) fluid and lungs of mice receiving anti-α4+β7 treatment. Reduced eosinophil peroxidase and β-hexosaminidase activity, downregulation of inflammatory genes, lower

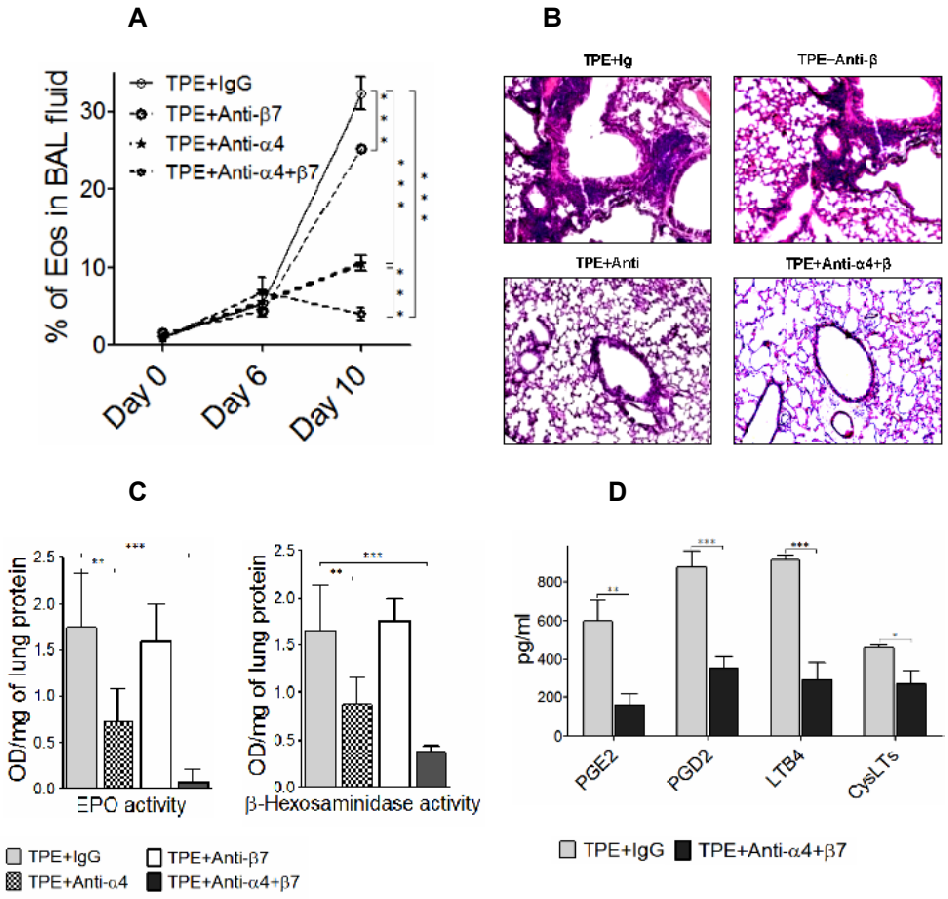


Fig.: (A) Percentages of eosinophils in the BAL fluid of mice (B) H-E stained lung sections of mice from different treatment groups at (10x) magnification(C) Eosinophilperoxidase and β-Hexosaminidase activity in the BAL fluid supernatant of different groups of mice. (D) Inflammatorylipid intermediates in the BAL fluid ofmice asmeasured by ELISA.

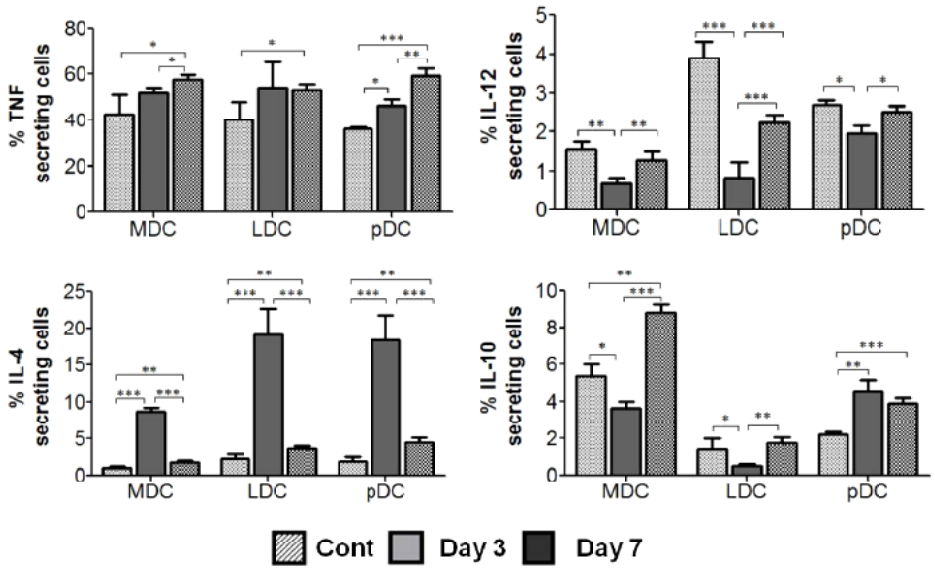


Fig. : Secretion of Th1 and Th2 cytokines by host DC subsets following infection with Bm-L3 (mDC=Myeloid DCs, LDCs=Lymphoid DCs, pDCs=Plasmacytoid DCs)

production of inflammatory lipid intermediates like prostaglandins E2 and D2, leukotriene B4 and cysteinyl leukotrienes were also noted in anti-α4+β7 treated mice. Reduced accumulation of central memory, effector memory, regulatory T cells and lower production of IL-4, IL-5 and TGF-β were other cardinal features of anti-α4+β7 treated mice lungs. Flow cytometry-sorted lung eosinophils from anti-α4+β7 treated mice showed higher apoptotic potential, downregulated anti-apoptotic gene Bcl-2 and exhibited reduced F-actin polymerization and calcium influx as compared to IgG controls. In summary, neutralization of α4+ β7 integrins impaired the transmigration, activation and survival of eosinophils and reduced TPE induced pathology in mice lungs. (*Sharma et al., Eur J Immunol, 2017*).

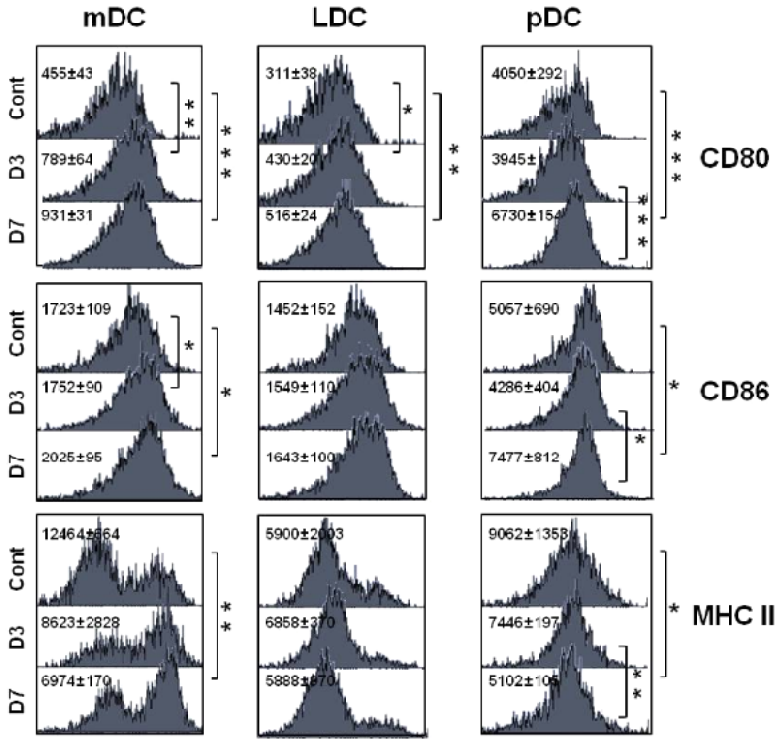
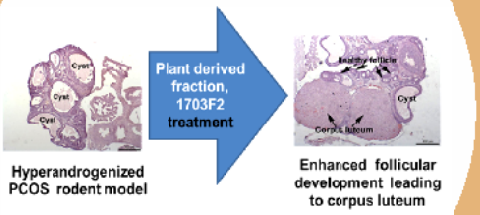


Fig.: Expression of co-stimulatory and maturation markers on host DC subsets following infection with Bm-L3. Numbers represent Median Flourescence Intensity (MFI) values of the respective marker at the indicated time points for each DC subset (mDC = Myeloid DCs, LDCs = Lymphoid DCs, pDCs = Plasmacytoid DCs).

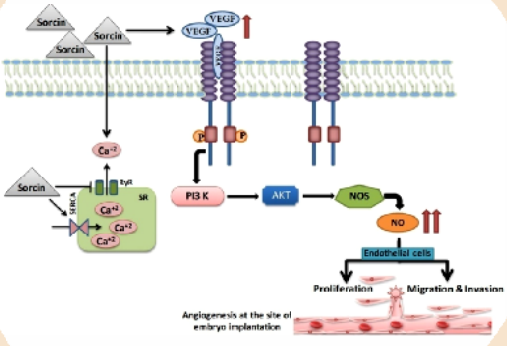
Reproductive and Bone Health Research

(Designed prototype, e)



Hyperandrogenized PCOS rodent model

Enharced follicular development leading to corpus luteum



Area Coordinators

Dr Naibedya Chattopadhyay

Dr Anila Dwivedi

Research Team

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2

Reproductive and Bone Health Research

Area Coordinators: Dr Naibedya Chattopadhyay & Dr Anila Dwivedi

Preclinical drug discovery program in Reproductive health & Bone health research area is focused towards developing novel strategies (NCE, phyto-pharmaceuticals) for ovarian disorders, endometrial disorders, infertility management & post- menopausal osteoporosis. The programme also aims to generate new knowledge on male and female reproductive physiology relevant to fertility regulation, reproductive disorders and to impart new knowledge on metabolic bone disease particularly post-menopausal osteoporosis and associated fracture.The research activities include following major objectives :

2.1 Reproductive Health Research

- Understanding the molecular signaling of endometrial receptivity for blastocyst implantation in addition to endometriosis, premature ovarian failure (POF) and polycystic ovary (PCOS) conditions.
- Identification and characterization of the oviductal factors playing role in sperm capacitation, fertilization, early embryonic development and understanding the basic mechanisms involved therein
- Identification of new targets for fertility regulation – Study of basic mechanisms governing spermatogenesis, sperm energetic, to understand the genetic and epigenetic causes of male infertility.

2.2 Bone Health Research

- The discovery of osteogenic proteins from bone marrow osteoprogenitors and osteogenic factors from plasma using animal models, proteomics and metabolomics approaches.
- Understanding the novel pathways that play critical role in osteoporosis, and to identify and characterize novel miRNAs involved in osteoblast differentiation.

2.1. Reproductive Health Research

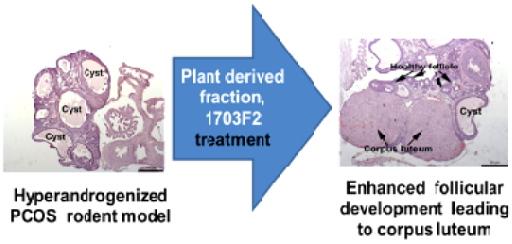
2.1.1. Progress in New Drug Development & Translational Research

2.1.1.1. Management of the polycystic ovarian syndrome through natural products.

Polycystic ovarian syndrome (PCOS) is a syndrome of the ovary with no ovulation and multiple follicular cysts in the ovary and contributes infertility in women with prevalence of 10% world-wide. This is considered to be a manifestation of the metabolic and endocrine system. PCOS give rise secondary disorder as well, which contributes to infertility in female. PCOS can affect a woman's long-term health in various ways such as anovulation (infertility), insulin resistance, diabetes, heart-attack or stroke and risk of developing endometrial cancer. Although there is no specific treatment of PCOS, insulin-sensitizing drugs (ISDs) have been advocated for the long-term treatment of PCOS. In continuation of our natural products drug discovery program through the phyto-pharmaceutical mode for the management of PCOS, we have analyzed the efficacy of natural product (plant derived fraction, 1703F2) in the hyper-androgenized PCOS model in SD rats. We observed improved ovarian follicular development and corpus luteum suggesting a potential phytoextract (fraction), 500mg/kg body weight, for the ovarian health improvement in the PCOS management. Further, work on the pharamacological formulation to maximize the efficiency of the plant-derived fraction is in progress.

2.1.1.2. Discovering novel dually active scaffolds for reproductive health

Sexually transmitted diseases like trichomoniasis along with opportunistic fungal infections like candidiasis are major global health burden in female reproductive health. In this context a novel non-nitroimidazole class of substituted carbamothioic amine-1-carbothioic thioanhydride series was designed, synthesized, evaluated for their spermicidal (contraceptive), trichomonacidal and fungicidal activities. Though exhibiting mild spermicidal activity, the compounds were found to be more active than the standard drug metronidazole against *Trichomonas vaginalis*.



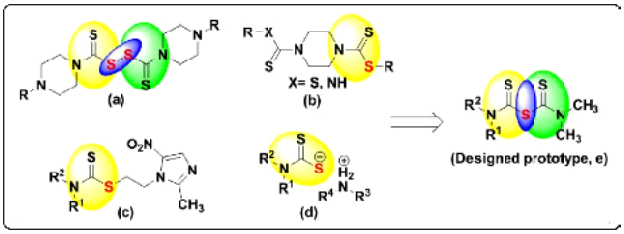


Fig.: Our previous lead molecules (a – d), which led to the design of prototype 'e'

The most active compound (Dimethylcarbamothioic 4-(pyrimidin-2-yl) piperazine-1-carbothioic thioanhydride) significantly inhibited free sulfhydryl groups present on *Trichomonas* and, in *in vivo* assay the most active compound significantly reduced infections at doses of 50 and 100 mg/Kg. A preliminary pharmacokinetic study has shown good distribution and systemic clearance of the compound in rats. The present study has discovered promising structures that could counter the drug-resistance against metronidazole in *Trichomonas vaginalis*. Further lead optimization may identify novel, effective, non-nitro imidazole class of anti-trichomonalagents (*Eur J Med Chem* 143 (2018) 632-645).

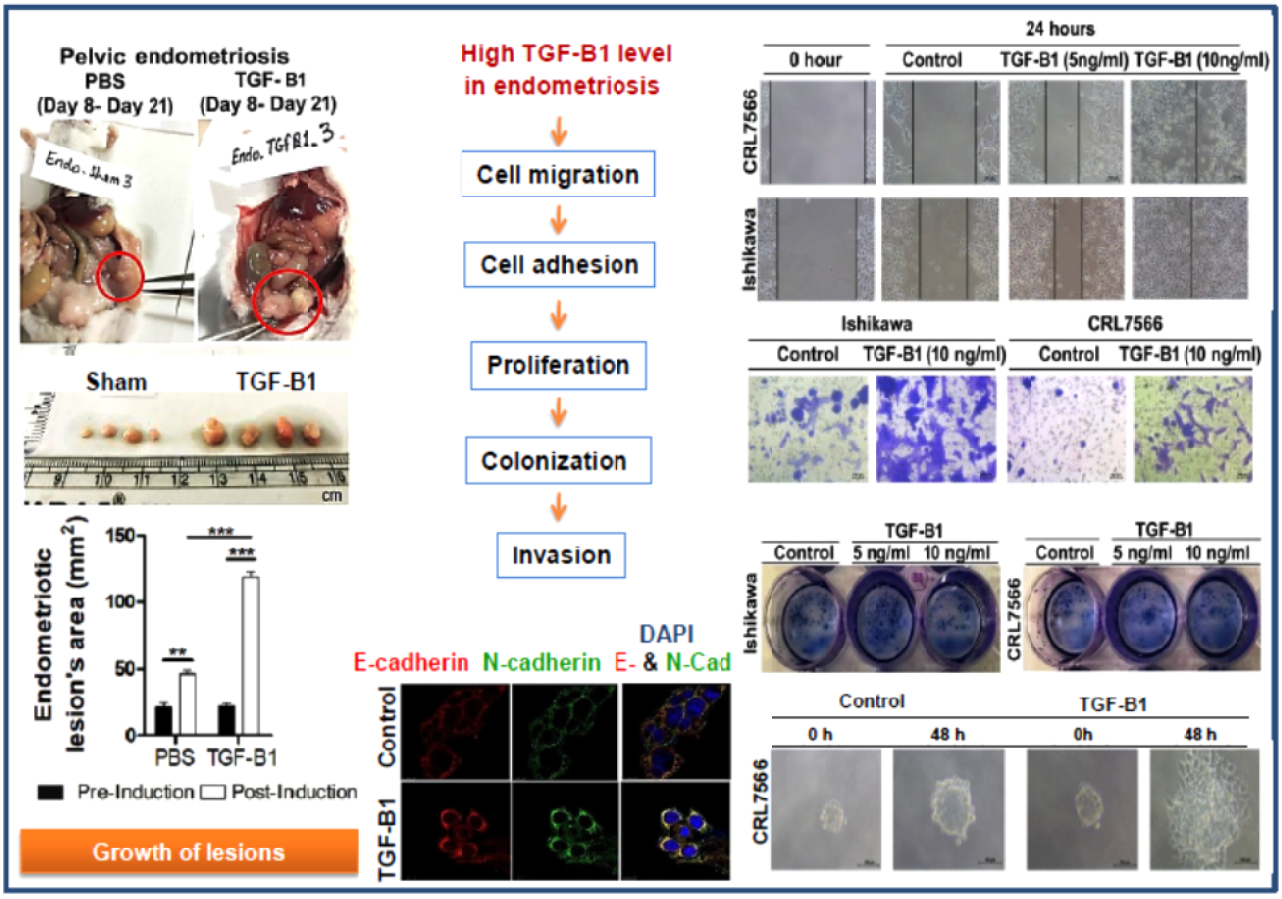
2.1.2. Progress on Advancing in Knowledge Frontiers

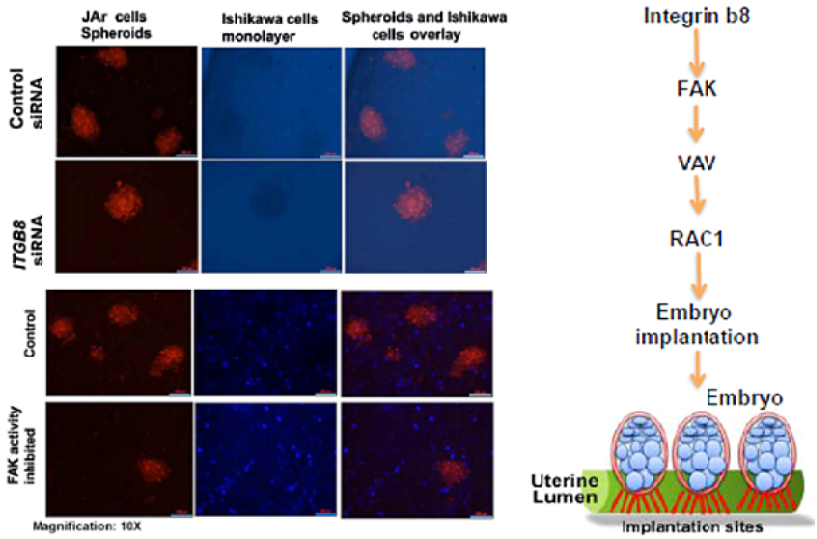
2.1.2.1. An elevated level of TGF-β1 promotes endometriosis development via cell migration, adhesiveness, colonization and invasiveness.

Endometriosis is referred as the growth of endometrial tissues outside the uterus that causes severe pelvic pain with chronic inflammation. Infertility and uterine cancer during reproductive age is the major consequence of endometriosis. The present therapies and management strategies are not sufficient to control or prevent this. There is no insight present on the cause and consequences and related molecular mechanism for endometriosis development. Here, we investigated that how high level of Transforming growth factor (TGF-β1) helps in the development of endometriosis. We established that high level of TGF-β1 promotes the invasion, adhesion, migration, and colonization at the ectopic location. Indeed targeting of TGF-β1 signaling cascade may become useful for target-based drug discovery for endometriosis patients.

2.1.2.2. Integrin beta8 (ITGB8) activates VAV-RAC1 signaling via FAK in the acquisition of endometrial epithelial cell receptivity for blastocyst implantation.

Endometrial receptivity is very crucial for the Embryo implantation leading to a successful pregnancy establishment. The epithelial lining of uterus facilitates the recruitment and invasion of the competent embryo during implantation. We found an important role of Integrin beta8 (ITGB8) and its signaling intermediates like FAK, VAV, and RAC1 in embryo implantation. The ITGB-8/FAK/VAV/RAC1 signaling axis is essential to bring about the endometrial receptivity, which subsequently assist in the embryo adhesion and attachment reaction on the endometrial epithelial cells, which suggests that ITGB8 is indispensable during embryos recruitment at the uterine epithelial lining (Sci Rep. 2017 May 15;7(1):1885).





2.1.2.3. Sorcin is involved during embryo implantation via activating VEGF/PI3K/Akt pathway in mice

Our earlier studies have demonstrated the cyclic variation and also the altered expression of sorcin in endometrium during early- to mid-secretory phase transition in women with unexplained infertility (Manohar et al 2014). The current study was undertaken to establish the functional role of sorcin in endometrial receptivity in mice. Results indicated that sorcin was highly expressed during the window of implantation in mice and functional blockage of sorcin caused significant reduction in number of implanted blastocyst. The receptivity markers (i.e. Integrinβ-3, HBEGF, IGFBP1, Wnt4 and Cyclin E) were found to be down-regulated in sorcin- knocked down uterine horn on day 5 as compared to untreated horn. The reduction in attachment and expansion of BeWo spheroids on RL95-2 endometrial cells with sorcin knock down, in *in vitro* model of endometrium–trophoblast interaction further supported these findings. The functional blockade of sorcin induced the intracellular Ca^{+2} levels in endometrial epithelial cells which indicated that altered Ca^{+2} homeostasis might be responsible for implantation failure. Sorcin silencing led to significant reduction in the expression of angiogenic factor VEGF and its downstream effector molecules i.e. PI3K, Akt and NOS. The migratory and invasive properties of HUVECs were abrogated by anti-VEGF or by adding culture media from sorcin blocked EECs, which indicated that sorcin might mediate angiogenesis during implantation. Taken together, sorcin is involved in regulation of Ca^{+2}-mediated angiogenesis via VEGF/PI3K/Akt pathway in endometrial cells and plays a crucial role in preparing the endometrium for implantation. (*J Mol Endocrinol*, In press)

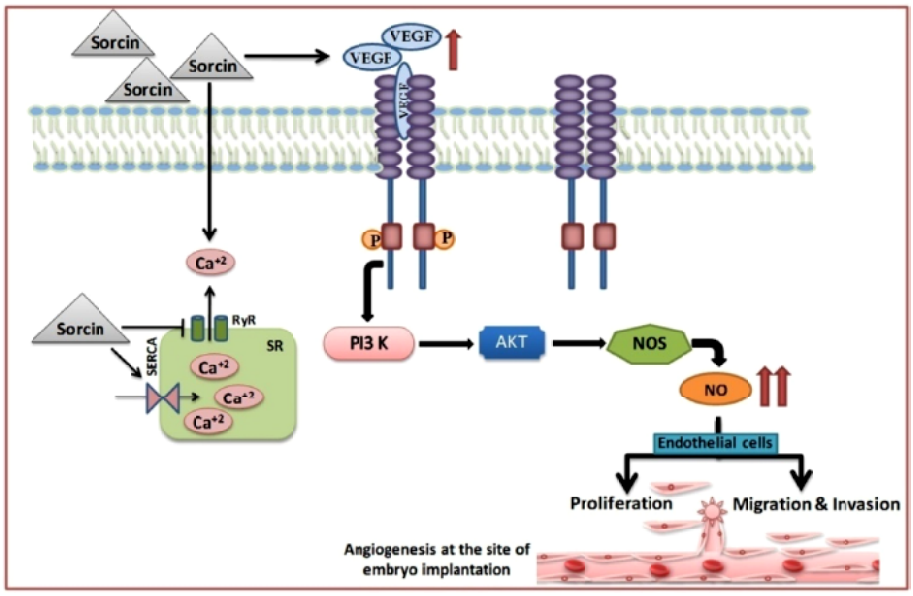


Fig.: Schematic hypothetical representation- Sorcin maintains calcium homeostasis (Colotti et al. 2014) and induces angiogenic factor-VEGF in endometrium and activates its downstream PI3K/Akt signaling cascade. Akt activates nitric oxide synthase (NOS) which in turn enhances the local nitric oxide (NO) level which regulates cellular proliferation, migration and invasion of endothelial cells and leads to the process of angiogenesis at implantation sites in the endometrium.

2.1.2.4. Selective estrogen receptor modulator Ormeloxifene suppresses embryo implantation via inducing miR-140 and targeting insulin-like growth factor 1 receptor in rat uterus

Ormeloxifene, the non-steroidal SERM contraceptive, inhibits endometrial receptivity and embryo implantation via countering nidatory estrogen. However, the molecular mechanism of ormeloxifene action responsible for its contraceptive efficacy still remains unclear. Herein, we aimed to identify the miRNAs modulated under the influence of ormeloxifene and to explore their role in endometrial receptivity and embryo implantation. By doing microRNA sequencing analysis, a total of 168 miRNAs were found to be differentially expressed in uterine tissue of ormeloxifene-treated rats, on day 5 (10:00 h) of pregnancy i.e. peri-implantation period. Out of differentially expressed miRNAs, miR-140 expression was found to be elevated in ormeloxifene administered groups and was selected for detailed investigation. *In-vivo* gain-of-function of miR-140 resulted in a significant reduction of implantation sites indicating its role in embryo implantation. In experiment on delayed implantation, estradiol was found to cause the down-regulation of

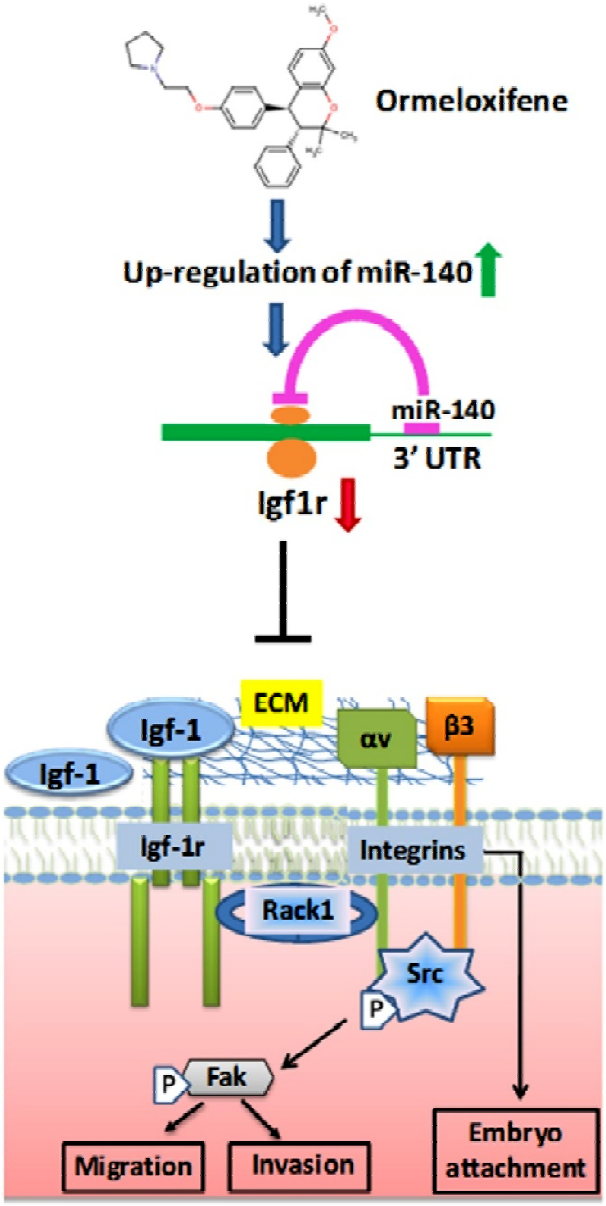


Fig.: Schematic representation of mechanism of action of ormeloxifene involved in suppression of endometrial receptivity and embryo implantation.

miR-140. It also suppressed the attachment and outgrowth of BeWo spheroids to RL95-2 endometrial cells. In transwell migration assay, miR-140 was found to be involved in suppression of migration and invasion of endometrial epithelial cells. The ormeloxifene treatment caused up-regulation of miR-140 along with down-regulated expression of its target IGF1R in endometrial epithelial and stromal cells which also led to the suppression of downstream effectors integrin β3 and FAK. In mimic miR-140 receiving horn, the reduced expression of IGF1R along with suppressed downstream integrin β3 and FAK was observed similar to that observed in uteri of ormeloxifene-treated rats. Our findings suggest that ormeloxifene-induced inhibition of embryo implantation occurs via inducing miR-140 and altering its target IGF1R in rat uterus.

2.1.2.5. Mutations in the prostate specific antigen (PSA/KLK3) correlate with male infertility

Prostate specific antigen (PSA/KLK3) is known to be the chief executor of the fragmentation of semenogelins, dissolution of semen coagulum, thereby releasing sperm for active motility. Recent research has found that semenogelins also play significant roles in sperm fertility by affecting hyaluronidase activity, capacitation and motility, thereby making PSA important for sperm fertility beyond simple semen liquefaction. PSA level in semen has been shown to correlate with sperm motility, suggesting that PSA level/activity can affect fertility.

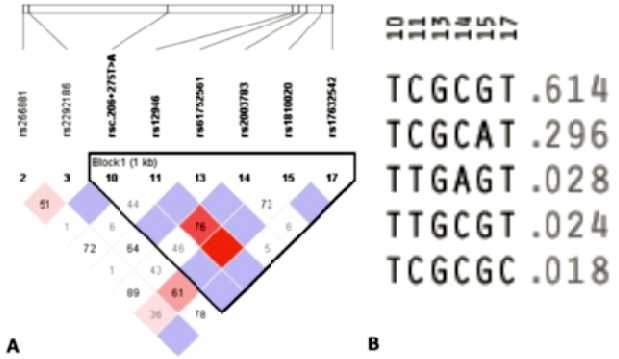


Fig.: LD analysis using four gamete rule method showing LD (A) and haplotypes (B)

However, no study investigating the genetic variations in the KLK3/PSA gene in male fertility has been undertaken. We analyzed the complete coding region of the KLK3 gene in ethnically matched 875 infertile and 290 fertile men to find if genetic variations in KLK3 correlate with infertility. Interestingly, this study identified 28 substitutions, of which 8 were novel (not available in public databases). Statistical comparison of the genotype frequencies showed that five SNPs, rs266881 (OR = 2.92, P < 0.0001), rs174776 (OR = 1.91, P < 0.0001), rs266875 (OR = 1.44, P = 0.016), rs35192866 (OR = 4.48, P = 0.025) and rs1810020 (OR = 2.08, P = 0.034) correlated with an increased risk of infertility. On the other hand, c.206 + 235 T > C, was more freuqent in the control group, showing protective association. Our findings suggest that polymorphisms in the KLK3 gene correlate with infertility risk. (*Sci Reports*. 2017; 7(1):11225.)

2.2. Bone Health Research

2.2.1. Progress in New Drug Development and Translational Research

2.2.1.1. S007-1500: Positioning as oral fracture repair agent

No oral fracture healing agent is available in market. Stimulates bone healing and formation at fracture site at a low dose of 1 mg/kg b/wt. Pilot study in female New Zealand rabbits exhibited a pattern of enhanced bone healing. Expansion studies to be initiated. S007-1500 was found to be safe in regulatory pharmacology and safety toxicology studies with no off target effects.

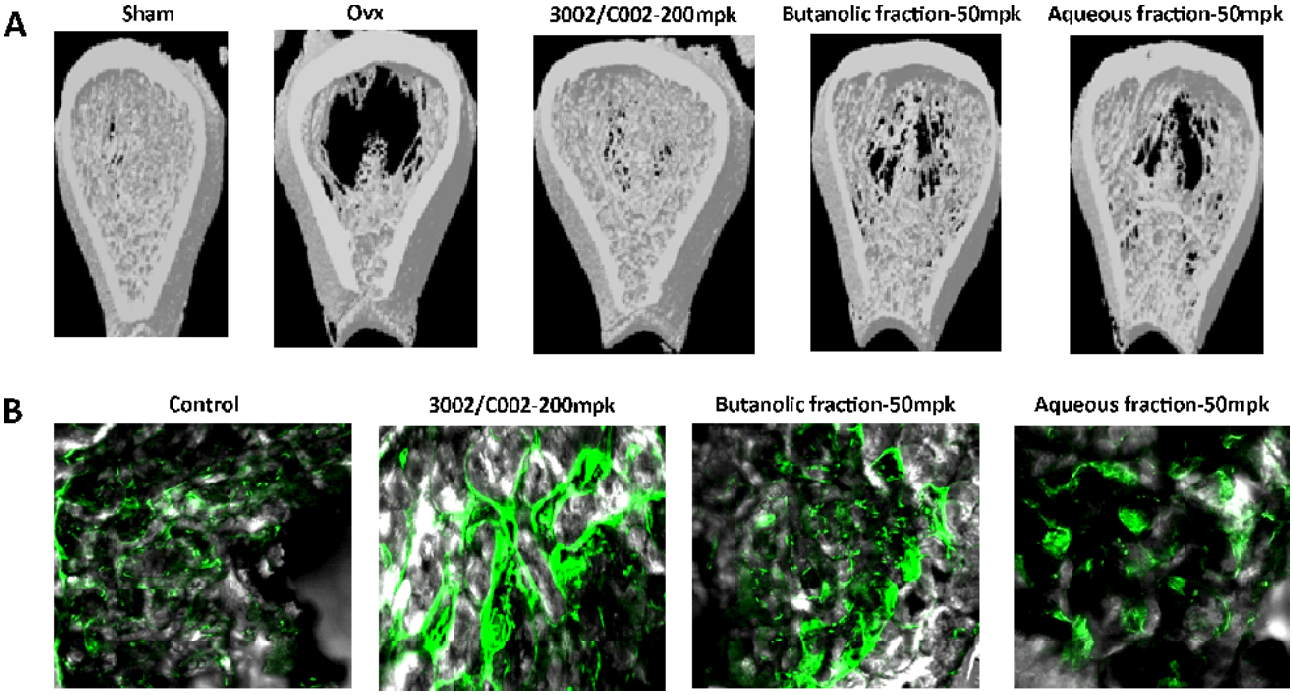


Fig.: Plant 3002/C002: Treatment of ethanolic leaf extract and butanolic and aqueous fraction lead to (A) restoration of ovariectomy induced deterioration of trabecular microarchitecture and (B) regeneration of new bone at injury site.

2.2.1.2. Plant 3002/C002

Ethanolic extract of leaves at 100 and 200 mg/kg body weight dose restored ovariectomy induced loss of trabecular bone micro architecture and improved bone biomechanical strength in osteopenic Sprague Dawley (SD) rat model for osteoporosis. A similar effect was observed with butanolic and aqueous fractions at doses of 50 mg/kg body weight. Apart from osteoprotective effect in osteopenic rats, ethanolic extract of leaves of plant 3002/C002 and its butanolic and aqueous fraction, exhibited faster bone healing properties.

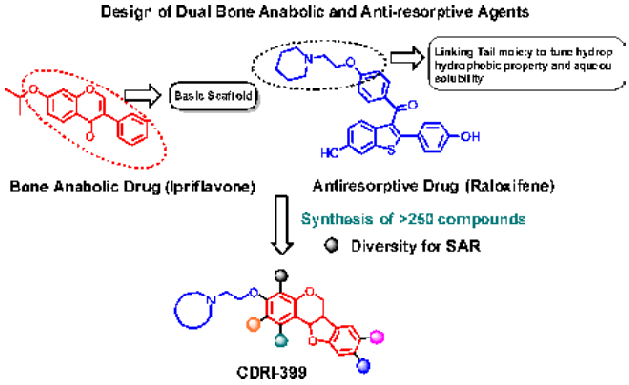
2.2.1.3. Plant C003/2492: A new product for Osteoarthritis

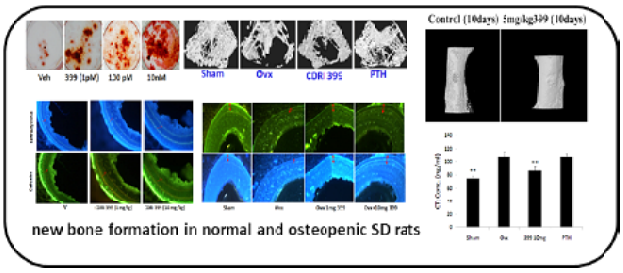
Osteoarthritis (OA) is a high prevalence disease with socio-economic impact. It afflicts mainly the weight-bearing joints such as hips and knees, and causes physical disabilities. It is a common rheumatologic problem with a prevalence of 22% to 39% in India. Despite, the identified risk factors the exact pathogenesis of osteoarthritis remains unclear. Currently, there is no effective treatment that can cure osteoarthritis leaving joint replacement as the only therapeutic option in patients with severe osteoarthritis. On the basis of histological, radio graphical, behavioral and molecular changes, it is concluded that SOE shows chondro-protecting effects in the subchondral bone and shifting the chondrocytes and cartilage homeostasis towards anabolism. It will be a promising option for the management of OA. The technology for this has been licensed to M/s Pharmanza Herbal Pvt. Ltd., Gujrat on 31st July 2017.

2.2.1.4. CDRI-S008-399: New dual bone anabolic and anti-resorptive agent to accelerate bone fracture healing

One in three female and one in eight males are affected from osteoporosis over the age of fifty, making India as one of the highest affected regions in the world. Osteoporosis increases the susceptibility to fractures. Besides, accidental fracture rates are highest in India. Our interest is focused on identification of stimulating factors which enhance bone mass and accelerate bone healing. For this, the strategy was to design compounds with dual bone anabolic and anti-catabolic effects. Taking leads from natural products, various compounds were synthesized by systematic variations of functional groups for the treatment of bone and related disorders. Among them, CDRI compound CDRI-S008-399 (US-8686028 dt 01.04.2014) remarkably promoted osteoblast differentiation and mineralization. CDRI-S008-399 is a hybrid molecule where basic scaffold of bone anabolic ipriflavone is linked to tail moiety of anti-resorptive drug, raloxifene. Currently there is no FDA approved drug available for fracture healing and thus an oral fracture healing agent is very much needed. Design, synthesis and extensive biological studies with CDRI-S008-399 established its dual anabolic and anti-catabolic effects in ovariectomized osteopenic Sprague Dawley rats. CDRI-S008-399 enhanced new bone formation and decreased the level of CTX, a collagen breakdown product and bone resorption marker. The compound acted via the stimulation of ER/p38MAPK/p-Smad signaling pathway. Most importantly, CDRI-S008-399 promoted rapid fracture

healing in mice femur osteotomy model (*Mol. Cell. Endocrinol*. 2017 Jun 15; 448:41-54). The compound has been licensed to M/s Ortho Regenics Private Limited, Hyderabad, where we will jointly develop the product by making a formulation of CDRI-S008-399 for the treatment of osteoporosis and Bone fractures. This novel product if successful will be highly beneficial for the mankind.





2.2.2. Progress on advancing in knowledge frontiers

2.2.2.1. To determine the role of miRNA in osteogenesis

Our studies have identified six miRNA candidates to negatively regulate osteoblast functions. These include miR-542-3p, miR-467g, miR-376c, miR-1187, miR-487-3p and miR-409-5p. These miRNAs inhibit osteoblast differentiation and mineralization affecting various signaling pathways and also suppress bone formation *in vivo*. Studies on miR-376c show that over-expression of miR-376c leads to repression of canonical Wnt/β-catenin signaling. Our overall results suggest that miR-376c targets Wnt-3 and ARF-GEF-1 and suppresses ARF-6 activation which prevents the release of β-catenin and its transactivation thereby inhibiting osteoblast differentiation. Apart from miR-376c, over expression of miR-467g in osteoblasts down regulated Runx-2 and Ihh signaling components. Furthermore, silencing of miR-467g led to significant increase in new bone regeneration and Ihh and Runx-2 localization at injury site in a day dependent manner. In conclusion, miR-467g negatively regulates osteogenesis by targeting Ihh/Runx-2 signaling (*Int J Biochem Cell Biol*. 2017;85:35-43).

2.2.2.2. To determine the role of anti-inflammatory/pro-inflammatory cytokines in pathogenesis of post-menopausal osteoporosis

We discovered that anti-inflammatory factors like IL-18 binding protein (IL-18BP) and IL-27 are reduced in osteoporotic subjects while pro-inflammatory cytokine IL-23 is elevated in osteoporotic conditions. We studied the effect of IL-27 supplementation on ovariectomized estrogen-deficient mice on various immune and skeletal parameters. IL-27 treatment in ovariectomized mice suppressed Th17 cell differentiation by inhibiting transcription factor RORγt. Supplementation of IL-27 activates Egr-2 to induce IL-10 producing Tr1 cells. IL-27 treatment prevented the loss of trabecular micro-architecture and preserved cortical bone parameters. Additionally, these results were corroborated in female osteoporotic subjects where we found decreased serum IL-27 levels along with reduced Egr-2 expression. Our study forms a strong basis for using humanized IL-27 toward the treatment of post-menopausal osteoporosis. We also determined the combining effect of anti-IL17 antibody and PTH (1-34) in mitigation of ovariectomy induced bone loss. Ovariectomized BALB/c female mice were treated with anti-IL17 and iPTH monotherapies and their combination. Combination of iPTH and anti-IL17 has synergistic effect in the restoration of skeletal and immune parameters compared to mono-therapies. Our studies also show that a combination of PTH (1-34) with anti-IL17 prevents bone loss by inhibiting IL-17/N-cadherin mediated disruption of PTHR1/LRP-6 interaction (J Biol Chem. 2017; 292(11):4686-4699, Bone 2017; 105:226-236).

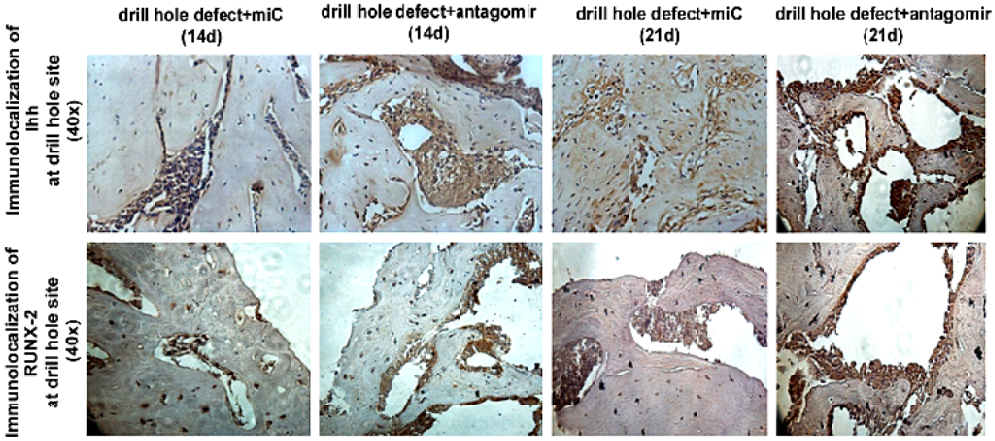


Fig.: Silencing of miR-467g promotes new bone regeneration by increasing localization of Runx-2, key transcription factor associated with osteoblast differentiation, and Ihh at the drill hole injury site.

2.2.2.3. Pharmacological activation of aldehyde dehydrogenase 2 promotes osteoblast differentiation via bone morphogenetic protein-2 and induces bone anabolic effect

Aldehyde dehydrogenases (ALDHs) are a family of enzymes involved in detoxifying aldehydes. Previously, we reported that an ALDH inhibitor, disulfiram caused bone loss in rats and among ALDHs, osteoblast expressed only ALDH2. Loss-of-function mutation in ALDH2 gene is reported to cause bone loss in humans which suggested its importance in skeletal homeostasis. We thus studied whether activating ALDH2 by *N*-(1, 3-benzodioxol-5-ylmethyl)-2, 6-dichlorobenzamide (alda-1) had osteogenic effect. We found that alda-1 increased and acetaldehyde decreased the differentiation of rat primary osteoblasts and expressions of ALDH2 and bone morphogenetic protein-2 (BMP-2). Silencing ALDH2 in osteoblasts abolished the alda-1 effects. Further, alda-1 attenuated the acetaldehyde-induced lipid-peroxidation and oxidative stress. BMP-2 is essential for bone regeneration and alda-1 increased its expression in osteoblasts. We then showed that alda-1 (40 mg/kg dose) augmented bone regeneration at the fracture site with concomitant increase in BMP-2 protein compared with control. The osteogenic dose (40 mg/kg) of alda-1 attained a bone marrow concentration that was stimulatory for osteoblast differentiation, suggesting that the tissue concentration of alda-1 matched its pharmacologic effect. In addition, alda-1 promoted modeling-directed bone growth and peak bone mass achievement, and increased bone mass in adult rats which reiterated its osteogenic effect. In osteopenic ovariectomized (OVX) rats, alda-1 reversed trabecular osteopenia with attendant increase in serum osteogenic marker (procollagen type I N-terminal peptide) and decrease in oxidative stress. Alda-1 has no effect on liver and kidney function. We conclude that activating ALDH2 by alda-1 had an osteoanabolic effect involving increased osteoblastic BMP-2 production and decreased OVX-induced oxidative stress (*Toxicology and Applied Pharmacology*, 2017; 316: 63-73).

2.2.2.4. Globular adiponectin reverses osteo-sarcopenia and altered body composition in ovariectomized rats

Adiponectin regulates variousmetabolic processes including glucose flux, lipid breakdown and insulin response. We recentlyreported that adiponectin receptor1 (adipoR1) activation by a small molecule reverses osteopenia in leptin receptor deficient db/db (diabetic) mice. However, the role of adiponectin in bone metabolism under the setting of post-menopausal (estrogen-deficiency) osteopenia and associated metabolic derangements has not been studied. Here, we studied the therapeutic effect of the globular form of adiponectin (gAd), which is predominantly an adipoR1

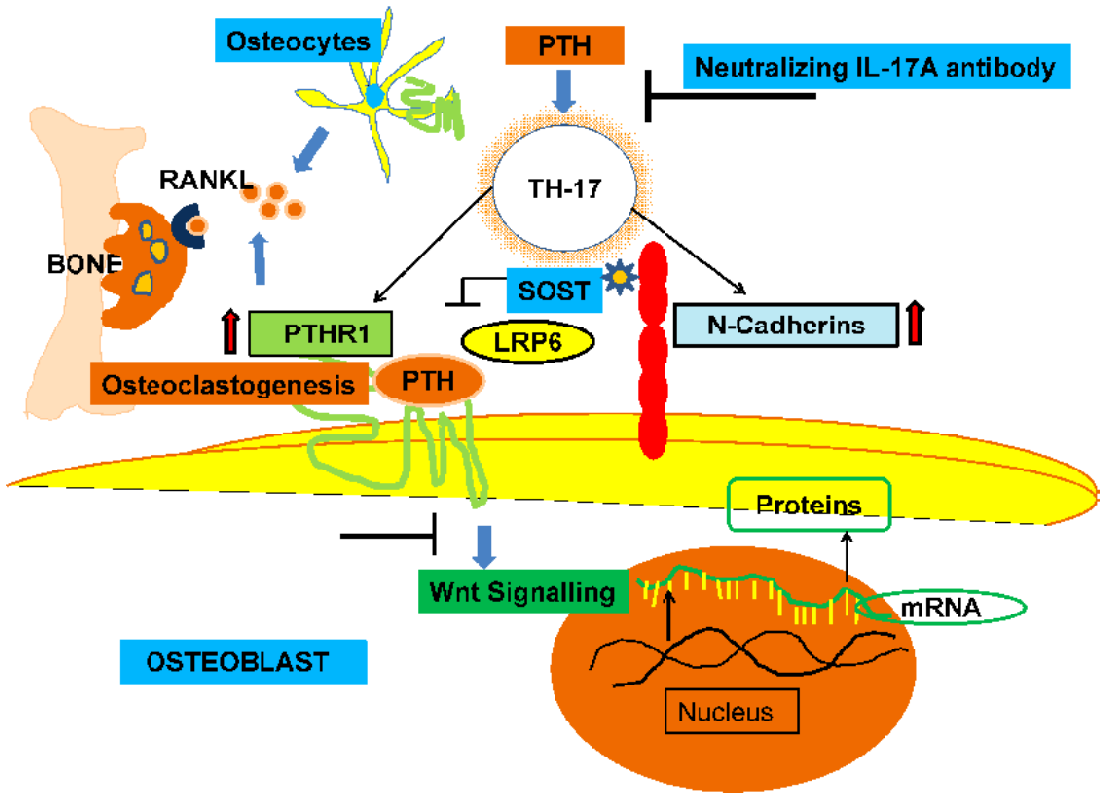


Fig.: Combined treatment of neutralizing IL-17 antibody and PTH(1-34) have synergistic effects in restoration of skeletal and immune parameters

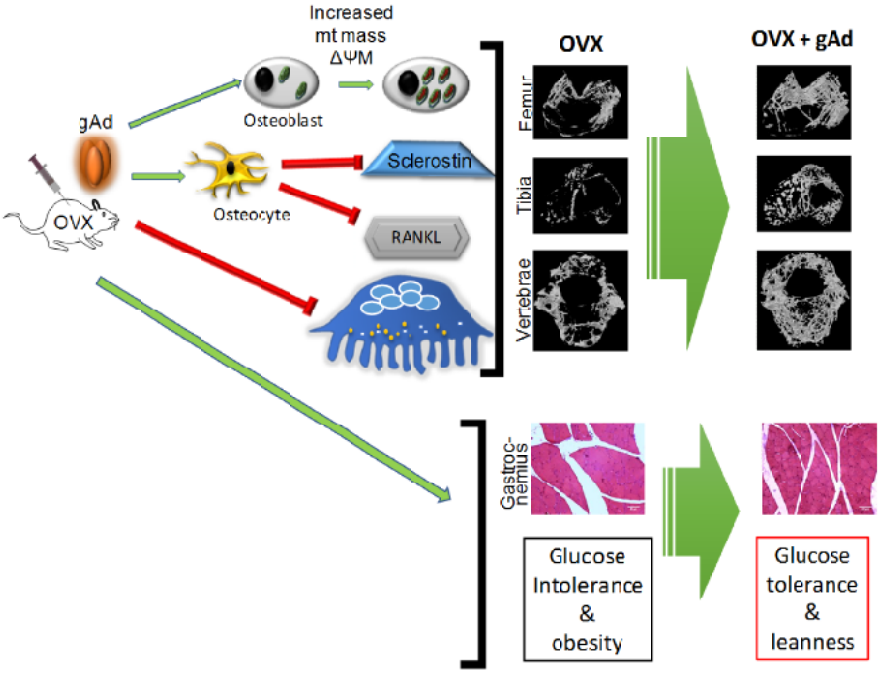


Fig.: Globular adiponectin (gAd) stimulates osteoblast differentiation with attendant increase in mitochondrial mass, and suppresses the production of anti-osteogenic sclerostin and pro-osteoclastogenic receptor activator of nuclear factor kB. In addition, gAd directly suppresses osteoclast differentiation. Together, gAd reverses osteopenia in ovariectomized (OVX) rats. Further, in OVX rats, gAd reverses sarcopenia and obesity and enhanced glucose tolerance.

agonist, in aged ovariectomized (OVX) rats and compared it with standard-of-care anti-osteoporosis drugs. In OVX rats with established osteopenia, gAd completely restored BMD and load bearing capacity and improved bone quality. Skeletal effects of gAd were comparable to PTH (osteoanabolic) but better than alendronate (anti-catabolic). Both osteoanabolic and anti-catabolic mechanisms led to the anti-osteoporosis effect of gAd. In cultured osteoblasts and bones, gAd increased a) adipoR1 and peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC1α) expression to promote mitochondrial respiration, which likely fueled osteoblast differentiation b) suppressed sclerostin (awnt antagonist) in a sirtuin1-dependent manner c) decreased receptor-activator of nuclear factor κB ligand (RANKL) to achieve its anti-catabolic effect. The OVX-induced sarcopenia and insulin resistance were also improved by gAd.We conclude that gAd has therapeutic efficacy in estrogen deficiency-induced osteoporosis, sarcopenia and insulin resistance and hold metabolic disease modifying potential in postmenopausal women. (*Bone*. 2017 Dec; 105: 75-86)

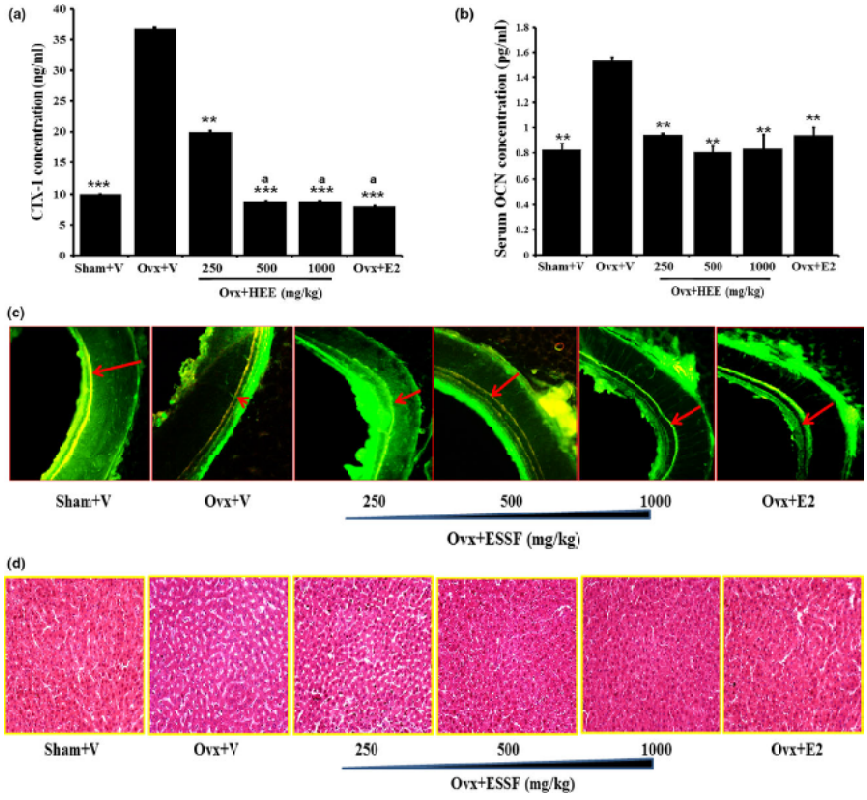


Fig. : Heartwood ethanolic extract exhibited osteogenic effect in Ovx rats without liver toxicity. Bone turnover markers, serum (a) CTX-1 and serum (b) osteocalcin were determined by ELISA. *P < 0.05, **P < 0.01 and ***P < 0.001 compared with the Ovx + vehicle group. p < 0.05 compared with the Ovx + HEE (250 mg/kg) group. (c) transverse sections (50 lm) of tetracycline and calcein labelled femur diaphysis from rats after 12 weeks of treatment. (d) transverse sections (5.0 lm) of livers followed by haematoxylin and eosin staining from rats after 12 weeks of treatment.

2.2.2.5. Heartwood extract from *Dalbergia sissoo* promotes fracture healing and its application in ovariectomy-induced osteoporotic rats

In the current study, we have assessed the osteo-conservative effect of HEE, a standardized fraction made from the heartwood of *D. sissoo*. This plant has been known for its traditional medicinal use in India. Promoting new bone formation over anti-resorption is considered to be the most effective approach in preventing osteoporotic fractures. In our study, we have performed drill-hole injury and

studied fracture healing capability as well as temporal and spatial changes at fracture site after the treatment of HEE in S.D. rats. Fluorochrome labelling and Micro-CT parameters demonstrated that in comparison with control group, HEE stimulated callus formation at injury site in dose-dependent manner and improved the remodelling capability from woven bone to lamellar bone. Here, we have compared the effects of HEE on bone parameters of Ovx rats with higher osteoprotective doses of 17-b estradiol (E2) that served as the reference hormone. Due to the absence of estrogenicity and liver toxicity, HEE can be a beneficial and safer therapeutic option against E2 deficiency-induced bone loss as well as rapid fracture healing. In correspondence to our preclinical study, we can conclude that the daily oral administration of a standardized phytopreparation, HEE, made from the heartwood of D. sissoo is safe and promotes rapid fracture healing by enhancing osteoblasts activity and imparts osteoprotection during Ovx-induced bone loss, thus gaining the chances of its use as a substitute therapy for people who are at increased fracture risk as well as postmenopausal osteoporosis. HEE can perform its bone sparing action by dual mechanism involving prevention of bone loss and formation of new bone. (*J Pharmacy and Pharmacol*, 2017; 69: 1381–1397)

2.2.2.6. Detrimental effects of atherogenic and high fat diet on bone and aortic calcification rescued by an isoflavonoid Caviunin β-D-glucopyranoside

Atherogenic diet (AD) and high fat diet (HFD) cause deleterious effect on bone microarchitecture and this phenomenon prompts aortic calcification. This study aims to show the effects of Caviunin β-D-glucopyranoside (CAFG), against bone loss and its associated aortic calcification in presence of AD and HFD challenged diets. Five groups of C57BL/6 male mice with 8 animals in each group, comprising of chow, AD, HFD, AD + CAFG and HFD + CAFG were fed with respective diets for 16 weeks. At the end of the treatment period, preventive effects of CAFG on bone tissue were analyzed by assessing the osteogenic potential of bone marrow cells, bone micro-architecture, ability of new bone formation and histomorphometry studies. Aortic calcification was assessed by transcription and translation analysis of osteogenic key markers in aortic tissue and assessment

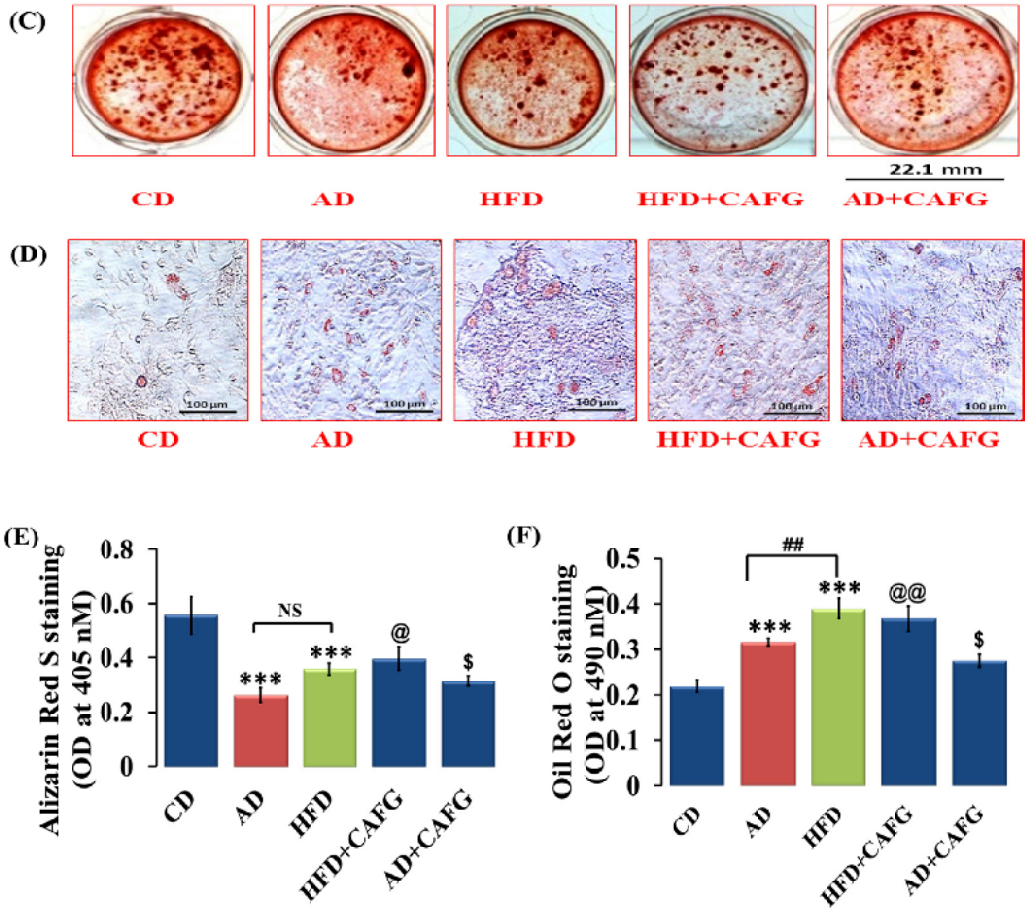
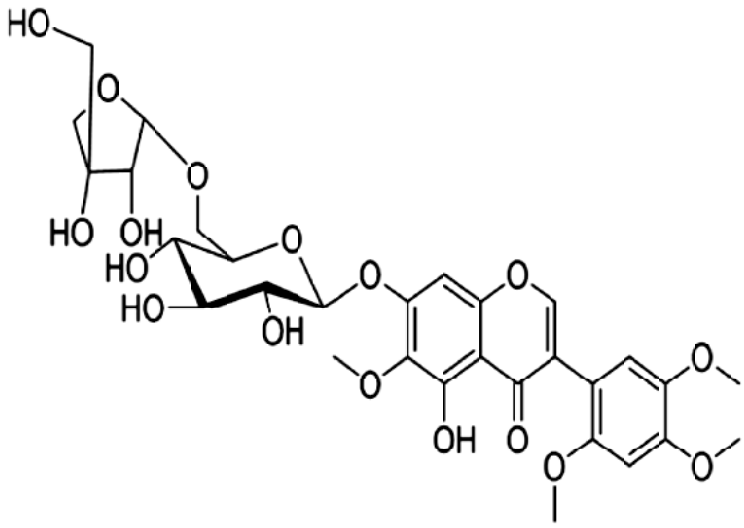


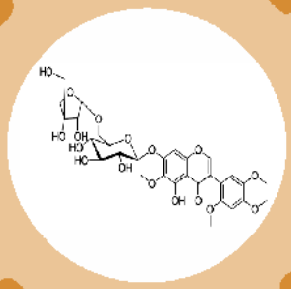
Fig.: Differentiation of Bone marrow stromal cells after treatment with challenged diets. (C) Representative images after Alizarin Reds staining to monitor new bone formation (D) Representative images of cells after Oil Red O staining for adipocytes (E-F) Represent quantitation of the two assays

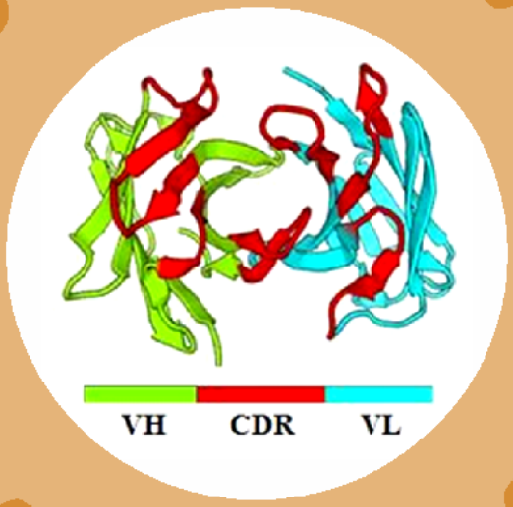


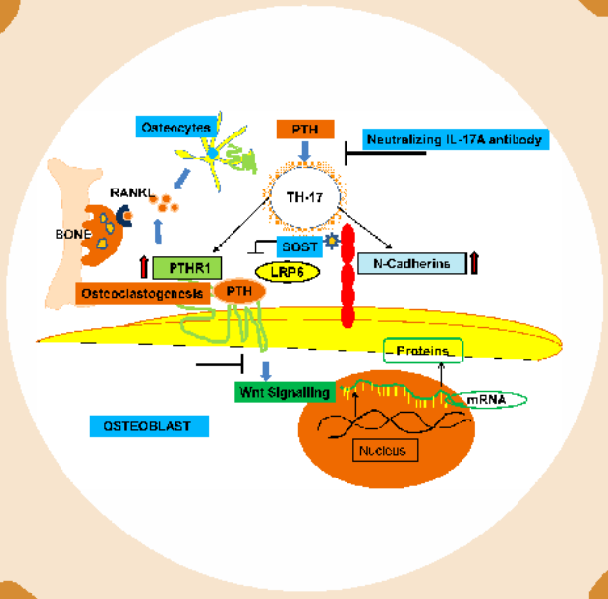
caviunin 7-O-[β-D-apiofuranosyl-(1→6)-β-D-glucopyranoside].

of aortic endothelial function. Plasma lipid profiling was done to assess the effects of diets as its role in both bone loss and aortic calcification. Bone marrow stromal cell (BMSC's) dynamics showed that AD and HFD decreased osteoblast number that led to bone loss, deterioration in bone micro-architecture with up-regulated bone resorptive genes that lead to increase in aortic calcification. CAFG treatment rescued the bone health by modulating BMSC's towards osteogenic lineage. It increased the osteogenic gene expression with simultaneous decrease in osteoclastic genes thus stabilized the receptor activator of nuclear factor-kappa-B ligand/ osteoprotegerin ratio that eventually reduced the amount of calcification in aorta. Biochemical studies showed that CAFG reduced the TC, TG and LDL-C content with no marked changes in HDL-C. Moreover, CAFG decreased the osteogenic key markers in the aortic tissue and enhanced endothelial function. Overall, this study indicates that CAFG protected against physiologically challenged diet induced bone loss with associated vascular calcification in mice. Moreover, data revealed that atherogenic diet is more detrimental as compared to the excess fatty acid diet to the bone and aorta. (*Biomed Pharmacother.* 2017; 92:757-771)

Tuberculosis & Microbial Infections







Area Coordinators

Dr Kishore K Srivastava

Dr Ravishankar Ramachandran

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3

Tuberculosis and Microbial Infections

Area Coordinators: Kishore K Srivastava & Ravishankar Ramachandran

The thrust focus of the area is on development of therapeutic strategies exploiting advances in research on the disease biology. This will expectedly have a significant impact on development of technologies, vaccines and drugs for microbial infections.

The focus of the area is to push the frontiers of research on the disease biology. It includes the identification and characterization of components of diverse pathways through a combination of experimental approaches. The efforts may significantly impact the development of new drugs, technologies & vaccines for TB & Microbial Infections.

3.1 Antifungal, Antibacterial and Antiviral evaluation of compounds

3.2 Gene Regulation in Mycobacteria

3.3 Design, Synthesis & Anti-Microbial screening of Peptides

3.4 Target Identification and Functional Analysis

3.5 Immunological studies and Subunit Vaccine

3.1 Antifungal, Antibacterial and Antiviral Evaluation of Compounds

A total of 2065 (under CBRS/synthetic 691, MoES 319, Maybridge Library/synthetic 1055) compounds/ extracts were evaluated for *in vitro* antifungal and antibacterial activity by micro-broth dilution method using standard protocol (as per CLSI guide lines) initially against 7 human pathogenic bacteria viz. 1) *E. coli* (ATCC 9637), 2) *Pseudomonas aeruginosa* (ATCC BAA-427), 3) *Staphylococcus aureus* (ATCC 25923), 4) *Klebsiella pneumoniae* (ATCC 27736), 5) *S. aureus* (ATCC 700699 MRSA), 6) *S. aureus* (ATCC 29213), 7) *S. aureus* (ATCC 33592 Gentamycin resistant) and six human pathogenic fungi viz., 1) *Candida albicans* (ATCC 10231), 2) *Cryptococcus neoformans,* 3) *Sporothrixschenckii,* 4)*Trichophyton mentagrophytes* (ATCC 9533), 5)*Aspergillus fumigatus,* 6) *Candida parapsilosis* (ATCC-22019). Under MoES synthetic compounds, SB/CDRI4/ 99, SB/CDRI4/100, SB/CDRI4/102, SB/CDRI4/105, SB/ CDRI4/142, SN/NIPERH1/7, DHD/IITK2/10, DHD/IITK2/ 11, NRK-NIIST1/C94-S2/E1, NRK-NIIST1/C99-S1/E1 and NRK-NIIST1/C100-S1/E1 exhibited antibacterial activity (MIC range 0.39-6.25 µg/ml) against *S. aureus* (including resistant) strains. Four of the extracts (MoES) VGS/AU1/ C146/E1, VGS/AU1/C159/E1, RRK-SUC1/C131/S1/E1 and RRK-SUC1/C131/S2/E1 exhibited antibacterial activity in the range of 3.90-62.50 µg/ml. Under Maybridge Library compound AW00248 exhibited antibacterial activity against *S. aureus* including the resistant strains (MIC 1.56-3.12 µM).

The work has also been carried out on ESKAPE pathogens on drug resistance mechanisms. Under the drug discovery efforts, we discovered DPIC and Ivakaftor as potential new drug candidates active against clinical strains of drug resistant *S. aureus*. These two molecules demonstrated potent antimicrobial activity in murine neutropenic thigh infection model which was comparable to vancomycin. Currently, these are under pre-clinical development.

Upon screening the LOPAC library, we identified DPIC to be potently active against NTMs and it exhibited concentration dependent activity as well as synergy with FDA approved drugs. When tested in neutropenic bacterimia model of *M. fortuitum* infection, it reduced cfu equal to amikacin that too at 1/100 concentration.

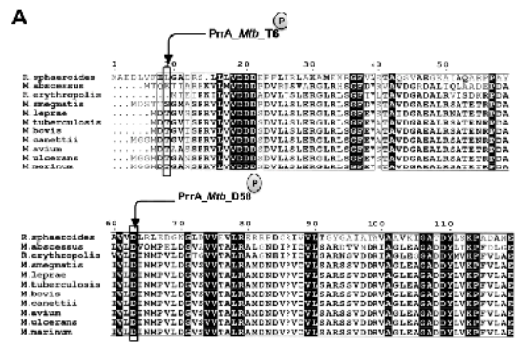
Host-Pathogen interactions (HPIs) are primarily responsible for infection and developing pathogenesis in host. HPIs are usually established through protein-protein interactions (PPI) which regulates the initiation and development of pathogenesis in host and therefore represent a large and important class of targets for human therapeutics. Our group is working towards identifying novel host proteins interacting with viral protein Nef and developing pharmacological inhibitors to block such interactions. The inhibitors are shown to restore the cellular function against viral pathogenesis. Moreover, we have patented novel inhibitor and *in vitro* assay to screen HIV-1 Nef- ASK-1 inhibitors.

3.2 Gene Regulation in Mycobacteria

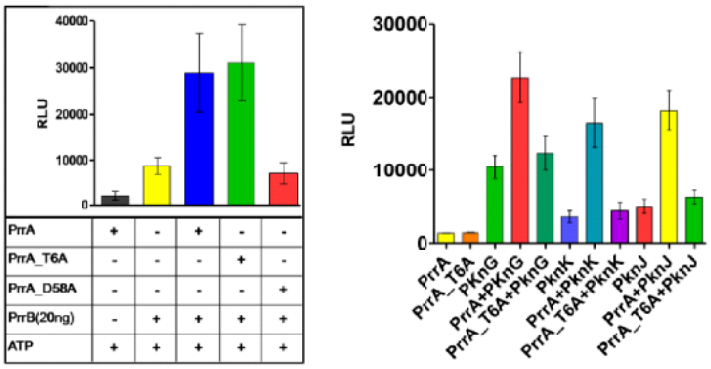
3.2.1 A Unique N-terminal Phosphorylation (Thr^6) in Response Regulator Protein PrrA is the Key Signature for the Increased Intracellular Survival of Mycobacteria Consequent upon Transcriptional Activation:

The remarkable ability of *M. tuberculosis* (*Mtb*) to survive inside the human macrophages is attributed to

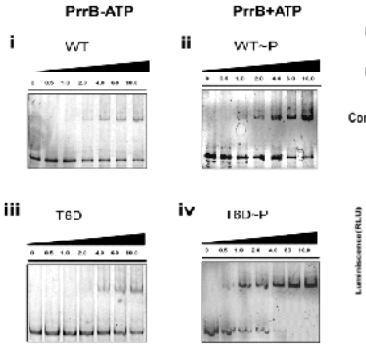
PrrA phosphorylation sites, Thr^{6} and Asp^{58}



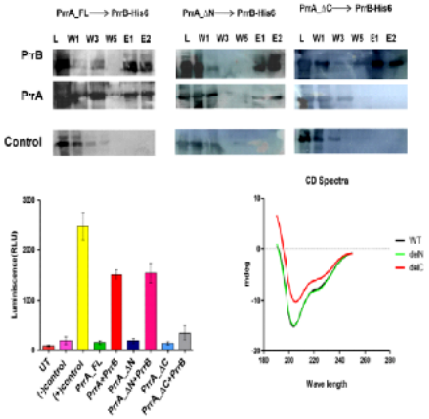
PrrA phosphorylation at Asp^{58} by PrrB and at Thr^{6} by STPKs



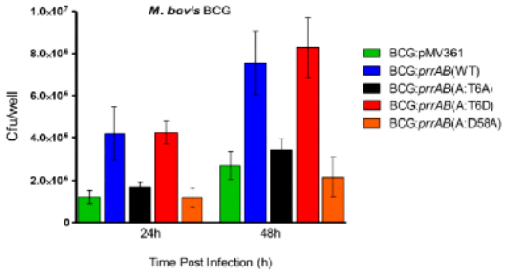
PrrA phosphorylation Inhances DNA-binding



PrrA Interact w th PrrB through its C-terminal



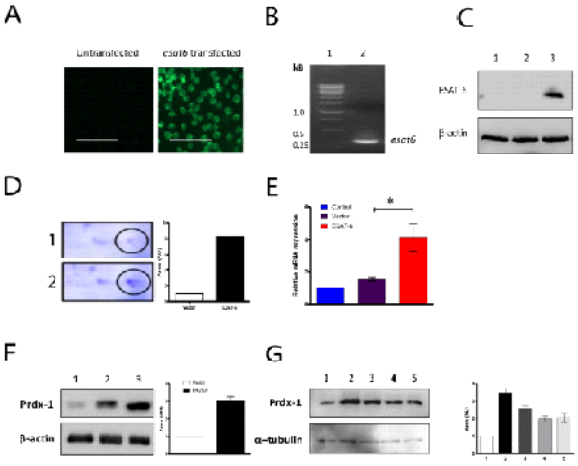
Phosphorylation enhances Intracellular Growth of BCG



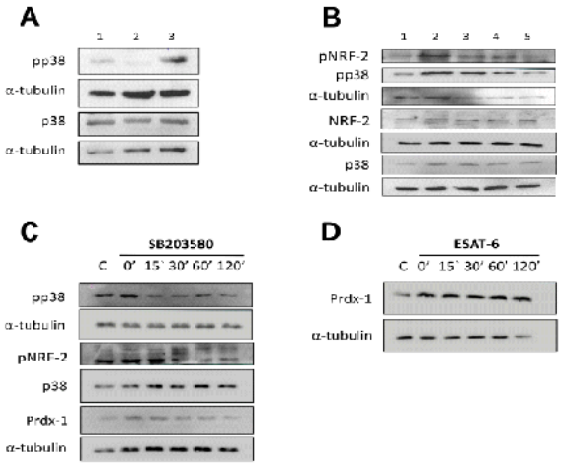
the presence of a complex sensory and regulatory network. PrrA is a DNA-binding regulatory protein, belongs to an essential two-component system (TCS), PrrA/B, which is required for early phase intracellular replication of *Mtb*. Despite its importance, the mechanism of PrrA/B-mediated signaling is not well understood. Here, we demonstrate that the binding of PrrA on the promoter DNA and its consequent activation is cumulatively controlled via dual phosphorylation of the protein. We have further characterized the role of terminal phosphoacceptor domain in the physical interaction of PrrA with its cognate kinase PrrB. The genetic deletion of *prrA/B* in *M. smegmatis* was possible only in the presence of ectopic copies of the genes, suggesting the essentiality of this TCS in fast-growing mycobacterial strains as well. The overexpression of phospho-mimetic mutant (T6D) altered the growth of *M. smegmatis* in an *in vitro* culture and affected the replication of *M. bovis* BCG in mouse peritoneal macrophages. Interestingly, Thr^{6} site was found to be conserved in *Mtb* complex, whereas altered in some fast-growing mycobacterial strains, which indicate that, this unique phosphorylation might be predominant in employing the regulatory circuit in *M. bovis* BCG and presumably in *Mtb* complex as well (Mishra AK,et al. *Biochem J.* 2017 Dec 6;474(24):4119-4136. doi: 10.1042/BCJ20170596).

3.2.2 Peroxiredoxin-1 of macrophage is critical for mycobacterial infection and is controlled by early secretory antigenic target protein through the activation of p38 MAPK

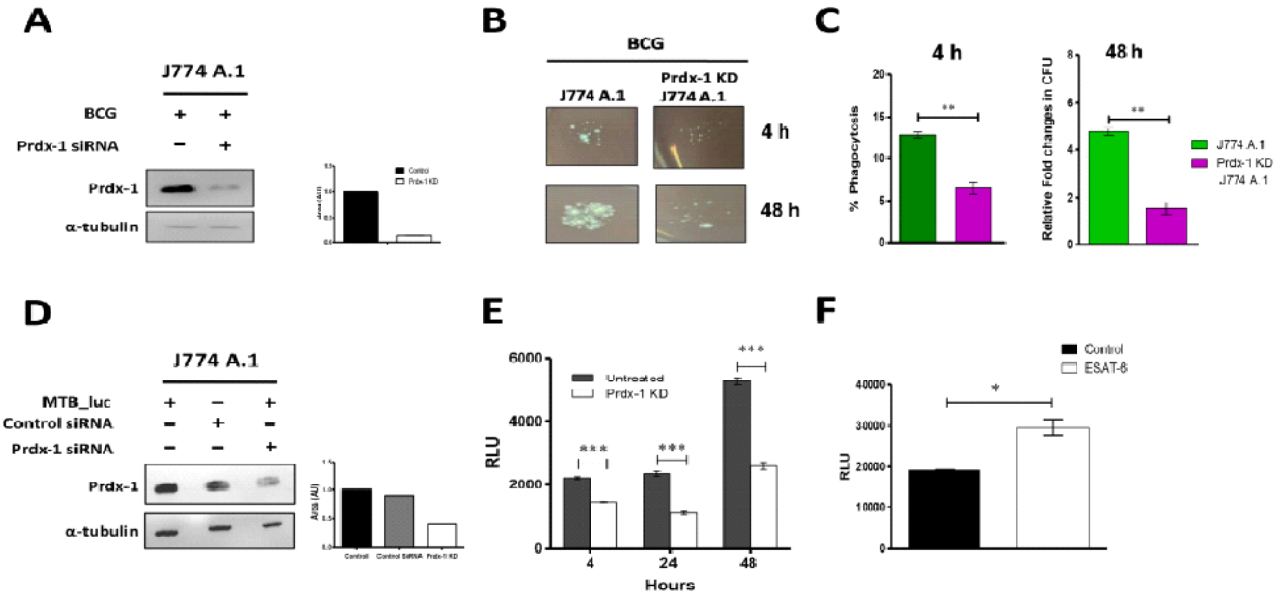
Early secretory antigenic target protein (ESAT-6) is a virulent factor which is involved in pathogenesis, is secreted by ESX-1 secretion system of *Mycobacterium tuberculosis* (MTB) with its interacting partner CFP10. Here, we demonstrate the role of ESAT-6 in phagocytosis and intracellular survival of mycobacteria through a mechanism mediated by regulation of host protein; Peroxiredoxin-1 (Prdx-1). Prdx-1 is an anti-apoptotic and stress response protein which protects cells from damage by ROS and H_2O_2. The J774 A.1 cells infected either with *esat-6* knockout MTB, or infected with rBCG carrying an integrative copy of *esat-6* gene (from MTB) or over-expressing ESAT-6 through eukaryotic promoter vector, showed elevated levels of expression of Prdx-1. Further investigation revealed that the up-regulation of Prdx-1 is mediated through the activation of one of the



ESAT-6 upregulates macrophage J774 A.1 protein Prdx-1 confirmed at mRNA and protein level.



Pathway for ESAT-6 mediated upregulation of Prdx-1



Survival of mycobacteria in *prdx-1* knocked down J774 A.1 cells

MAP kinases, p38. However, the phosphorylation levels of ERK, JNK, PI3K, PKC and AKT kinases remain unaffected. The NRF-2, a transcriptional activator of Prdx-1 is phosphorylated by p38 and this phosphorylation increases its translocation to the nucleus and thereby regulating the *prdx-1* transcription. Inhibition of the p38 MAPK by specific inhibitor, SB203580, abrogates the ESAT-6 mediated induction of Prdx-1 expression as well as the phosphorylation of NRF-2 in a time dependent manner. The inhibition of Prdx-1 expression by specific SiRNA in J774 A.1 cells resulted into the reduced bacterial uptake and intracellular persistence of the BCG or rBCG. This is the first report proclaiming the ESAT-6 controlled host protein which is involved in the increase of mycobacterial uptake and survival. The intermediate mechanisms involve the increased Prdx-1 production in macrophages through the activation of p38 and NRF-2 dependent signaling (Yabaji SM et al, *Biochem Biophys Res Commun*. 2017 Dec 16;494(3-4):433-439. doi: 10.1016/j.bbrc.2017.10.055).

3.2.3 Role of a triacylglycerol synthase in the persistence of Mycobacterium tuberculosis

Triacylglycerol (TAG) is important to mycobacteria both as cell envelope component and energy reservoir. *Mycobacterium tuberculosis* (Mtb) genome encodes at least 15 putative TAG synthase (tgs)s. We report that one of these genes, Rv3371, specific to pathogenic mycobacteria, when expressed in *M. smegmatis* leads to modifications in colony morphotype, bacterial architecture, cell surface properties and elevated TAG levels. Rv3371 was found to largely localize in the cell membrane. The Rv3371 promoter is minimally active during exponential growth *in vitro*, however, is up-regulated under stationary phase, hypoxia, nutrient starvation, nitrosative stress, low iron, in IFN-γ activated

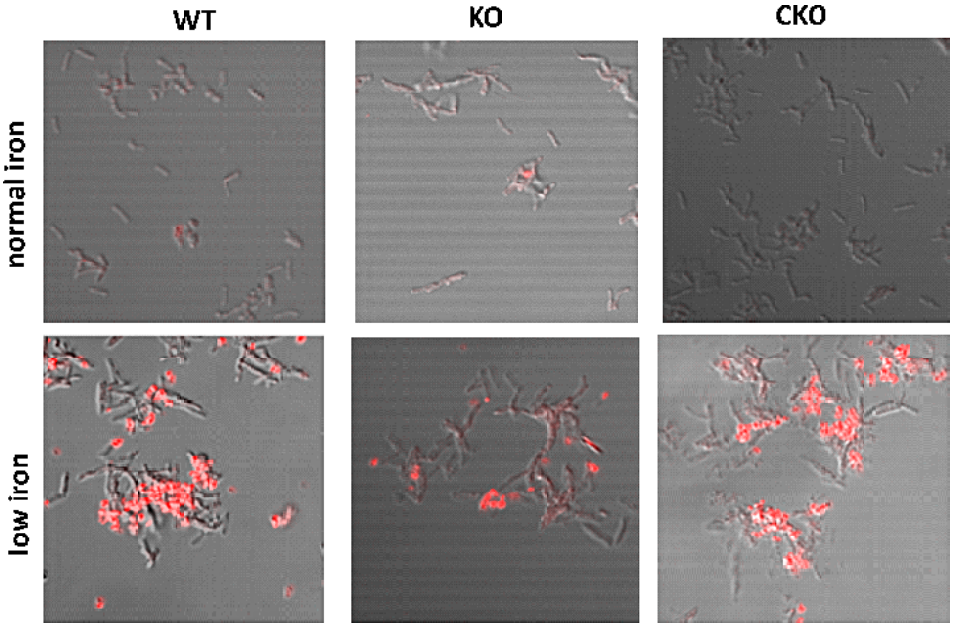


Fig. Deletion of triacylglycerol synthase impairs the release of nile red staining microvescicles by mycobacteria

decreased. Levels of trehalose esters and free mycolic acids were increased. In contrast to *M. smegmatis* expressing MTB PE11, a role reversal was observed in MTB with respect to pellicle/biofilm formation. The PE11 knock-down Mtb strain showed significantly enhanced aggregation and early biofilm growth in detergent-free medium, compared to the wild-type. Knock-down strain also showed nearly 27-fold up-regulation of a fibronectin attachment protein (Rv1759c), linking biofilm growth with over-expression of bacterial proteins that help in aggregation and/or binding to host extracellular matrix. (Rastogi S, *Microbiology*. 2017 Jan; 163(1):52-61.).

macrophages and infected mice. The low iron-induced expression of Rv3371 is likely due to the de-repression by Rv1404, which is probably activated by ideR. An Rv3371 deletion mutant of Mtb showed impaired non-replicating persistence *in vitro* and altered sensitivity to anti-mycobacterial drugs. In low iron medium, the Rv3371 deletion mutant showed reduced formation of TAG containing extracellular vesicles. Therefore Rv3371 is likely involved in Mtb growth arrest and cell wall alterations during persistence. (Rastogi *et al*., *Tuberculosis* (Edinb). 2017; 104:8-19).

3.2.4 PE11, an esterase of Mycobacterium tuberculosis is involved in the regulation of biofilm formation

PE11 (Rv1169c or LipX) is a cell wall associated esterase/lipase of *Mycobacterium tuberculosis* (MTB). Previous studies have shown that PE11 leads to modification in cell wall lipid content and enhanced virulence when expressed in the non-pathogenic surrogate *Mycobacterium smegmatis*. Since cell wall lipids often play different roles in pathogenic and non-pathogenic mycobacteria, we investigated the role of PE11 in its host, MTB. MTB with lowered expression of PE11 (PE11 knock-down) displayed significant changes in colony morphology and cell wall lipid profile, confirming the role of PE11 in cell wall architecture. In addition, the levels of phthiocerol dimycocerosates, a cell wall virulence factor, were

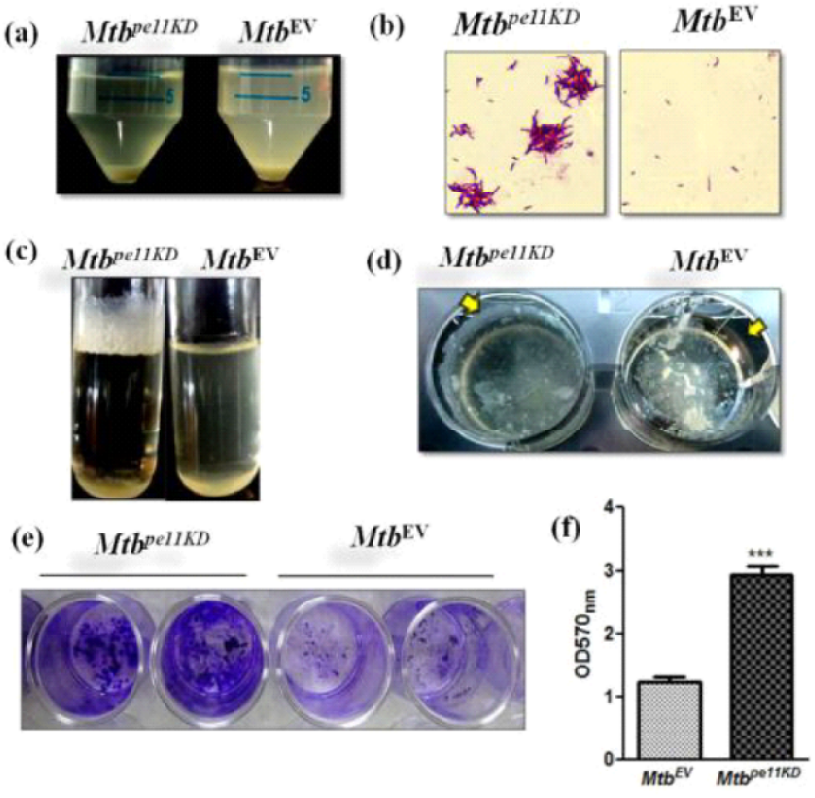


Fig.: Effect of *pe11* repression on bacterial aggregation and pellicle formation.

3.2.5 Mycobacterium bovis sigF mutant is deficient in surface phenotype and exhibits compromised pathogenesis

Mycobacterium bovis causes tuberculosis in both humans and bovines. SigF, an alternate sigma factor, has been shown to be widely conserved in mycobacteria

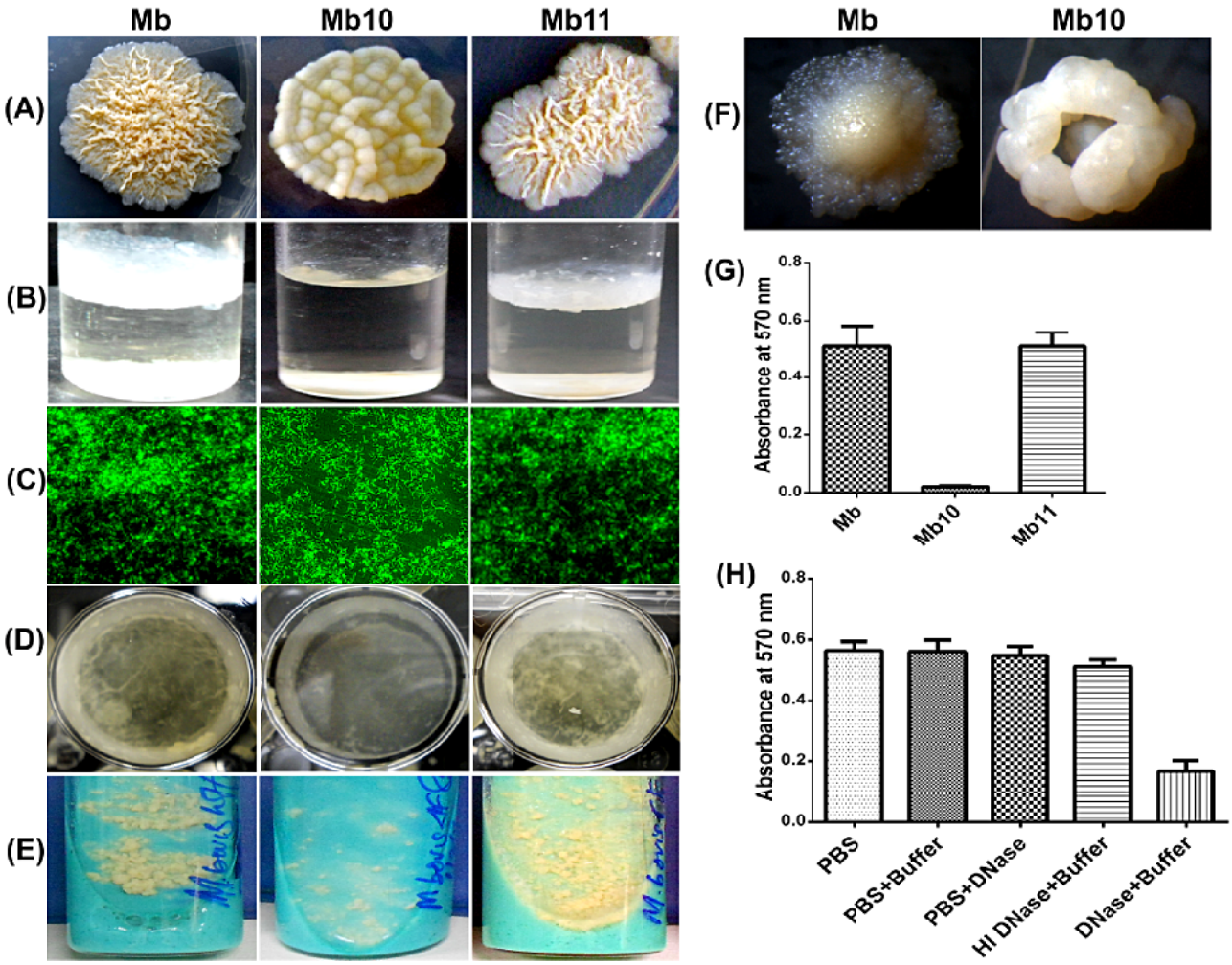


Fig. Changes in phenotypes of *M. bovis* strains: wild type (Mb), Δ*sigF* mutant (Mb10), complemented strain (Mb11). (A) Distinctly smooth bacilli devoid of cords are evident in Mb10 mutant. (B) Pellicle formation at air-water interface. (C) Pellicles of GFP expressing *M. bovis* strains smeared- thinly distributed bacilli in apparently reduced biofilm matrix are evident in Mb10 mutant. (D) Biofilm formation in *M. bovis* strains. (E) Distinct *M. bovis* strains on LJ slants. (F) Motility defect in mutant Mb10 compared to *M. bovis* wild type strain. (G) Crystal violet staining assay for biofilm assessment. Crystal violet (CV) stained biofilms were ethanol extracted and quantified by absorbance at 570nm. The data are means and standard deviations of three wells per strain. (H) DNase treatment disrupts biofilm formation in *M. bovis*. Plates carrying biofilms are incubated with PBS, PBS and reaction buffer, PBS and DNase, heat inactivated (HI) DNase and reaction buffer and DNase with reaction buffer. Biofilms are then quantified via crystal violet staining. Results are from three independent experiments.

playing a larger role in addition to regulation of virulence genes. In this study, we have generated a Δ*sigF* mutant in *M. bovis* and studied its surface phenotypes. The mutant displayed distinct cellular and colonial morphotypes suggestive of deficiency in surface properties, which were duly restored in the complemented Δ*sigF* mutant. The mutant showed marked depletion in key cord forming lipids, trehalose 6-6'-dimycolate, trehalose 6-monomycolate and phthiocerol dimycocerosate. Comparative proteomics revealed significant down-regulation of several proteins having the purported roles in cell surface properties, stress response and virulence associated functions. Proteome analysis of *M. bovis* biofilms highlights the role of SigF regulated proteins in biofilm formation as several of them appeared down-regulated in the Δ*sigF* mutant. The most notable was a key metabolic enzyme, malate synthase G (Mb1868c). Consistent with its pleiotropic role, the diminished level of Mb1868c in the Δ*sigF* mutant resulted in reduced adherence of the mutant bacilli to lungs epithelial cells. Other down-regulated proteins too have been reported to have critical roles in tuberculosis pathogenesis. In summary, we report novel morphotypes of the *M. bovis* Δ*sigF* mutants and provide better rationale for their *in vitro* and *in vivo* phenotypes, which improve our understanding of the role of SigF in mycobacterial biology.

3.2.6 hsa-let-7b-5p facilitates *Mycobacterium tuberculosis* survival in THP-1 human macrophages by Fas down regulation

Tuberculosis continues to be one of the deadliest infectious disease worldwide. MicroRNAs (miRNAs) are small non-coding entities that play critical role as post-transcriptional regulators and are transcriptionally deregulated upon mycobacterial infection. In this study, we found significant upregulation of hsa-let-7b-5p in

Mycobacterium tuberculosis (Mtb) infected THP-1 human macrophages. Concomitantly, we detected the reduced level of Fas protein, one of the targets of hsa-let-7b-5p, in Mtb infected THP-1 macrophages. Using luciferase assay a direct interaction between hsa-let-7b-5p and the Fas 3'-untranslated region (UTR) was established. Inhibition of hsa-let-7b-5p augmented the apoptosis of THP-1 cells enabling enhanced clearance of Mtb. Our findings suggest that hsa-let-7b-5p helps intracellular survival of Mtb in THP-1 cells by down-regulating Fas protein level. This highlights hsa-let-7b-5p as a potential therapeutic target for tuberculosis treatment.

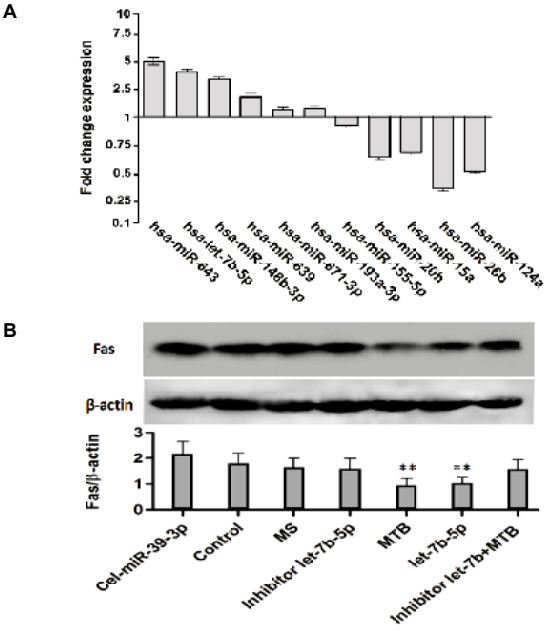


Fig.: (A) Validations of differentially regulated miRNAs by TaqMan Real time RT-PCR. Relative expression was analysed using RNA samples from *M. tuberculosis* infected and uninfected THP-1 cells. The expressions were normalized to U6 snRNA and values plotted are mean ± SD. (B) Western blot analysis of FAS protein in THP-1 cell transfected with *M. smegmatis* (MS) and *M. tuberculosis* (MTB), hsa-let-7b-5p mimics, hsa-let-7b-5p inhibitor and non-specific miRNA Cel-miR-39-3p. Densitometry values were normalized to the levels of β-Actin. Data are mean ± SD (**P< 0.01).

3.3 Design, Synthesis & Anti-Microbial Screening of Peptides

3.3.1 A short non-cytotoxic antimicrobial peptide designed from Ab29-40 adopts a nanostructure and shows *in vivo* anti-endotoxin activity

Aβ29-40 residues with tryptophan in place of the lone methionine residue at the 35th position and three arginine residues added to its C-terminus exhibited augmented antibacterial activity and protected mice against a lethal dose of LPS. The results show the conversion of Aβ29-40 segment into a cell-selective antimicrobial/anti-endotoxin peptide having nanostructure and cation-π interaction (*Chem Commun* (Camb) 2017 Dec 5; 53(97):13079-13082).

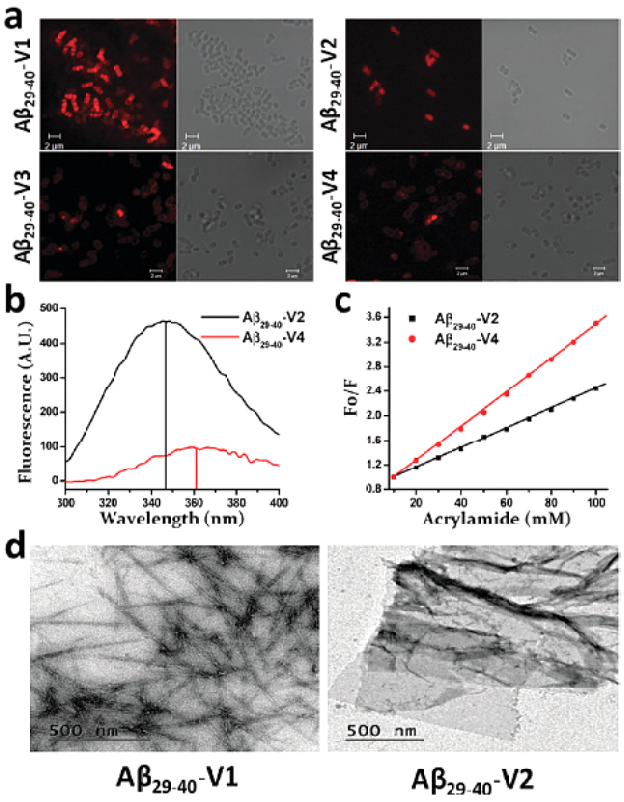


Fig.: (a) Confocal microscopy for the detection of localization of Rho-labeled Ab29-40-variants onto *E. coli*. For each variant treatment (concentration, 15 mM), the fluorescence and DIC images of E. coli are shown. (b) Fluorescence spectra of Ab29-40-V2 and Ab29-40-V4 in the presence of PC/PG lipid vesicles (200 mM) in PBS. (c) Stern–Volmer plots for acrylamide quenching of tryptophan fluorescence of Ab29-40-V2 and Ab29-40-V4 in PC/PG lipid vesicles. (d) TEM images indicating the nanostructure forming property of Ab29-40-V1 and Ab29-40-V2.

3.3.2 Selective phenylalanine to proline substitution for improved antimicrobial activities of peptides designed on phenylalanine heptad repeat:

An antimicrobial peptide (AMP) designed on phenylalanine heptad repeat possesses significant cytotoxicity along with desired antimicrobial and anti-endotoxin properties. Amino-acid substitutions at 'a' and/or 'd' positions of the heptad repeats of AMPs could alter their helical structure in mammalian membrane-mimetic environments and cytotoxicity towards mammalian cells. Since proline is a helix breaker, effects of selective proline substitution(s) at 'a' and/or 'd' positions of a 15-residue peptide designed on phenylalanine heptad repeat (FR-15) were investigated. Proline-substituted FR-15 variants were highly selective toward bacteria and fungi over hRBCs and murine 3T3 cells and also retained their antibacterial activities at high salt, serum and elevated temperatures. These non-cytotoxic variants also inhibited LPS-induced production of pro-inflammatory cytokines/chemokines in human monocytes, THP-1, RAW 264.7 and in Balb/c mice. The two non-cytotoxic variants (FR8P and FR11P) showed potent anti-cancer activity against highly metastatic human breast cancer cell line MDA-MB-231 with IC_{50} values less than 10 μM. At sub-IC_{50}

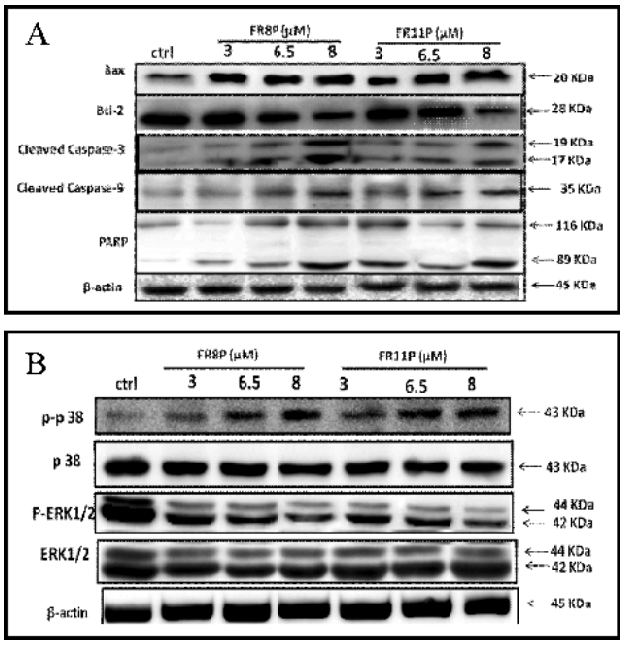


Fig.: Pro-apoptotic activities of FR8P and FR11P (A): treatment with peptides FR8P and FR11P alters the expression of pro- and antiapoptotic proteins (as marked) in MDA-MB-231 cells following the treatments of peptides for 24 h at indicated concentrations. β-Actin was used as an equal loading control. The blots are representative of three independent experiments. (B): FR8P and FR11P alter MAPKs expression in MDA-MB-231 cells. MDA-MB-231 cells were treated for 24 h with the indicated concentrations of peptides.

concentrations, FR8P and FR11P also showed anti-migratory and anti-invasive effects against MDA-MB-231 cells. FR8P and FR11P induced cellular apoptosis by triggering intrinsic apoptotic pathway through depolarization of mitochondrial membrane potential and activation of caspases. Overall the results demonstrated the utilization of selective proline to phenylalanine substitution in a heptad repeat of phenylalanine residues for the design of cell-selective, broad-spectrum AMPs with significant anti-cancer properties (*Acta Biomater*. 2017 Jul 15;57:170-186).

3.3.3 Cryptic antimicrobial peptides from Glutathione S-transferase

As per the Infectious Diseases Society of America (IDSA) report, ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species) are the leading cause of infections throughout the world. The problem of antimicrobial resistance is more in ESKAPE pathogens, as most of the ESKAPE group pathogen are part of normal microflora or commensals with an ability to cause infections when the immune system breaks. Antibiotics eliminate sensitive bacterial species, leaving behind resistant bacterial population to multiply and thriving more rapidly in larger numbers. Unfortunately, out of 39 antibiotics in the pipeline, only 12 can tackle with the AMR in ESKAPE pathogens Currently, multidrug resistance is the top three threats to global public health and to tackle this problem, truly new classes of anti-infective therapeutics are urgently needed.

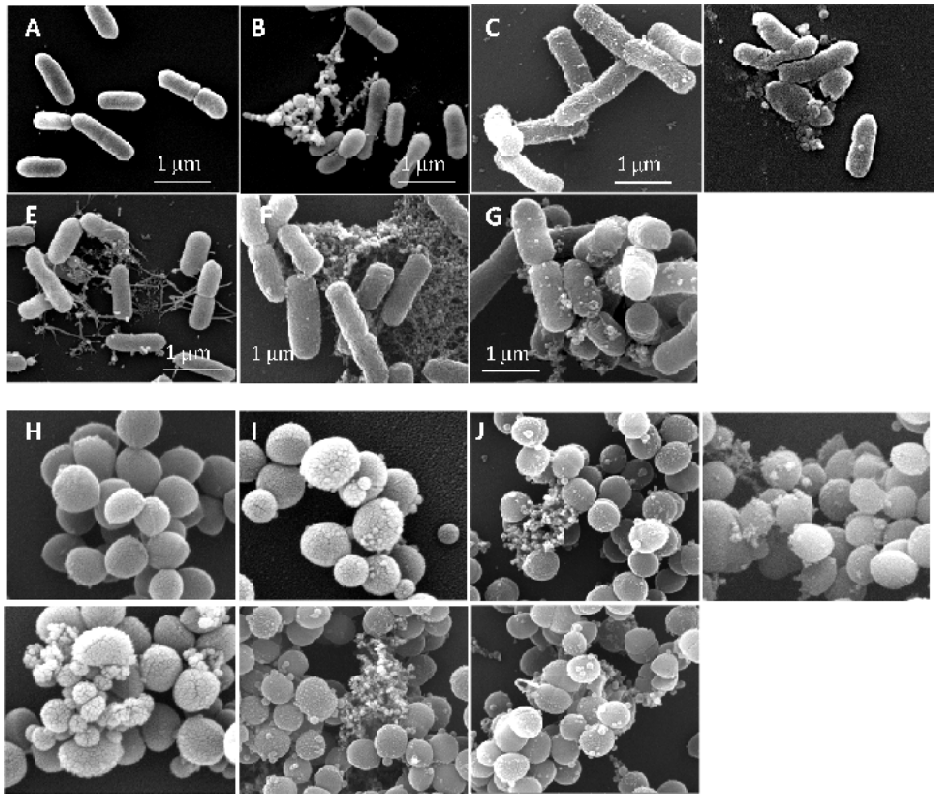
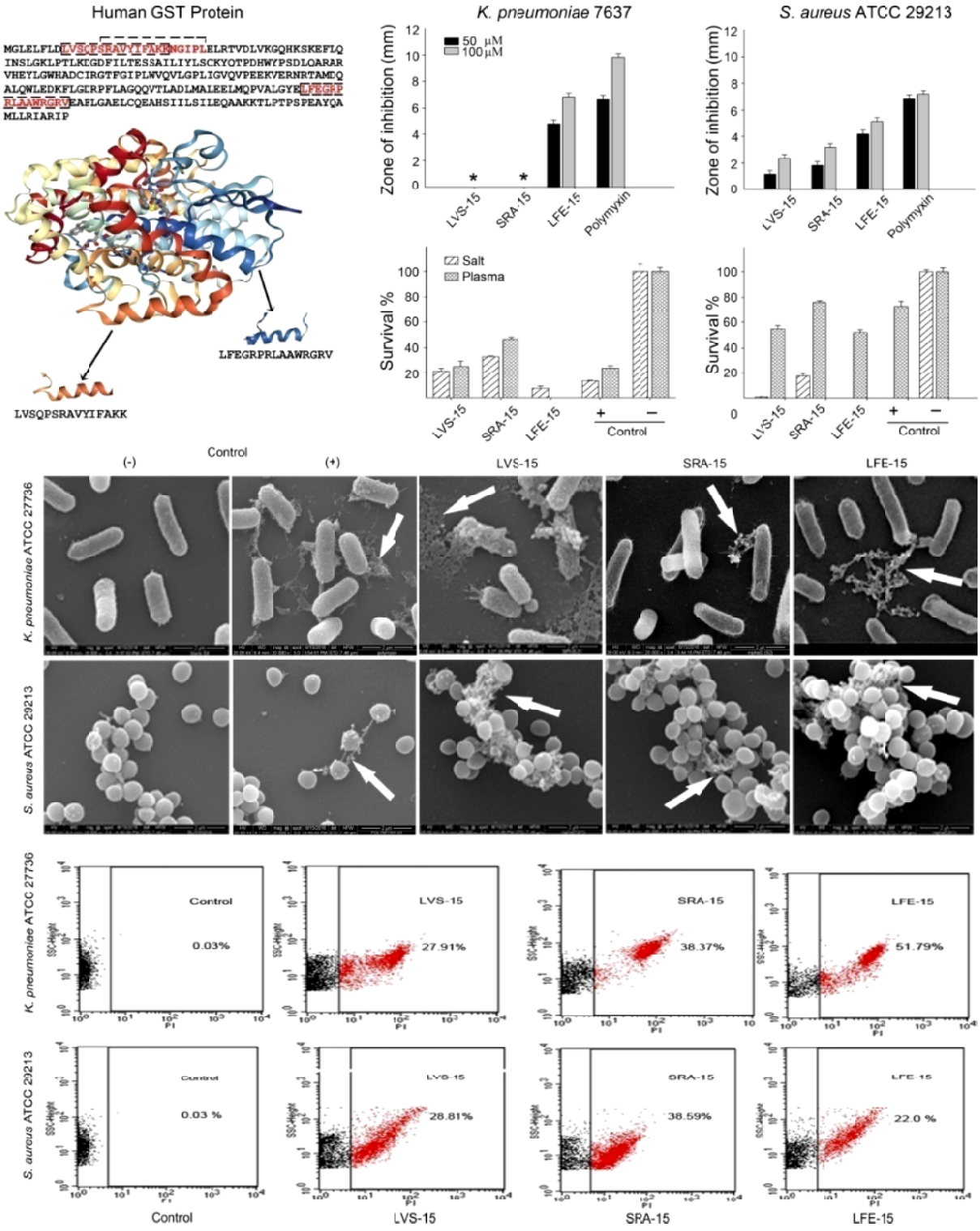


Fig.: Peptide-induced membrane damage as visualized by Scanning electron Microscopy (SEM). SEMmicrographs of *E. coli* and *S. aureus* treated with 2X MIC for 1 h. Upper Panel. A) Untreated *E.coli* Cells-No peptide B) FR-15–treated C) FR4P –treated D) FR8P –treated E) FR-11P –treated F) FR4,8P –treated G) FR8,11P –treated. Lower Panel H) Untreated *S.aureus* Cells I) FR-15 –treated J) FR4P –treated K) FR8P–treated L) FR-11P –treated M) FR4,8P –treated N) FR8,11P –treated.

Antimicrobial peptides are one of the most important components of the human immune defense system. They play a very crucial role in fighting against various microbial infections. Despite their differences in sequence structure and charge, they have been thought to target the bacterial cell membrane. Although vast sequence and structural diversities exist, AMPs share several common features including cationicity and amphipathicity. In this study, a moderately short cationic and hydrophobic peptides derived from the conserved domains of human glutathione s-transferase have been shown to be active against *S. aureus* and *K.*

pneumonia in physiological conditions without any toxicity issues. We further show here that human glutathione s-transferase, a C-terminal region which showed the higher antimicrobial activity, is conserved in the vertebrates. Our results demonstrated the potential of human glutathione s-transferase derived peptides as a template for the development of anti-infective therapeutics. Whether GST derived peptides or protein itself *per se* contribute to immunity or can act on other pathogens is not addressed in this study and clearly remains to be investigated in future studies. It is strange and interesting to observe that the peptides regions derived from the C-terminal region of various proteins such as superoxide dismutase, complement system anaphylatoxin, thrombin, GST (this study), etc. were found to be antimicrobial. However, we did not find any reason till date, why it is like that? Probably, nature might have designed it like that. To the best of our knowledge, this is the first report on short synthetic



peptides derived from human glutathione s-transferase with direct antimicrobial activity and cell selectivity.

3.4 Target Identification and Functional Analysis

3.4.1 Study of carbon and nitrogen metabolic pathways of MTB for their suitability as a source of new drug targets: Malate Synthase

The enzyme malate synthase performs a condensation reaction to convert glyoxylate to malate in the presence of acetyl-CoA. This reaction helps in bypassing the TCA cycle reactions causing loss of carbon and also ensures pushing forward the overall carbon cycling intended to generate gluconeogenic and TCA cycle intermediates. Malate synthase (GlcB) of *Mycobacterium tuberculosis* H37Ra (*Mtb*-Ra) is encoded by MRA_1848. To evaluate the functional relevance of GlcB in *MTB*-Ra we developed a knockdown (KD) strain by down-regulating it and performed *in-vitro* and *ex-vivo* survival

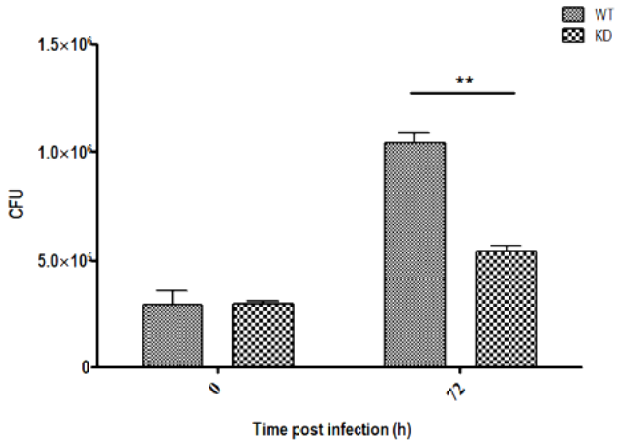


Fig. : Survival in mouse macrophages: The WT and KD refer to wild-type and GlcB knockdown *Mtb*-Ra. The CFU of WT and KD was performed after 0 h and 72 h post-infection. Significance testing was performed by Student *t*-test, $^{**}p<0.01$

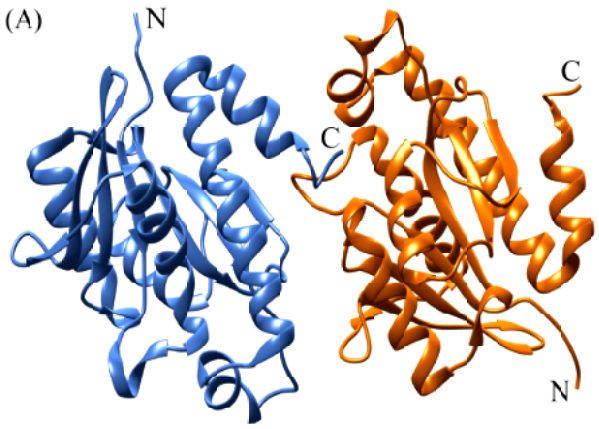
studies. These studies suggested increased susceptibility to oxidative and nitrosative stress. Increased killing of KD was observed in the presence of 5 mM DETA-NO. In addition, DETA-NO treatment in the presence of scavenger led to recovery in both WT and KD. Similarly, with H_2O_2 substantial increase in inhibition of KD was observed after 96 h of incubation. Both, WT and KD, recovered in the presence of free radical scavenger. The inhibition studies with rifampicin suggested a substantially increased inhibition of KD compared to WT, at lower rifampicin concentrations. Also, reduced ability to persist as well as reduced growth inside macrophages was observed. The study of post-endocytosis events showed differences in endosomal maturation in macrophages infected with KD and WT (*Tuberculosis*, 2017).

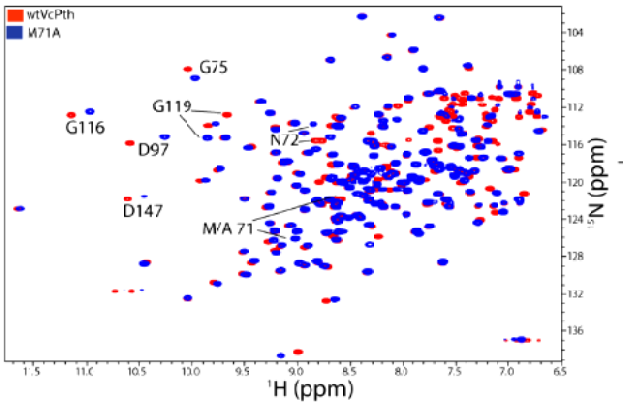
3.4.2 Biochemical characterisation of MTB Nei2

Nei2 (Rv3297) is a DNA Base Excision Repair (BER) glycosylase that is essential for survival of *Mycobacterium tuberculosis* in primates. We demonstrated that MtbNei2 is a bifunctional glycosylase that specifically acts on oxidized pyrimidine-containing single-stranded, double-stranded, 5'/3' fork and bubble DNA substrates. MtbNei2 possesses Uracil DNA glycosylase activity unlike *E. coli* Nei. Mutational studies demonstrate that Pro2 and Glu3 located in the active site are essential for glycosylase activity of MtbNei2. Mutational analysis demonstrated that an unstructured C-terminal zinc finger domain that was important for activity in *E. coli* Nei and Fpg, was not required for the glycosylase activity of MtbNei2. Lastly, we screened the NCI natural product compound database and identified three natural product inhibitors with IC50 values ranging between 41.8 μM-92.7 μM against MtbNei2 in *in vitro* inhibition assays. Surface Plasmon Resonance (SPR) experiments showed that the binding affinity of the best inhibitor, NSC31867, was 74 nM. The present results set the stage for exploiting this important target in developing new therapeutic strategies that target Mycobacterial BER.

3.4.3 Structural characterization of bacterial peptidyl-tRNA hydrolase

We have characterized the structure and dynamics of peptidyl-tRNA hydrolase from *Vibrio cholerae* (VcPth) and mutants of its catalytic site residue by X-ray





crystallography and NMR spectroscopy. Further, we have determined the crystal structure of M71A mutant of VcPth in a novel form with dimer interface formed by the C-terminal of one monomer and active site of the other monomer (Kabra A, et al. *RNA* 2017, 23:202-216).

3.4.4 EccA3, a CbbX family ATPase from the ESX-3 secretion pathway of *M. tuberculosis*

EccA family proteins are conserved components of ESX secretion pathways in *M. tuberculosis* H37Rv. Here, we report the characterization of EccA3 (Rv0282), a CbbX family AAA (ATPases Associated with diverse cellular Activities) protein from the ESX-3 pathway that is required for *in vitro* growth of mycobacteria, secretion of virulence factors, and acquisition of iron and zinc. EccA3 is a thermostable ATPase with a molecular weight of ~68kDa. It exists as a dodecamer in the apo form and associates as a hexamer in the presence of ATP. Its C-terminal region consists of a CbbX-like AAA-domain while the N-terminal region contains a tetratricopeptide repeat (TPR) domain with lower homology to other EccA-type proteins. Further, the C-terminal domain functions as the oligomerization domain and also exhibits ATPase activity. Mutational analysis, steady state kinetics and molecular docking studies identify R573 as the important 'sensor arginine' and R505 as an 'arginine finger' in EccA3. Dynamic fluorescence quenching experiments suggest that the N-terminal domain moves closer to the C-terminal domain upon ATP-binding. The ATP-dependent 'open-close' relative movements of the two domains might help EccA3 interaction and secretion of essential virulence factors. The results can help target this pathway as an approach for new therapeutic development (Amit Gaur et al, *Biochim. Biophys. Acta* 1865, 715-724, 2017, Kiran Lata et al., *Biochem Biophys Rep*, https://doi.org/10.1016/j.bbrep.2017.07.010, 2017)

3.5 Immunological Studies and Subunit Vaccine

3.5.1 Progress on design of subunit vaccine against TB

Our studies are aimed at discovering novel proteins for the development of a subunit/booster vaccine against tuberculosis. We have determined the immunological response against two pairs of ESAT-family proteins from *Mycobacterium tuberculosis* H37Rv viz. Rv1197/Rv1198 and Rv3444c/Rv3445c, using BALB/c mice as the model organism. These proteins/antigens elicit strong IgG titers in immunized mice. Moreover, the antigens also elicit strong recall responses from cultured splenocytes, which is characterized by high lymphocyte proliferation and specific cytokine induction. These proteins are strongly seroreactive towards the sera of TB patients (Pandey H, *Biochim Biophys Acta* 2017, 1861:396-408).

3.5.2 Monoclonal antibodies against surface proteins of A. fumigates

Two monoclonal antibodies MAb-R5(IgM) and MAb-R16(IgG) developed earlier against cell surface proteins of *Aspergillus fumigatus* were followed for their *in vitro* characterization (MTT assay,indirect immunofluorescence and *in vitro* CFU reduction) and *in vivo* antifungal efficacy in mouse.The *in vivo* evaluation of protective ability of MAb-R5(IgM) and MAb-R16(IgG) were assessed in experimental BALB/c mice challenged with *Aspergillus fumigatus* (1.0 x10^5 cells per mouse) and pretreated with the two MAbs (100 µg /mouse) where a reduction in cfu (kidney tissue) by 85.9% and 79.8% respectively (Fig.1) was observed compared to the irrelevant MAb control ($P<0.001$).

cDNA from MAb-R5(IgM) for heavy chain variable region and light chain variable region were successfully amplified and sequenced. These sequence were translated in three forward and three reverse (six frames) corresponding peptide sequences by EMBOSS Transeq. Theoptimum frames were selected and six CDR sequences were identified with the help of KABAT rule. The antibody modeling of MAb-R5 was done using heavy chain variable sequence and light chain variable sequence by ABodyBuilder tool (Fig.). Paratope derived peptide sequences for 3 dodecapeptides have been identified and are being synthesized for further studies and optimization of antifungal activity, if any.

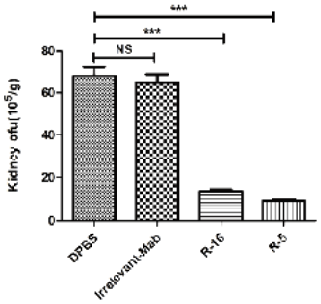


Fig.: Evaluation of Protective ability of MAb-95 (IgM) and MAb-R16 (1gG)

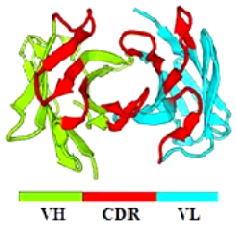
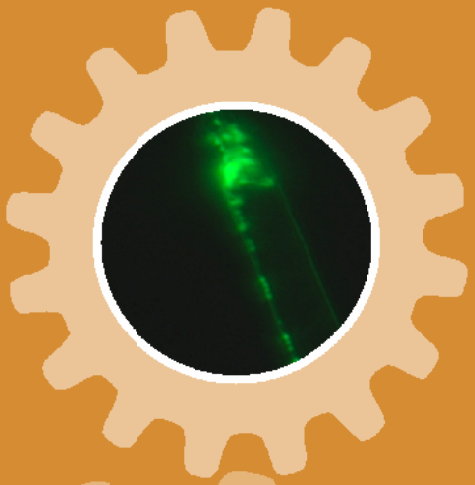
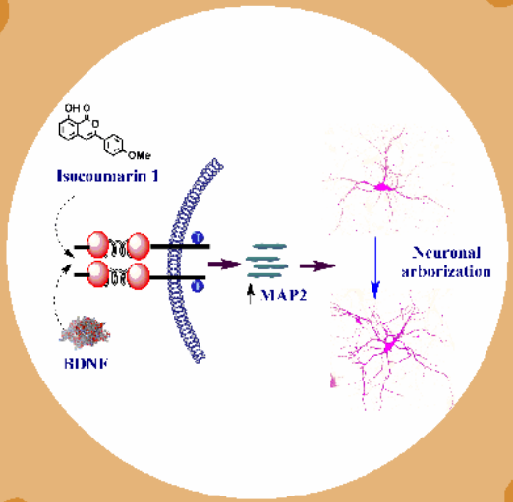
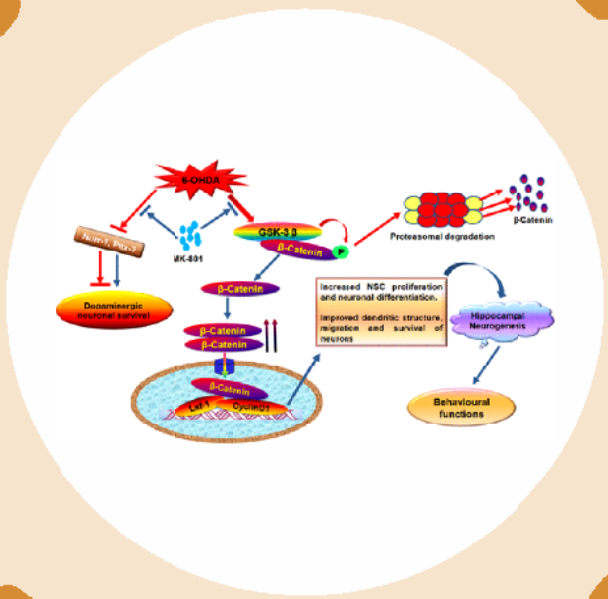


Fig.: Antibody Modelling of MA6-R5

CVS, CNS and Related Disorders







Area Coordinators

Dr Manoj K. Barthwal

Dr PN Yadav

Research Team

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4

CVS, CNS and Related Disorders

Area Coordinator: Dr Manoj K. Barthwal & Dr PN Yadav

The research and development activities in CVS-CNS and related disorders comprises advancing the knowledge frontier in biomedical aspects of following disorders:

- Cardiovascular system (Hypertension, Pulmonary hypertension, Dyslipidemia, Atherosclerosis, Thrombosis and Myocardial Infarction)
- Central nervous system (Depression, Neurodegeneration, Dementia and Stroke)
- Other related disorders (e.g., Inflammation)

4.1 Advancing the Knowledge Frontiers

4.1.1 Ox-LDL Induces Metabolic and Inflammatory Re-programming of Dendritic cells

Atherosclerosis is a lipid-related chronic inflammatory disease in which immune cells play a pivotal role in the pathogenesis of disease. Here, we investigated the effects of oxidized low density lipoprotein (Ox-LDL) on dendritic cell activation, inflammation and metabolism. Bone marrow derived dendritic cell (DCs) stimulated with Ox-LDL (40µg/ml) for different time undergoes dramatic changes in their metabolic activity. Oxygen consumption rates (OCRs) and extracellular acidification rates (ECARs) were analyzed at 6hr and 24hr after stimulation with OX-LDL by Seahorse extracellular flux analyzer. Higher ECAR activity in DCs was observed after stimulating with Ox-LDL for 6hr but decrease in both ECAR and OCR was observed at 24hr. DCs stimulated with Ox-LDL demonstrated abundant expression of glucose transporter 1 (GLUT1) ($p<0.01$) and pro-inflammatory cytokine IL-1β ($p<0.01$) at initial 6hr but sharp decrease in expression of GLUT 1 ($p<0.01$) and IL-1β ($p<0.01$) were observed at 24hr. The present study demonstrates that Ox-LDL induces enhanced glycolytic and inflammatory programming of the dendritic cells. Therefore, Dendritic cells can be targeted for modulating atherosclerosis progression by regulating its metabolic activation.

4.1.2 S-glutathionylation Profile in M1&M2 BMDM & Stromal Vascular Fraction from Diabetic Mice

Post-translational modifications (PTMs) of different proteins due to oxidative stress are associated with different pathological conditions which are often paved in alteration in cell function. Hyperglycemia or lack of insulin action flag the way towards diabetic pathological conditions. Under diabetic condition the number of the inflammatory macrophages increases which is one of the main source of ROS. PTMs of proteins are one of the mechanism by which cells respond to oxidative stress. Therefore, the present study evaluates the status of ROS mediated S-glutathionylation in M1 and M2 macrophages and in diabetic condition. Bone Marrow Derived Macrophages BMDMs were cultured and polarized in to M1 by LPS (1 µg/ml) , IFNγ (10ng/ml) and M2 by IL4 (10ng/ml). Purity of the macrophages was assessed by using flow cytometry (FACS Calibur) & M1/M2 markers were checked by RT-PCR. SVF was isolated from adipose tissue of *db/+* & *db/db* mice by enzymatic method. Total GSH content in M0, M1, M2 macrophages and in SVF was measured by DTNB method. GSH/GSSG ratio was also calculated. S-Glutathionylation pattern of the proteins was monitored by anti-GSH antibody through western blotting. Purity of the isolated BMDMs was more than 97%. Gene expression of markers such as IL-1β & TNF in M1, and YM-1 & Arg-1 in M2 BMDM was increased. A significant increase in the total GSH content in M1 macrophages was observed. Ratio of GSH/GSSG was also increased in M1 macrophages. Further, post translational modification study shows increased S-glutathionylation status of some proteins in M1 macrophages. Similarly, increased S-glutathionylation was also observed in SVF of db/db mice. Current study speculates that protein S-glutathionylation may play an important role in M1 phenotype activation and adipose tissue inflammation.

4.1.3 Glucose and lipid metabolism alterations in liver and adipose tissue pre-dispose $p47^{phox}$ knockout mice to systemic insulin resistance

The present study was undertaken to assess the role of $p47^{phox}$ in insulin resistance (IR) using wild type (WT) and mice lacking global $p47^{phox}$ ($p47^{phox}$ KO) fed with different diets (HFD, LFD or Chow). Augmented body weight, glucose intolerance and reduced insulin sensitivity after 5 or 10 weeks of high fat (45% or 60% HFD), low fat (10% LFD) or Chow diets indicated systemic IR in KO mice (Fig. 1). Further, body fat and circulating

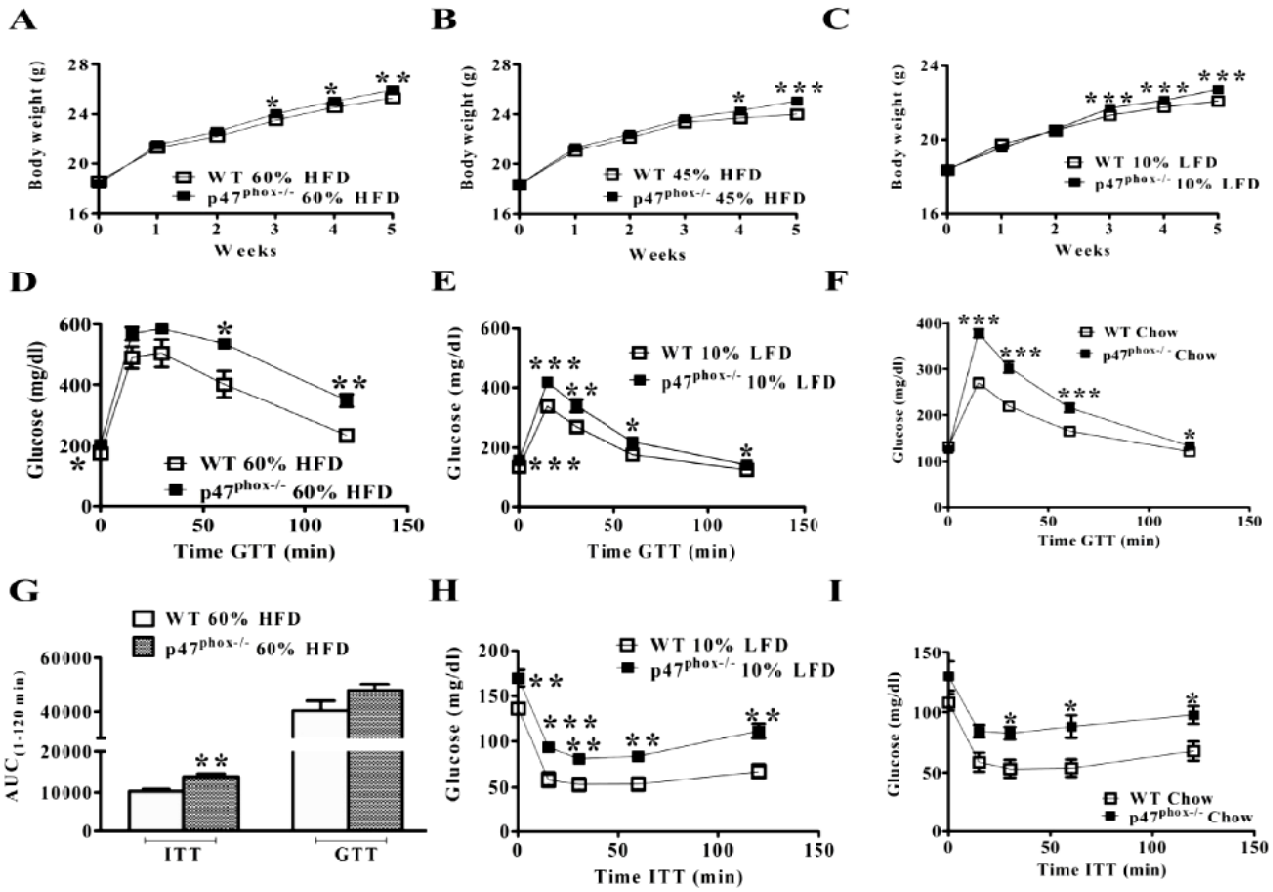


Fig. : Effect of global p47^{phox} absence on parameters of systemic IR. Increased body weight after (A) 10 weeks 60% HFD, (B) 5 weeks of 45% HFD and (C) 5 weeks of 10% LFD; Augmented glucose tolerance (GTT) and altered tissue insulin sensitivity (ITT) after (D, G) 5 or 10 weeks 60% HFD, (E, H) 5 weeks 10% LFD, and (F, I) 5 weeks Chow feeding.

lipids in LFD or Chow fed p47^{phox} KO mice after 5 weeks were significantly increased, while parameters of energy homeostasis were reduced in LFD but not in Chow fed ones. Moreover, LFD fed p47^{phox} KO mice also showed enhanced hepatic glycogenolysis, significant increase in hepatic lipids along with expression of genes regulating lipid synthesis, breakdown and efflux, adiposity and reduced insulin signaling in liver and adipose tissue. Our data demonstrates that lack of p47^{phox} is sufficient to induce systemic IR.

4.1.4 Absence of inducible nitric oxide synthase preserves kidney structure and prevents renal fibrosis in HFD mice model of obesity

The present study investigated the role of inducible nitric oxide synthase (iNOS) on kidney function and tissue fibrosis in 45% high fat diet (45% HFD) mice model of obesity. In comparison with WT C57BL/6, iNOS KO fed with 45% HFD for 20 weeks demonstrated improved glomerular structure & reduced kidney fibrosis as assessed from glomerular tuft area and tissue collagen content (Fig.). Mice lacking global iNOS showed attenuated kidney weights, body fat as well as decreased circulatory lipids along with improved glucose tolerance (GTT) over WT HFD. Decreased tissue collagen content concurred with attenuated immunohistochemical expressions of TGF-β1, fibronectin and tissue inhibitors of MMPs (TIMP-1 & 2). Further, significant decrease in blood urea nitrogen (BUN) and albumin/creatinine ratio were also observed in KO mice on 45% HFD. Mechanistically, iNOS KO mice on HFD showed increased NO availability (DAF-2DA), decreased nitrotyrosine as well as reduced inflammatory protein/ gene expressions. These observations signify that iNOS

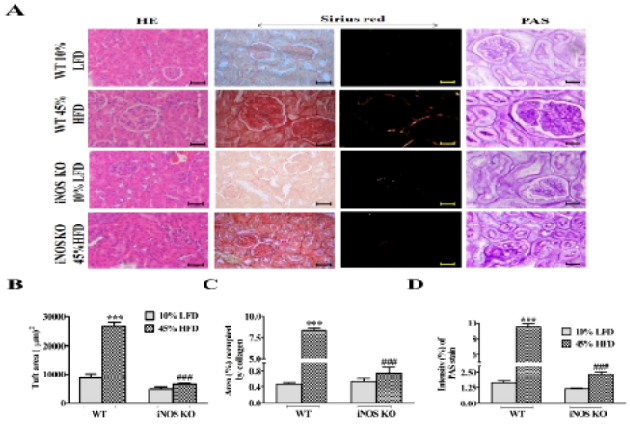


Fig. : Effect of iNOS absence on glomerular structure and tissue collagen content. Morphometric analysis by (A, B) HE, (A, C) picrosirius red & (A, D) PAS staining demonstrated reduced glomerular tuft area along with decreased renal collagen content and mesangial matrix.

plays a crucial role in HFD induced obesity associated renal dysfunction.

4.1.5 Chronic hyper-leptinemia induces insulin signaling disruption in adipocytes: implications of NOS2

Leptin, following its discovery, has developed a formidable interest in the scientific community to delineate its contribution towards overall metabolic homeostasis. It is well reported fact that a positive correlation exists between circulatory leptin levels and obesity/insulin resistance. We also found the same as surveyed in a small pool of human individuals. Leptin being an inflammatory class of adipokine and the presence of leptin receptors on adipocyte, it was interesting to study the autocrine effect of chronic hyper-leptinemia on insulin signaling in adipocytes. Our results showed that prolonged exposure of patho-physiological concentration of leptin for 48h to adipocyte *in vitro* induced insulin signaling impairment by reducing insulin stimulated downstream signaling and glucose uptake. LIR (Leptin induced insulin resistant) adipocytes were found to have increased oxidative stress mediated by cellular and mitochondrial superoxide generation, which in turn may cause mitochondrial dysfunction. In the light of confirmed mitochondrial dysfunction, the levels of NOS isoforms were assessed.Our studies showed NOS2 was significantly up-regulated. Interestingly NOS2 inhibition restored reduced glucose uptake partially and ameliorated insulin signaling.To further validate these findings *in vivo*, C57BL/6 mice were implanted with Alzetosmotic pumps filled either with vehicle or leptin to mimic control and hyper-leptinemia milieu. Leptin treated mice showed glucose and insulin intolerance with disrupted adipocyte insulin signaling, whereas these observations were absent in NOS2-/- mice implanted with leptin osmotic pumps. In conclusion, our studies put forward a potential link between increased leptin levels and reduced adipocyte insulin responsiveness mediated by NOS2.

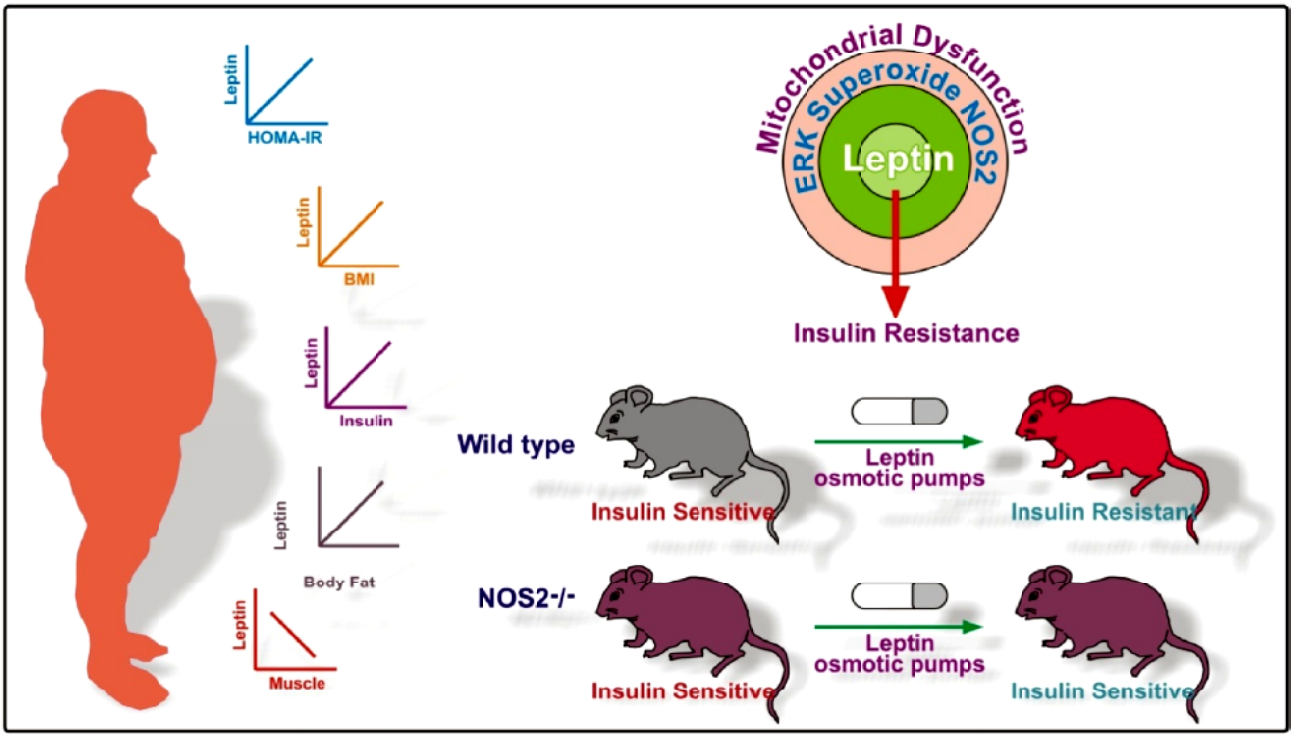


Fig.: Rate of NoS2 in leptin-Insulin signaling in adipocytes

4.1.6 Elucidation of antinociceptive mechanism of histamine H3 receptor (H3R) antagonism in neuropathy

Neuropathic pain, a debilitating pain condition, is a common consequence of damage to the nervous system. More importantly, there is complete dearth of an effective and safe therapeutics for neuropathic pain. Emerging evidences indicate that histamine H3 receptor (H3R) antagonism is a potential therapeutic target for treatment of neuropathic pain. However, the molecular mechanisms underlying the effect of H3R antagonist treatment after nerve injury are largely unknown. In the present study, we investigated the antinociceptive role of H3R antagonism. We found that chronic treatment withH3R antagonist GSK334429 (0.5 mg/kg twice a day *i.p.*; for 2 weeks) significantly attenuated the mechanical hyperalgesia and allodynia as measured by the van Frey hair test in rodent model of chronic constriction nerve injury (CCI). Interestingly, we also observed that H3R antagonism modulate NGF/trkA signaling in spinal cord CCI rat. However, we did not observe any effect of GSK334429 on CCI induced thermal hyperalgesia. These results for the first time reveal the molecular mechanism of beneficial effect of H3R antagonist in neuropathic pain (Fig.).

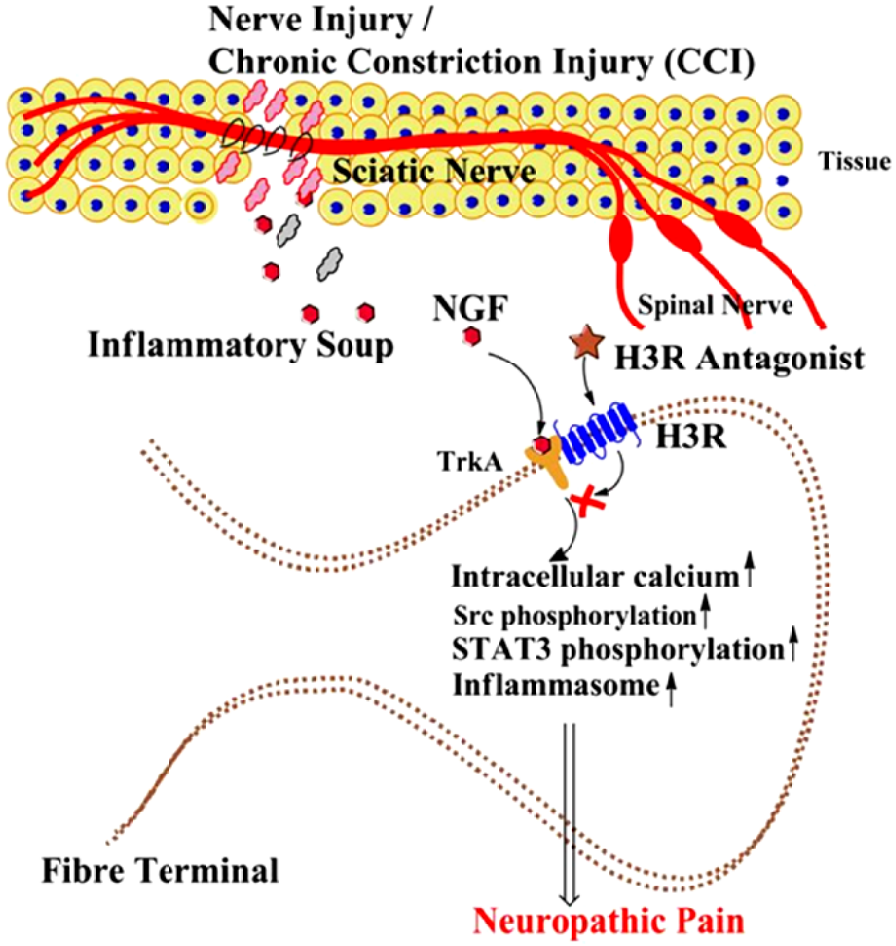


Fig. : Graphical illustration of mechanism of H3R modulation of neuropathic pain in CCI model.

Isocoumarins, a lactone ring containing natural products, are quite abundant in microbes and higher plants, and have been shown to exhibit broad range of pharmacological properties. However, molecular mechanism or target of this class of molecules are not known. In this study, we have synthesized 14 isocoumarin derivatives and evaluated for their activity at TrkB receptor in transiently transfected HEK293T cells. We identified 8-hydroxy-3 aryl isocoumarin 1, as a high affinity agonist at TrkB receptor. Furthermore, this compound also stimulated TrkB receptor in endogenously expressing primary cortical neurons and modulated various markers of synaptic plasticity, and increased dendritic arborization in primary neurons. These results indicate therapeutic potential and molecular target of 8-hydroxy-3 aryl isocoumarins for the treatment various CNS disorders (Fig.).

4.1.7 Isocoumarin analogue activates neurotrophin receptors TrkB and modulates synaptic proteins and neuron dendritic arborisation.

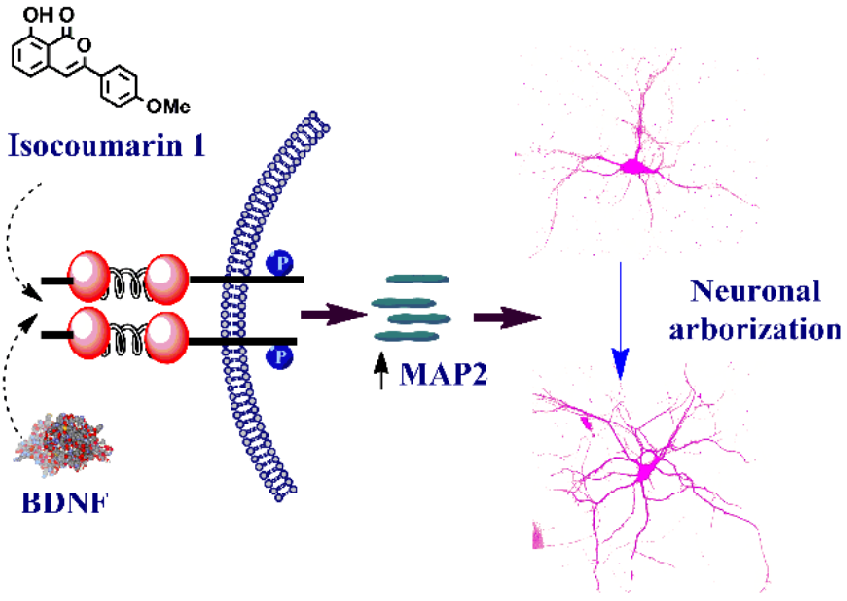


Fig. : Graphical illustration of Isocoumarin1 modulation of synaptic plasticity

4.1.8 Standardized herbal extract Picroliv protects mice from alcohol induced liver dysfunction

Picroliv treatment significantly protected the alcohol induced mice liver damage on par with the standard drug Silymarin. Non-invasive detection of liver using 2D ultrasound detected reduced liver hardening in the Picroliv treated group compared to the vehicle treatment. Morphological analysis of alcohol induced mice liver showed the presence of reduced presence of nodule formation, distorted feathery morphology of hepatocytes, reduced lipid deposition and collagen deposition in the Picroliv treated group. Picroliv treatment significantly reduced the Oleic acid: Palmitic induced fatty acid uptake in Eahy.926 endothelial cells and HepG2 hepatocyte cells. Similarly, picroliv treatment reduced the uptake of Dil. LDL in endothelial cells. Our results show that Picroliv protects the alcohol induced liver damage in mice.

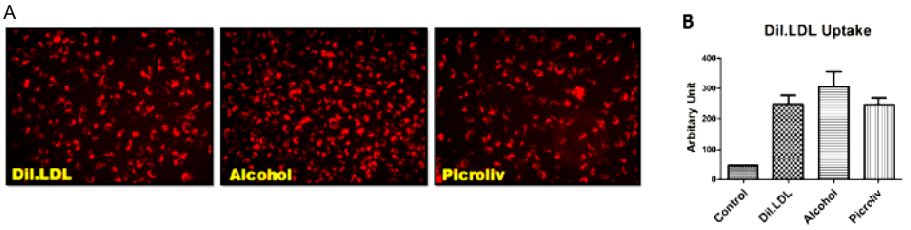


Fig.: (A) Shows the uptake of Dil LDL in endothelial cells. (B) Histogram shows fluorescence intensity of cells with Dil. LDL.

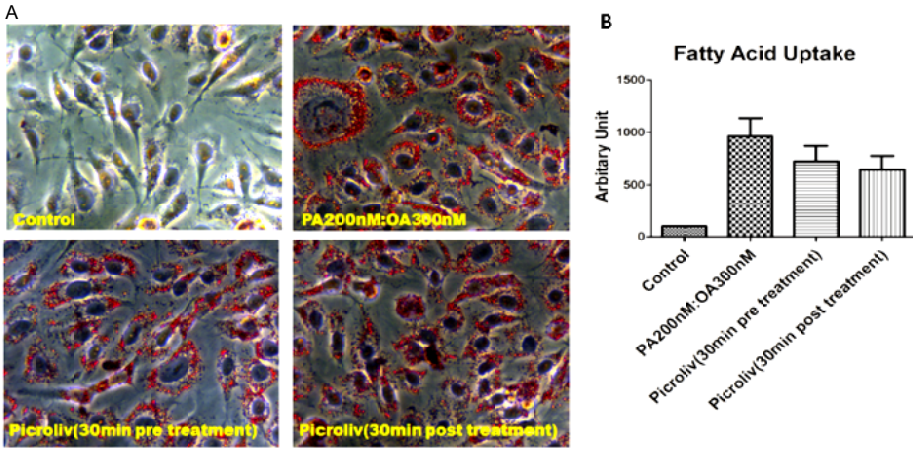


Fig.: (A) Shows the images of Oil Red O staining in endothelial cells loaded with Oleic acid: Palmitic acid. (B) Bar diagram depicts the intensity of Oil Red O staining.

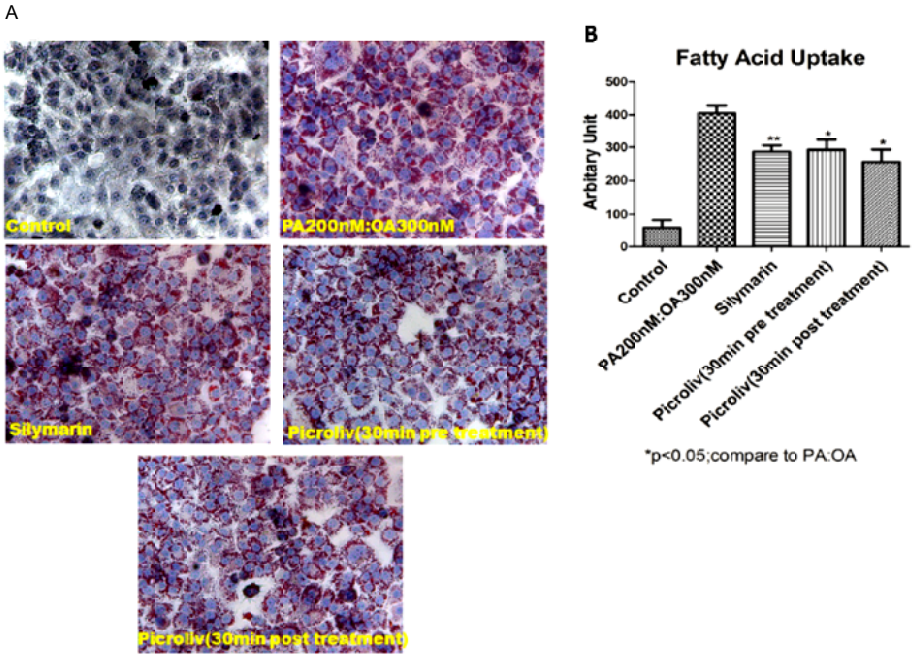


Fig.: (A) Shows the images of Oil Red O staining in HepG2 cells loaded with Oleic acid: Palmitic acid. (B) Bar diagram depicts the intensity of Oil Red O staining.

4.1.9 Hypertension leads to glial activation and angiotensin receptor blockade (ARB) inhibits glial activation and promotes neurogenesis

With change in life style, incidences of hypertension are increasing rapidly. Not only for cardiovascular system, hypertension is one of the major risk factors for central nervous system (CNS) disorders like stroke and Alzheimer's disease (AD). On the other hand, CNS diseases like AD have been associated with gliosis and impaired neurogenesis. Further, renin angiotensin system (RAS) is intricately associated with hypertension; however, the accumulating evidences suggest that over-

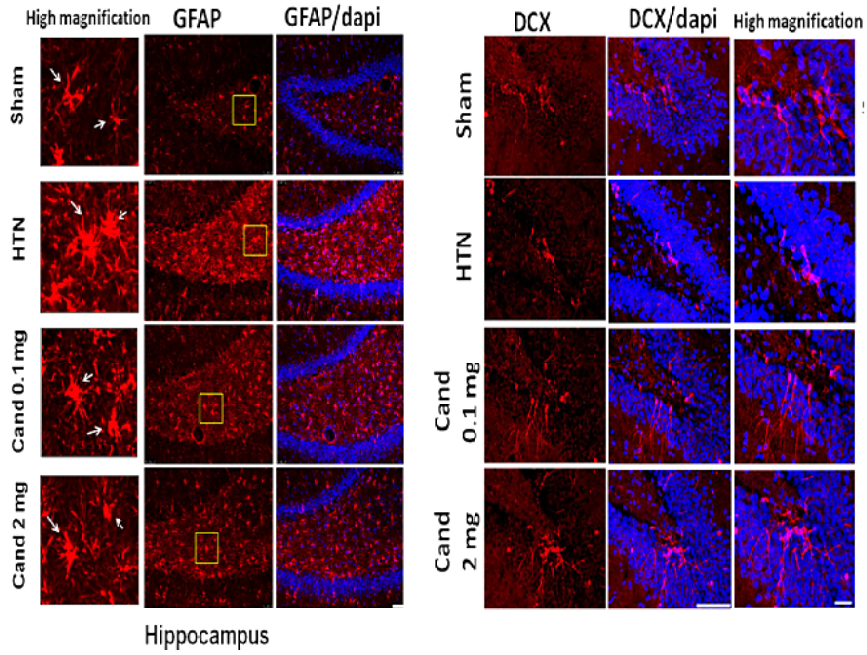


Fig.: A. Hypertension increases glial activation as shown by fluorescent images of astrocytes (GFAP+) in the hippocampus.
B. Hypertension dereased nurogenesis as evident by dereased expression of Doublecortin (DCX), a marker nueurogenesis.

activity of RAS may perpetuate the brain inflammation related with AD. Therefore, in the present study, we have examined the effect of hypertension and RAS on glial (astrocytes and microglia) activation and hippocampal neurogenesis in a rat model of chronic hypertension. We used Candesartan [Angiotensin type 1 receptor (AT1R) blocker (ARB)] both at a low dose (0.1 mg/kg) and anti-hypertensive dose (2 mg/kg) to explore whether their effect on astrocyte and microglial activation, neuroinflammation, and neurogenesis is blood pressure (BP) dependent or independent. Our data revealed that hypertension induces robust microglial and astrocyte activation, neuroinflammation, and cripples hippocampal neurogenesis. Importantly, AT1R blockade by Candesartan, even at low dose (0.1 mg/kg), prevented astrocyte and microglial activation and neuroinflammation in the brain of hypertensive rats. Mechanistically, AT1R blockade prevented the activation of NADPH oxidase, reactive oxygen species (ROS) generation, suppression of MAP kinase and NFêB signaling. Importantly, we, for the first time to our knowledge, provided the evidence that AT1R blockade by activating Wnt/β-catenin signaling, promotes neurogenesis during hypertensive state. We conclude that AT1R blockade prevents astrocyte and microglial activation and improves hippocampal neurogenesis in hypertensive state, independent of BP lowering action.

4.1.10 Fatty acid synthase modulates proliferation, metabolic functions and angiogenesis in hypoxic pulmonary artery endothelial cells.

In our previous work, we have shown that Fatty acid synthase is involved in pathophysiology of pulmonary hypertension (PH). However, endothelial dysfunction plays an important role in structural remodeling occurring in the pulmonary vasculature during PH. Endothelial injury causes apoptosis and activation of endothelial cells. However, some endothelial cells show apoptosis-resistance and later proliferate extensively leading to vascular oculopathy and formation of plexiform lesions in PH. Studies have shown that rapidly proliferating cells exhibit increased expression of Fatty acid synthase (FAS), a regulatory enzyme responsible for the production of fatty acids. Our previous study has shown that FAS inhibition prevented smooth muscle cell proliferation, reversed pulmonary vascular remodeling and improved pulmonary

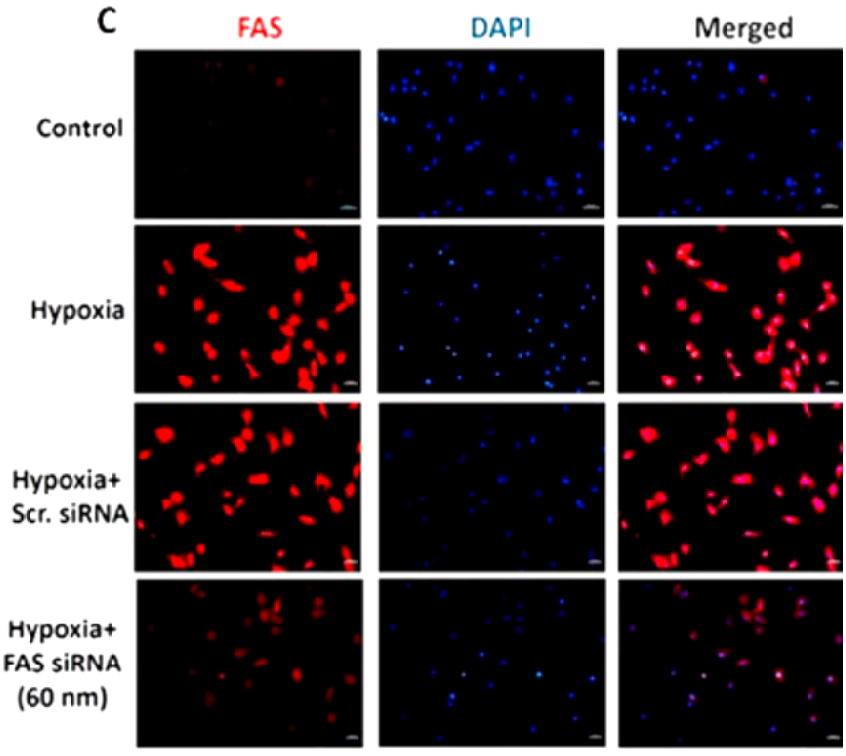


Fig.: Increased FAS and *de novo* fatty acid synthesis in hypoxic HPAECs

vasoreactivity in monocrotaline induced PH model. However, the role of FAS in pulmonary artery endothelial cell proliferation and angiogenesis has not been explored. The present study was designed to explore the role of FAS in proliferation, metabolic dysfunctions, and angiogenesis in endothelial dysfunction associated with PH. The human pulmonary artery endothelial cells (HPAECs) were exposed to hypoxia and FAS siRNA (60nM) was used for the FAS inhibition. Increased expression and activity of FAS were observed in hypoxic HPAECs. Inhibition of FAS increased apoptosis and glucose oxidation, but decreased cellular proliferation, markers of autophagy and glycolysis in hypoxic HPAECs. FAS inhibition decreased the angiogenesis as evident by decreased tubule length and VEGF expression in hypoxic HPAECs. Inhibition of FAS also increased expression of endothelial NOS in hypoxic HPAECs, a marker of endothelial function. Our results proved and further supported previous findings, that inhibition of FAS is beneficial for endothelial function in pulmonary hypertension (*Eur J. Pharmacol*. 2017, 815: 462-469).

4.1.11 MK-801 (Dizocilpine) Regulates Multiple Steps of Adult Hippocampal Neurogenesis and Alters Psychological Symptoms via Wnt/β-Catenin Signaling in Parkinsonian Rats.

Adult hippocampal neurogenesis is directly involved in regulation of stress, anxiety, and depression that are commonly observed nonmotor symptoms in Parkinson's disease (PD). These symptoms do not respond to pharmacological dopamine replacement therapy. Excitotoxic damage to neuronal cells by N-methyl-D-aspartate (NMDA) receptor activation is also a major contributing factor in PD development, but whether it regulates hippocampal neurogenesis and nonmotor symptoms in PD is yet unexplored. Herein, for the first time, we studied the effect of MK-801, an NMDA receptor antagonist, on adult hippocampal neurogenesis and behavioural functions in 6-OHDA (6-hydroxydopamine) induced rat model of PD. MK-801 treatment (0.2 mg/kg, ip) increased neural stem cell (NSC) proliferation, self-renewal capacity, long-term survival, and neuronal differentiation in the hippocampus of rat model of PD. MK-801 potentially enhanced long-term survival, improved dendritic arborization of immature neurons, and reduced 6-OHDA induced neurodegeneration via maintaining the NSC pool in hippocampus, leading to decreased anxiety and depression-like phenotypes in the PD model. MK-801 inhibited glycogen synthase kinase-3β (GSK-3β) through up-regulation of Wnt-3a, which resulted in the activation of Wnt/β-catenin signaling leading to enhanced hippocampal neurogenesis in PD model. Additionally, MK-801 treatment protected the dopaminergic (DAergic) neurons in the nigrostriatal pathway and improved motor functions by increasing the expression of Nurr-1 and Pitx-3 in the PD model. Therefore, MK-801 treatment serves as a valuable tool to enhance hippocampal neurogenesis

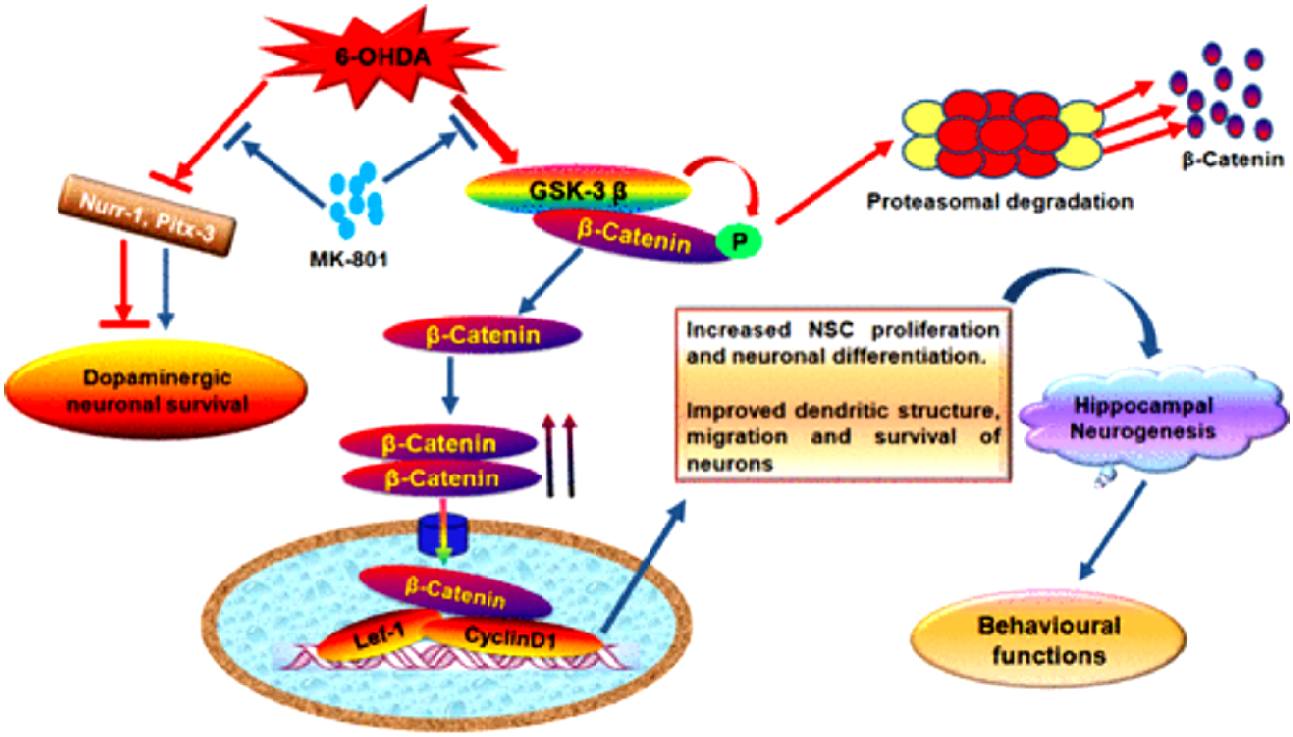


Fig.: A proposed schematic representation of the means by which MK-801 improves adult hippocampal neurogenesis in hemiparkinsonian rats: On the basis of our experimental studies, we found that MK-801 enhances NSC proliferation and neuronal differentiation and protects DAergic neurons through activation of the Wnt/β-catenin pathway by inhibiting GSK-3β. 6-OHDA treatment, causes the activation of GSK-3β which phosphorylates β-catenin and provokes proteasomal degradation of β-catenin. MK-801 inhibits GSK-3β activation which leads to increased levels of cytosolic β-catenin. MK-801 also enhances nuclear translocation of β-catenin, leading to activation of target genes (Lef-1, Cyclin-D1) which causes increased NSC proliferation and up-regulation of transcription factors (Nurr-1, Pitx-3) involved in DAergic neuronal survival.

in PD, but further studies are needed to revisit the role of MK-801 in the neurodegenerative disorder before proposing a potential therapeutic candidate. (*ACS Chem Neurosci*. 2017 Mar 15; 8(3): 592-605)

4.1.12 microRNA Let-7 studied for its effect on alpha-synuclein expression and associated effects employing transgenic *C. elegans* model.

Neurodegenerative Parkinson's disease (PD) is a multi-factorial disorder for which a complete cure does not exist. Understanding the mechanism of initiation and progression of this disease has been quite challenging; however, progress has been made towards understanding certain genetic aspects related to the disease condition. Genetics studies have provided clues towards the role of microRNAs (miRNAs) in various disease conditions. One of the crucial miRNA molecules, Let-7, is highly conserved miRNA and is known to regulate important functions of development and viability. Altered expression of let-7 miRNA has been reported in *C. elegans* model of PD. We carried out studies with Let-7, employing transgenic *C. elegans* model expressing 'human' alpha-synuclein. We developed a let-7 loss-of-function model towards studying the downstream effects related to PD. We observed let-7 miRNA was up-regulated in *C. elegans* model of Parkinson's disease. We figured that loss of let-7 miRNA leads to decreased alpha-synuclein expression, increased autophagy, increased Daf-16 expression, increased oxidative stress and increased lipid content with no effect on dopaminergic / acetylcholinergic neurons. Our findings indicate that let-7 miRNA regulates Parkinson's disease-associated pathways. Our study provides insight towards the role of let-7 in regulating expression of genes associated with these pathways which might have implications on the multi-factorial nature of PD. Potential pharmacological agents modulating the expression of let-7 could be studied towards targeting the multi-factorial aspect of PD (Front Mol Neuronci. 2017 Oct 13; 10: 328)

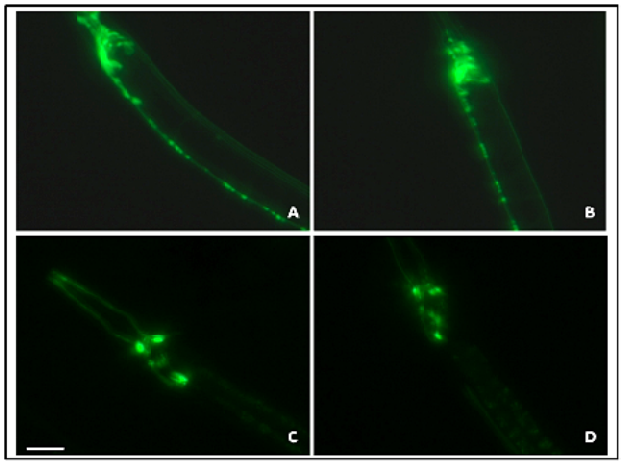


Fig.: GFP expression pattern in the unc-17::GFP strain (A: Control, B: let-7 miRNA knockdown) and dat-1::GFP strain (C: Control and D: let-7 miRNA knockdown) using fluorescence microscopy. Scale bar 50uM

4.1.13 GLP-Safety Pharmacology Studies of Fracture Healing Candidate Drug S007-1500:

Oral treatment with test item S007-1500 at 1, 2.5, 5 and 10 mg/kg in rats and 2,5,10 and 20 mg/kg in mice did not produce any consistent and sustained adverse effect on CVS, respiratory, oxygen saturation and CNS parameters after oral administration. It showed no affinity for hERG ion channel up to 30 µM concentration in the assay system tested. In conclusion, no adverse effect was observed.

4.2 New Initiative

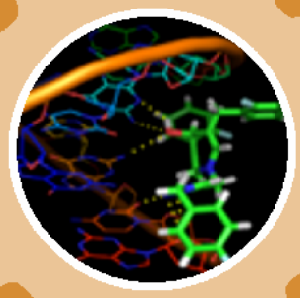
4.2.1 Immunomodulatory Studies in Cardiometabloic Disorders

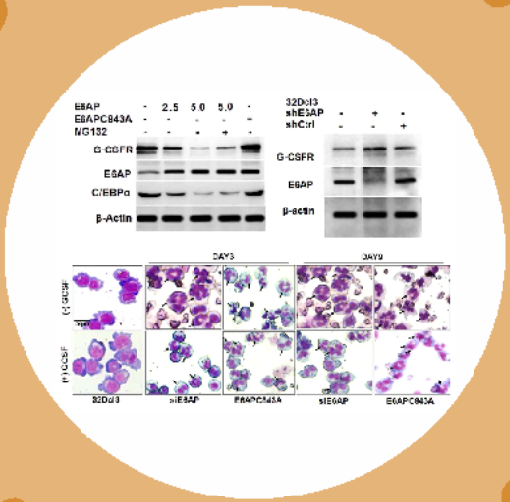
Based on the expertise of new scientist recruited in this area, immunomodulatory studies with the novel chemical entities, phytopharmaceuticals, herbal extracts have been initiated to further improve their effectiveness and safety profile.

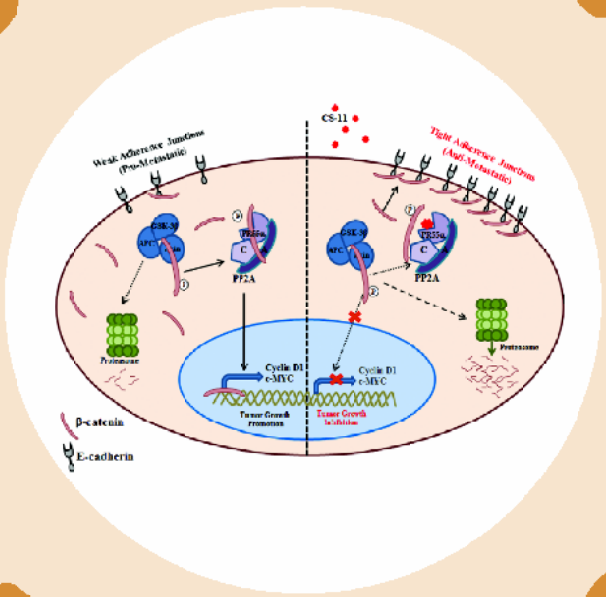
4.2.2 Electrophysiological Studies

State of the Art Electrophysiology unit is being setup at CDRI. This patch clamp set up would help in GLP safety pharmacology studies by specifically determining hERG channel liability of CDRI lead molecules. This facility will also help to discover novel ion-channel blockers, which can be used as medicines as well as molecular probes.

Cancer and Related Areas







Area Coordinators

Dr Arun Kumar Trivedi

Dr Smrati Bhadauria

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Second Row : Deepankar Koli, Deepak Datta, DP Mishra, Shakil Ahmed

5

Cancer and Related Areas

Area Coordinators: Dr Arun Kumar Trivedi & Dr Smrati Bhadauria

Focus of cancer research at CSIR-CDRI is to decipher underlying mechanisms of cancer pathogenesis (Particularly Breast, Cervical, Oral, Colorectal and leukemia) for better understading of the disease with sole objective to identifying disease-biomarkers for better diagnosis, prognosis and molecular targets for efficacious cancer therapeutics.

In line with this, research highlights of the passing year are highlighted below:

5.1 Discovery of a Novel Small-Molecule Inhibitor that Targets PP2A-β-Catenin Signaling and Restricts Tumor Growth and Metastasis.

Molecular hybridization of different pharmacophores to tackle both tumor growth and metastasis by a single molecular entity can be very effective and unique if the hybrid product shows drug-like properties. Here, we report synthesis and discovery of a novel small-molecule inhibitor of PP2A-β-catenin signaling that limits both *in vivo* tumor growth and metastasis. Our molecular hybridization approach resulted in cancer cell selectivity and improved drug-like properties of the molecule. Inhibiting PP2A and β-catenin interaction by selectively engaging PR55α-binding site, our most potent small-molecule inhibitor diminished the expression of active β-catenin and its target proteins c-Myc and Cyclin D1. Furthermore, it promotes robust E-cadherin upregulation on the cell surface and increases β-catenin-E-Cadherin association, which may prevent dissemination of metastatic cells. Altogether, we report synthesis and mechanistic insight of a novel drug-like molecule to differentially target β-catenin functionality via interacting with a particular subunit of PP2A. (*Mol Cancer Ther;* 16(9); 1791-805)

5.2 siRNA delivery using cationic lipid based highly selective human DNA ligase I inhibitor.

The discovery of a cationic lipid based human DNA ligase I inhibitor and development of siRNA delivering, human DNA ligase I targeted cationic lipid based non-viral vector is reported. We tested a small in-house library of structurally similar cationic lipo-anisamides for anti-ligase activity and amongst the tested molecules, N-dodecyl-N-(2-(4-methoxybenzamido)ethyl)-N-methyldodecan-1-ammonium iodide (C12M) selectively and efficiently inhibited the enzymatic activity of human DNA ligase I, compared to other human ligases (hLigIIIβ and hLigIV/XRCC4) and bacterial T4 DNA ligase (Fig A). Furthermore, upon hydration with equimolar cholesterol, C12M produced cationic liposomes which transfected survivin siRNA (Fig B) and showed significant anticancer activity of surviving siRNA in PC-3 cells (Fig C). More significantly, C12M demonstrated the inhibition of tumor growth in a melanoma model of mouse cancer (Fig D & E). (*ACS Appl Mater Interfaces*. 2017 Dec 19.doi: 10.1021/acsami.7b19193)

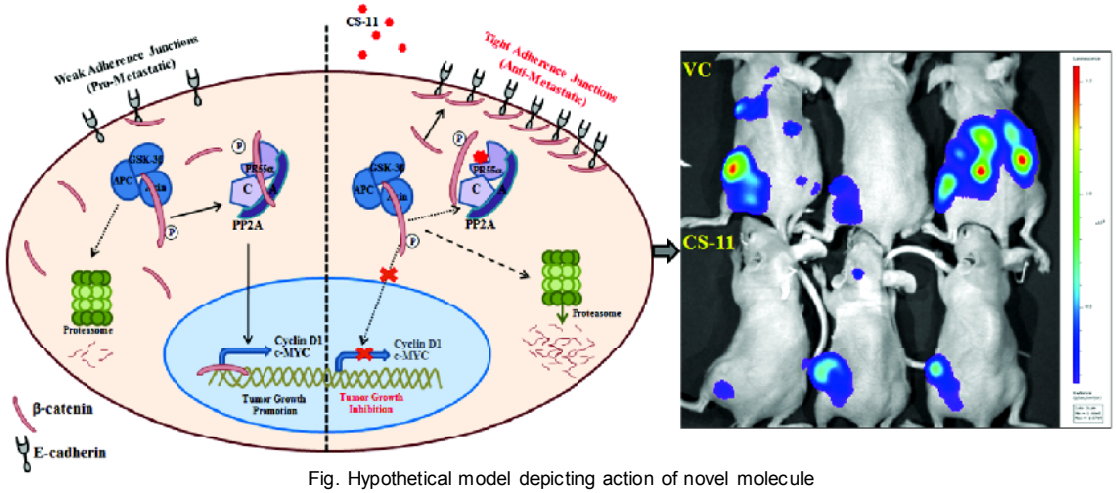

Fig. Hypothetical model depicting action of novel molecule

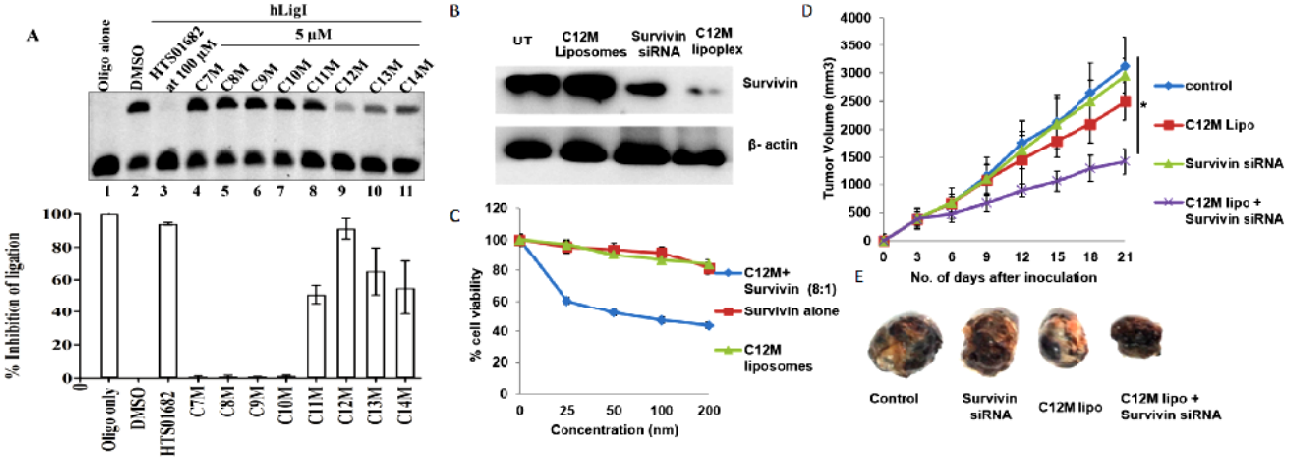

Fig. (A) Gel picture and graph showing inhibition of hLigI activity of C7M-C14M compounds. (B) Gene silencing efficiency of surviving siRNA delivered by C12M liposomes in PC-3 cells. (C) Anticancer effect of survivin siRNA in PC-3 cells measured by MTT assay. (D) Relative tumor size of the B16F10 syngenic tumo-rbearing mice after treatment. (E) Representative images of the harvested B16F10 tumor from each group at day 21. * P<0.05.

5.3 Description of mechanismof anti-cancer action of new curcumin-triazole conjugate

Tumor DNA damage and p53 pathway are clinically established target for developing cancer chemotherapeutics. A new orally active curcumin-triazole conjugate (CT-1) with significant anti-breast cancer activity *in vitro* was identified which selectively binds to minor groove of DNA and induces DNA damage leading to increase in p53. Oral administration of CT-1 induced significant inhibition of *in vivo* tumor growth in LA-7 syngeneic orthotropic rat mammary tumor model. CT-1 treated mammary tumor showed enhanced DNA damage, p53 upregulation and apoptosis. CT-1 could serve as a prototype of safe orally active molecule for developing new anti-cancer drugs (Fig.). (*Molecular Carcinogenesis* 2017 Apr; 56(4):1266-1280).

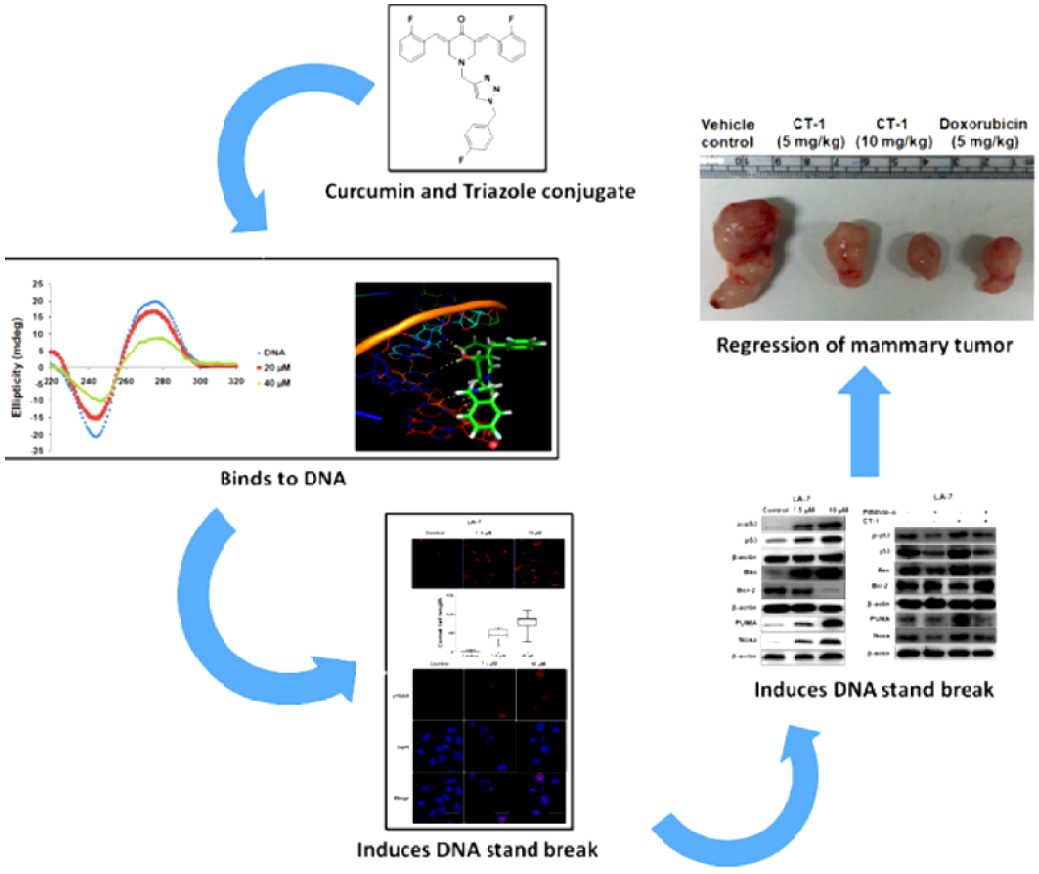

Fig.: Mechanism of anti-cancer action of new curcumin-trizole conjugate CT-1.

5.4 Understanding the role of RNA Polymerase II CTD in mRNA biogenesis

It has long been recognized that transcription is globally silenced during mitosis due to the presence of highly condensed chromatin. However, a few recent studies support active transcription albeit with a possibility of distinct mechanism. We have identified a kinase which modifies a key regulator of the transcription and is a part of the mitotic exit network. A prolonged mitotic arrest induces genetic instability and cell death. The inactivation of Cdc15 affects CTD phosphorylation and ongoing transcription during mitosis. We are further using a chemical genetic approach and carry out genome-wide transcriptome and proteome analysis to understand the process and mechanism of transcription in mitosis (Fig.) (*J. Biol. chem*, 2007, 292, 5507-5518).

5.5 Fission yeast Ctf1, a cleavage and polyadenylation factor subunit is required for the maintenance of genomic integrity

Accurate segregation of chromosome during mitosis requires the coordinated action of several cell cycle checkpoints that monitor replication of the genome and the attachment of sister chromatids to the mitotic spindle apparatus. We have characterized the fission yeast Ctf1, an ortholog of *S.cerevisiae* Rna15 in the maintenance of genomic integrity. The *ctf1* is nonessential for the cell survival and its deletion exhibit cold sensitivity. The *ctf1* deleted cells exhibit genetic interaction with spindle checkpoint protein Mad2 and Bub1. The deletion of *ctf1* gene affects the chromosomal attachment to the mitotic spindle leading to the accumulation of Bub1-GFP foci. Ctf1 localizes to the nucleus and physically interacts with Rna14, a cleavage and polyadenylation factor (Fig) (*Mol Genet Genomics* 292(5), 1027-1036).

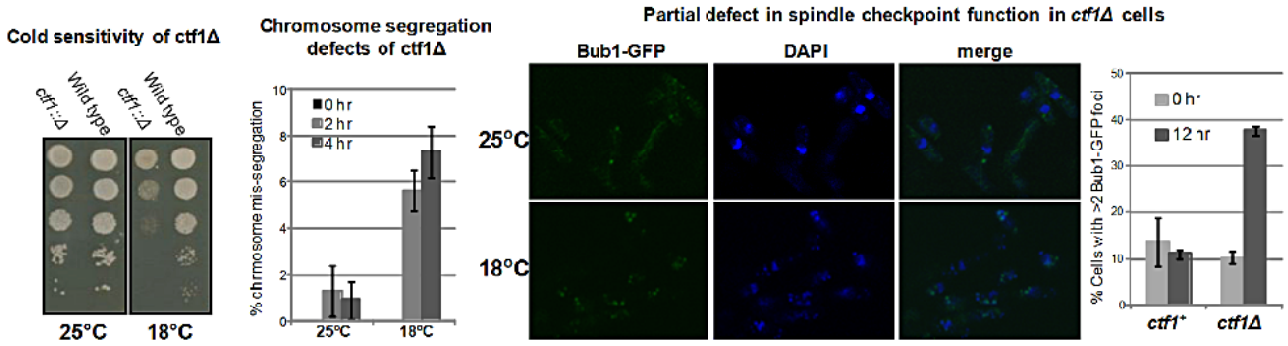

Fig. CH1 localizers polyadenylation factor

5.6 E6AP Inhibits G-CSFR Turnover and Functions by promoting its Ubiquitin-Dependent Proteasome Degradation.

Granulocyte colony-stimulating factor receptor (G-CSFR) plays a crucial role in regulating myeloid cell survival, proliferation, and neutrophilic granulocyte precursor cells maturation. Previously, we demonstrated that Fbw7α negatively regulates G-CSFR and its downstream signaling through ubiquitin–proteasome mediated degradation. However, whether additional ubiquitin ligases for G-CSFR exist is not known. Identifying multiple E3 ubiquitin ligases for G-CSFR shall improve our understanding of activation and subsequent attenuation of G-CSFR signaling required for differentiation and proliferation. Here, for the first time we demonstrate that E6 associated protein (E6AP), an E3 ubiquitin ligase physically associates with G-CSFR and targets it for ubiquitin-mediated proteasome degradation and thereby attenuates its functions. We further show that E6AP promoted G-CSFR degradation leads to reduced phosphorylation of signal transducer and activator of transcription 3 (STAT3) which is required for G-CSF dependent granulocytic differentiation. More importantly, our finding shows that E6AP also targets mutant form of G-SCFR (G-CSFR-T718), frequently observed in severe congenital neutropenia (SCN) patients that very often culminate to AML, however, at a quite slower rate than wild type G-CSFR. In addition, our data showed that knockdown of E6AP restores G-CSFR and its signaling thereby promoting granulocytic differentiation. Collectively, our data demonstrates that E6AP facilitates ubiquitination and subsequent degradation of G-CSFR leading to attenuation of its downstream signaling and inhibition of granulocytic differentiation (Fig.) (*Bioctim Biophyus Acta;* 1864(10): 1545-1553)

5.7 Novel noninvasive cancer biomarkers for early diagnosis of cervical cancer

Cervical cancer is one of the most common cancers among women worldwide and the second leading cause of cancer related deaths in India. Patients are often staying undiagnosed at the earlier stages and fall victim to prey of the grave disease in advanced stages. So, there is an urgent need of novel cancer biomarkers which could detect the early neoplastic changes through non invasive diagnostic methods. Our research output established PP1γ2 (Protein phosphatase1-gamma 2) and CABYR (Calcium-binding tyrosine phosphorylation-regulated protein) as diagnostic/therapeutic biomarkers of cervical cancer.

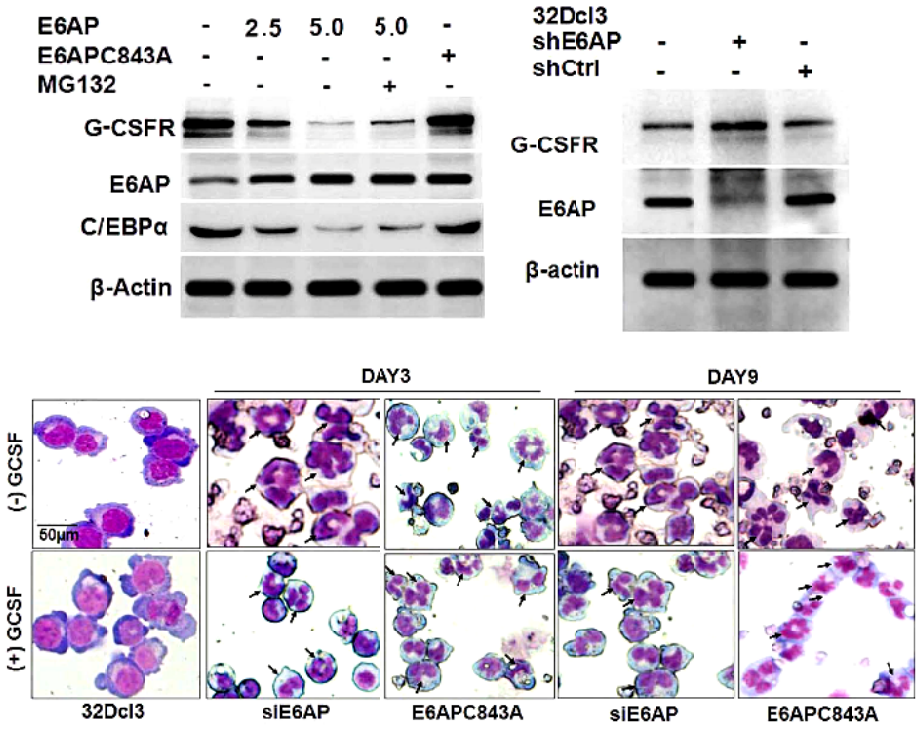

Fig 6: E6AP facilitates ubiquitination and subsequent degradation of G-CSFR leading to alternation of its downstream signating and inhibition of granulocytic deffountiation.

Our previous results showed very specific expression of these biomarkers in biopsy and Pap smear samples of the cervical cancer patients. In continuation, sera samples of almost hundred clinically confirmed cervical cancer patients of different stages, 50 CIN stages as well as 50 un-healthy non-cancerous patients were checked for the existence of circulating antibodies specific to PP1γ2 and CABYR through ELISA assay. Interestingly, antibody titre was observed to be significantly higher in cancerous sera samples as compared to the noncancerous ones; while CIN stages showed intermittent values. Further, PP1γ2 and CABYR antigen shedding was also observed in quite a few patients' urine samples through western blotting; Data generation with more number of such urine samples is in progress.

Our findings suggest that individual's risk for developing cancerous and precancerous cervical lesions can be assess through the analysis of easily accessible body fluids. This may lead to the development of completely non-invasive or less invasive diagnostic biomarkers as it may no longer be necessary to localize or interrogate precancerous tissue.

Technical Services and Facilities

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Technical Services and Facilities

1. Business Development & Intellectual Property

1.1 Business Development Activities:

The Institute sustained to explore the business development opportunities by establishing liaison with national and international organizations and industries in order to have more public–private partnership at early stage of the development and to have collaborations for new leads. The major new contracts/assignments signed/undertaken by the Institute during reporting period are as follows:

Sl. No.	Project Title	Client/Collaborator	Signing Date
License Agreements			
1.	License of CDRI product CDR2492/C003 – a standardized formulation for the management of osteoarthritis	Pharmanza Herbal Pvt. Ltd., Gujarat	31.07.2017
2.	Development of Bone anabolic agent CDRI compound S008-399	Ortho Regenics Pvt. Ltd., Hyderabad	15.02.2017
Sponsored Agreements			
3.	Estimation of biomarkers of serum Homocystiene (Hcyt) and Methyl Malonic Acid (MMA) for Iron deficiency anemia	UP-USI Coalition (Technical), Dept. of Molecular Medicine & Biotechnology, SGPGIMS, Lucknow	25.08.2017
4.	Anti-malarial activity of one of Evolva ingredients Nootkatone	Evolva Biotech Pvt. Ltd., Taramani, Chennai	04.07.2017
5.	*In vitro* testing of three Sphaera compounds for proliferation studies	Sphaera Pharma Pvt. Ltd., New Delhi	03.05.2017
6.	*In vitro* evaluation of activation of adiptonection receptor signaling by Sphaera compounds	Sphaera Pharma Pvt. Ltd., New Delhi	26.04.2017
Secrecy Agreements			
7.	A novel Antileishmanial compound CDRI-96/261 showing remarkable in vivo efficacy via oral route against L. *donovani* in hamsters	Drugs for Neglected Diseases initiative, Geneva, Switzerland	12.12.2017
8.	Information disclosed by CSIR-CDRI for development of their hit/lead/candidate drugs/molecules	Rainbow & Nature Pvt. Ltd., Australia	24.11.2017
9.	CSIR-CDRI product Picroliv from *Picrorhiza kurroa* for the treatment of liver disorder, CDRI-4655 standardized enriched fraction for the management of dyslipidemia, CDR-267-F018 standardized fraction for the treatment of dyslipidemia and antiosteoporosis compound 99/373	Panacea Biotec Ltd., Punjab	25.10.2017
10.	CSIR-CDRI product Picroliv from *Picrorhiza kurroa* for the treatment of liver disorder, CDRI-4655 standardized enriched fraction for the management of dyslipidemia and CDR-267-F018 standardized fraction for the treatment of dyslipidemia	Blumen Biovitals Healthcare Pvt. Ltd., Mumbai	09.10.2017
11.	Evaluation of Lifecare NCE(s)	Lifecare Innovations Pvt. Ltd., Gurugram	05.10.2017
12.	Evaluation of formulation	Lotus Pharmaceutical, Taiwan (China)	25.09.2017
13.	CSIR-CDRI product Compositions containing lipid soluble curcuma extracts for the treatment of neurocerebro-vascular disorders	Tata Chemical Ltd., Pune	16.09.2017
14.	CSIR-CDRI product Picroliv from *Picrorhiza kurroa* for the treatment of liver disorder	Natural Remedies Pvt. Ltd., Bangalore	18.08.2017
15.	Information disclosed by CSIR-CDRI for development of their hit/lead/candidate drugs/molecules	Pharmanza Herbal Pvt. Ltd., Gujarat	29.05.2017
16.	Information disclosed by CSIR-CDRI for development of their hit/lead/candidate drugs/molecules	Sanzyme Pvt. Ltd., Hyderabad	18.05.2017
17.	A novel synthetic anti-platelet compound S007-867 useful in treating intravascular arterial thrombosis	Ami Life Sciences Pvt. Ltd., Gujarat	15.05.2017
18.	Information disclosed by CSIR-CDRI for development of hit/lead/candidate drugs/molecules	Pirincs Pharmaceuticals, Lucknow	18.04.2017

Memorandum of Agreements			
19.	Design, development and performance evaluation of hybrid systems comprising novel cationic lipids intended to deliver siRNA to solid tumors	DBT, New Delhi	24.11.2017
20.	Induction of Autophagy as a strategy for treatment of Tuberculosis	DBT, New Delhi	05.10.2017
21.	Exploring the role of Nucleotide binding Oligomerization Doman proteins (NODs)-mediated inflammation in diet-induced insulin resistance	DBT, New Delhi	21.09.2017
22.	Induction of mitochondrial cell death and reversal of anti-cancer drug resistance via multifunctional immunotherapeutic nanoemulsion	DBT, New Delhi	19.07.2017
23.	Development of Tocopherol succinate anchored nano-constructs bearing paclitaxel for synergistic efficacy against bone metastatic breast cancer: Crosstalk between breast cancer and bone	DBT, New Delhi	18.07.2017
24.	Functional characterization and validation of drug target potential of a unique triacyl glycerol synthase of Mycobacterium tuberculosis	DBT, New Delhi	12.06.2017
25.	Design, development and performance evaluation of hybrid systems comprising novel cationic lipids intended to deliver therapeutic siRNA to solid tumors	DBT, New Delhi	10.02.2017
26.	Mesenchymal stem cells with a polymeric scaffold may improve cardiac function in a mouse myocardial model	DBT, New Delhi	23.01.2017
Memorandum of Understanding signed for joint R&D			
27.	To promote institutional linkage between CSIR-CDRI and Dr. RML Avadh University and to explore other avenues for possible collaborative research programs in specific fields of interest	Dr. Ram Manohar Lohia Avadh University, Faizabad	15.11.2017
28.	To promote institutional linkage between CSIR-CDRI and NIPER and to explore other avenues for possible collaborative research programs in specific fields of interest	National Institute of Pharmaceutical Education & Research (NIPER), S.A.S. Nagar (Mohali)	14.11.2017
29.	Small molecule inducers of redox stress targeting antibiotic resistance	Indian Institutes of Science Education and Research, Pune	02.11.2017
30.	To promote institutional linkage between CSIR-CDRI and GIPER and to explore other avenues for possible collaborative research programs in specific fields of interest	Global Institute of Pharmaceutical Education and Research, Kashipur, Uttarakhand	01.11.2017
31.	To promote institutional linkage between CSIR-CDRI and Haffkine Institute and to explore other avenues for possible collaborative research programs in specific fields of interest	Haffkine Institute for Training, Research & Testing, Mumbai	16.10.2017
32.	To promote institutional linkage between CSIR-CDRI and KSDPL and to explore other avenues for possible collaborative research programs in specific fields of interest	Kerala State Drugs & Pharmaceuticals Ltd., Govt. of Kerala, Kalavoor, Alappuzha	08.08.2017
33.	To promote institutional linkage between CSIR-CDRI and NITM and to explore other avenues for possible collaborative research programs in specific fields of interest	ICMR-National Institute of Traditional Medicine, Nehru Nagar, Belagavi- Karnataka	14.07.2017
34.	To promote institutional linkage between CSIR-CDRI and SMSMCH and to explore other avenues for possible collaborative research programs in specific fields of interest	SMS Medical College and Hospital, Jaipur	13.07.2017
35.	To investigate the role of lipid droplets (LDs) by Fluoranthene derivatives in dendritic- and myeloid cells	Radboud university medical center, Netherland	20.04.2017
36.	Host-pathogen interactions during Plasmodium liver stage development	National Center for Biological Sciences, Tata Institute of Fundamental Research, Bangalore	17.04.2017
37.	Study on the roles of Proteasome accessory factor-C (pafC) in determining the susceptibility of antimycobacterial drugs with special reference to fluoroquinolones	King George Medical University, Lucknow	11.04.2017

38.	(i) Synthesis and characterization of siRNA/shRNA loaded ligand bearing PLGA micro and nanoparticles for targeted delivery to the for lung inflammation and lung cancer treatments and (ii) Targeted delivery of shRNA loaded microparticles to the lung macrophage for lung inflammation disease	Centre of Biotechnology, University of Allahabad, Allahabad	11.04.2017
39.	Exploring the possible role of epidermal growth factor receptor pathway substrate 8 (EPS8) and forkhead box M1 (FoxM1) along with related growth factors and their regulation in patient with implantation failure/miscarriage	King George Medical University, Lucknow	02.03.2017
40.	Hyperinsulinemic euglycemic clamp (HEC) study of CSIR-CDRI's Pancreastatin inhibitor (named PSTi8) in db/db mouse	Cadila Healthcare Limited, Ahmedabad, Gujarat	22.02.2017
41.	To promote institutional linkage between CSIR-CDRI and SGPGIMS	SGPGI Medical Sciences, Lucknow	02.02.2017
42.	To promote institutional linkage between CSIR-CDRI and IITM	Indian Institute of Technology; Madras, Chennai	31.01.2017
43.	Evaluation of anti-filarial and immunomodulatory activities of some natural plant products and synthetic compounds	School of Life Sciences, University of Hyderabad	29.12.2016
44.	Epigenetic regulation, disease progression, relapse and therapy resistance in myeloid leukemias	King George Medical University, Lucknow	22.11.2016
45.	Cytokine and xenobiotic metabolizing enzyme gene polymorphisms in acquired aplastic anemia	King George Medical University, Lucknow	20.06.2016
Renewal Agreements			
46.	Ligand and structure-based virtual screening of designed and synthesized chemical library against DNMT1	TCG Life Sciences, West Bengal	28.11.2017
47.	Evaluation of data on CDRI candidates drugs S007-867, S002-333 & S007-1235	Sun Pharma Advanced Research Company Ltd, Mumbai	18.10.2017
Technical Service			
48.	DNA Bar-coding & LC-MS fingerprinting of the herbal product	Office of the Commissioner of Customs (Preventive), UP & Uttarakhand, Lucknow	22.09.2017
Other Agreements			
49.	Novel small molecules as selective and positive allosteric modulators (PAM) of 5-HT2c receptor: Discovery and development of potential anti-obesity agent	I. DST, New Delhi II. DRILS, Hyderabad III. DRL, Hyderabad	23.06.2017
50.	Bioanalytical studies of analytes *in vitro* & drug elimination and absorption studies of BMS compounds	Bristol-Myers Squibb Foundation, New Jersey, USA	19.05.2017
51.	To develop a new generation redox based compounds through modulation of the inflammatory processes, which will provide effective lead compounds for use in cancer prevention and treatment, infectious and cardiovascular disease and use of complimentary reagent chemical libraries in CSIR-CDRI to identify and develop multifunctional agents to provide the next generation of treatment	National Cancer Institute, USA	17.04.2017
52.	Amendment agreement for the parent secrecy agreement between CSIR-CDRI and Cadila Healthcare Ltd. Ahmedabad (ZYDUS) on June 17, 2016	Cadila Healthcare Ltd., Ahmedabad	29.03.2017

Dr. Sripathi Rao Kulkarni and Mr. Naseem Ahmad Siddhiqui

1.2 Intellectual Property Activities: Implementation of Intellectual Property Management Policy to ensure timely completion of procedures for filing and grant of patents for the institute and their maintenance. The assignments undertaken during the reporting period are as follows:

- Protection of innovations arising from the institute's pursuits

- Coordination for filing and grant of Indian and foreign applications/patents with CSIR-IPU,CSIR-URDIP, Collaborative partners (Industry & Academia) and IP Law attorneys in respect of various jurisdictions
- Maintenance of Patents and Management of patent portfolio
- Recommendations for renewal of patents/ commercialization status
- Maintenance of information on IP system/ surveillance
- Respond to queries on IP related issues
- Training and dissemination of IP in the region
- Resource lab for DST-TIFAC KIRAN-IPR (Women Scientist) internship

2. S&T Management Activities

The S&T Management Unit is the nucleus of multifarious management and coordination activities at CSIR-CDRI including Project, HRD & HRM, ISTAG, RTI, ERP Coordination, Press & Media, Technical Information, Societal Activities, Event Organizations, PRO and other miscellaneous activities. List of assignments undertaken during the reporting period are as follows:

2.1. PME Activities

- Vetting of project proposals and processing for approval of the competent authorities monitoring of funds and day to day clearance of indent through the Real Time Budget Monitoring Tool raised by the scientists & other staff members in various projects
- Incorporation of newly joined staff and new sanctioned projects in SnP software
- Co-ordination with Finance & Accounts and Stores & Purchase
- Maintenance of all kind of project folders and record keeping at central place
- Vetting of expenditure statements, utilization certificates and processing for approval of the competent authorities
- Processing and obtaining, Security & Sensitivity clearance of the projects involving foreign agencies, from CSIR
- Digitized information management
- Information for ERPS

2.2. Human Resources Management & HRD Activities

As per the New Human Resources Management Policy which made a paradigm changes in human resource planning and its management, optimize the output and meet the current as well as future requirements of the Institute and ultimately enhance the productivity of individual.

- Background work for recruitment of Technical & Scientific Staff
- Nominations for training programs
- Processing of staff nominations for honours & awards and fellowships
- Processing of requests of staff and research fellows for participation in various fora (Conference/ symposia / seminar / workshop / training programmes)
- Advance Training Courses for Postgraduate Students and for the employees of R&D Institutions/ Pharmaceutical Industry/Government Laboratories, Academic Institutes etc.
- IAS, INSA & NASI Summer Fellows
- Postgraduate Research Students training
- Training in Instrumentation (SAIF)

L to R : Dr. D.N. Upadhaya, Shri Prem Prakash, Shri Vinay Tripathi, Dr. Sanjeev Yadav

- Training in Laboratory Animal Science for Technical personnel
- Induction and motivation of post graduate students from across the country through arranging interactive lab visit programmes
- Coordination of Skill Development Program

2.3. Dissemination of Technical Information

- Maintaining and updating the CSIR-CDRI Social Media (Facebook & twitter) portals
- Biological screening services for external users
- Respond to queries from various agencies (Govt./ non-Govt. agencies)
- Replies to Parliament and Audit queries
- Print and Electronic Media management
- Communication within and outside the institute
- Management of database on projects, staff, budget, ECF, awards, research fellow's conferences / symposia /seminar / workshops etc.

2.4. Institutional Publications

- CSIR-CDRI Annual Report
- CSIR-CDRI Newsletters (two issues per year)
- CSIR-CDRI Advertisements
- Inputs for CSIR News and CSIR Annual Report

2.5. ISTAG

- Processing of foreign deputation proposals of scientists and other technical staff visiting abroad to attend Conferences, Meetings, Fellowships, Bilateral exchange programme and instruments trainings etc.
- Providing foreign deputation reports to the Head, ISTAD, CSIR regarding scientists visited abroad
- Arranging training programs for foreign candidates
- Coordination of distinguished foreign visitors/ delegation at CSIR-CDRI
- International collaborative projects, Bilateral International cooperation programs

2.6. ERPS

- Co-ordinate and facilitated various groups for integration of the ERPS implementation at CSIR-CDRI

2.7. RTI

- Implementation of Right to Information Act-2005 in the institute for Scientific & Technical matters to promote transparency and accountability in the working of every public authority in India

2.8. Societal Activities

- Conducting student motivation and health awareness programs in Institute as well as in rural areas.

3. Sophisticated Analytical Instrument Facility

Sophisticated Analytical Instrument facility at CSIR Central Drug Research Institute, Lucknow is more than 40 years old and is one of the first four such facilities set up by the Department of Science & Technology (DST), Government of India for fulfilling the following objectives:

- Provide facilities of Sophisticated Analytical Instruments to CSIR-CDRI scientists and otherusers from academic institutes, R&D laboratories and industries to enable them to carry out measurements for R&D work
- Acquire and develop capability for preventive maintenance and repair of sophisticated instruments and organize short term courses/ workshops on the use and application of various instruments and analytical techniques
- Development of new measurement/analytical techniques: Apart from providing routine analytical techniques/methods of analysis available on the instruments, efforts are made by the SAIF to develop new techniques/methods of analysis to put the instruments to their full use and offer them to the scientists for exploring new dimensions in research in various areas of science and technology

Dr Brijesh Mumar

Dr Ravi S Ampapathi

Dr Sanjeev Kanojiya

Dr Sanjeev Shukla

Kalyan Mitra

Name of the facility	External Samples	Internal Samples	Total no of samples analyzed
Mass Spectrometry	1584	36063	37647
NMR Spectroscopy	1231	25142	26373
IR & UV-Vis Spectroscopy	330	2431	2761
Flowcytometry	95	14619	14714
HPLC & OR	80	1751	1831
Micro Analysis	457	753	1210
Electron Microscopy	227	2953	3180
Total	**4004**	**83712**	**87716**

- Train technicians for maintenance and operation of sophisticated instruments
- Organize training programs and workshops for internal and external candidates
- Apart from providing analytical services, SAIF is involved in R & D activity of the institute with several ongoing projects and a large number of Ph.D. students.

4. Academic Affairs Unit


Dr. Anju Puri

The unit serves as a centre for the management of research students (PAs/JRFs/SRFs/RAs) working in different departments of the institute. The activities carried out during the period include:

- Completion of pre-Ph.D. course work (Ist and IInd semester) under CSIR-CDRI Ph.D. program for JNU and AcSIR students (total 60) for the session Jan 2017
- Coordinated centralized admission of JRF/SRFs for registration under AcSIR for CDRI-PhD program through interview for the batches commencing August 2017 and January 2018
- Liaised with Jawaharlal Nehru University, New Delhi for timely registration, synopsis approval, panel of examiners approval, thesis submission, Ph.D. viva at CSIR-CDRI
- Conducted viva voce exams of 63 students registered with JNU New Delhi and 32 students registered with AcSIR at CSIR-CDRI (total-95)
- Coordinated with JNU, AcSIR and other universities for submission of eighty two (82) Ph.D. thesis for the award of Ph.D. degree from respective universities
- Liaised with AcSIR-HQ for the registration of students working at CSIR-CDRI
- Comprehensive exams of AcSIR students were held
- Screening and endorsement of post-doctoral application forms being submitted by Ph.D. students from outside CSIR-CDRI to Indian funding agencies
- Meeting of CSIR-CDRI-JNU academic council was organized at JNU, New Delhi
- Coordinated with AcSIR for submission of Ph.D. thesis and successful conduction of viva-voce examination of thirty two (32) students at CSIR-CDRI
- Formation and Implementation of DAC (Doctoral Advisory Committee) for JNU students of five academic years, 2012-2017
- Five meetings of CSIR-CDRI Academic Council were held to prepare guidelines for carrying out academic activities in the institute
- Formation of DAC (Doctoral Advisory Committee) for AcSIR students
- Formation of Comprehensive Examination Committee (CEC) for AcSIR students
- Coordinated AcSIR 800 course work of AcSIR students
- Coordinated the nomination of annual day awards for students under five different categories of memorial awards for the year 2017(Dr MM Dhar, Dr JM Khanna & Dr Swarn NityAnand Awards)
- Students were nominated for Eli-Lilly best thesis award for the year 2016-2017

5. National Laboratory Animal Facility

5.1. Objectives

The Division of Laboratory Animals, CSIR-Central Drug Research Institute, Lucknow which is also recognized as the National Laboratory Animal Center (NLAC), is a CPCSEA-registered (Reg. no. 34/GO/Re-SL/BiS/99/CPCSEA), Institutional Animal Ethics Committee (IAEC) monitored and GLP certified (No.: GLP/C-108/2017, DOI: 18.10.2017) R&D support facility of the institute engaged in breeding and production of small laboratory animal species like rodents and rabbits required for biomedical research and experimentation programmes. The facility also serves as national resource center for supply of healthy animals to other CPCSEA registered research and academic institutions across the country. The Center possesses approximately 20 thousand laboratory animals of about 9 species with their more than 25 inbred and outbred strains which is unique in terms of having disease specific, transgenic specialized research animal models for more precise studies on human diseases.

The major objectives of the center are as follows

- Breeding, production and supply of standard quality laboratory animals for IAEC approved in-house studies and research
- Supply of healthy lab animals to other CPCSEA-approved private/government research and academic organizations.
- Monitoring and maintaining animal health and quality through genetic, microbial, viral, pathological, and parasitological screening of animals
- Acting as Referral Center for scientific and technical advisory/consultancy on development of research

animal facility in accordance with guidelines of the CPCSEA

- Conducting human resource development programmes including organizing symposium/ workshop/seminar on various aspects of laboratory animal science and on-hand fresher/advanced practical training in care, breeding and management of laboratory animals
- Publication and dissemination of scientific literature on contemporary issues of laboratory animal science and animal experimentation
- Generation of ECF through animal sales and supplies

5.2 Status of animals in Non Human Primates facility

Species maintained	Brought forward	Animals under experiment	Animals procured	Animals in rehabilitation unit	Animals euthanized as per protocol	Current stock position
Rhesus monkey	32	18	48	14	33	47

5.3. Animal species available

Sl No	Species	Strains	Genotype	Opening stock (as on 01.01.17)	Closing stock (as on 26.12.17)
1	Mice	Out bred: Swiss	Out bred	3958	1367
		Inbred: C57BL/6, CBA , BALB/c, DBA1J, DBA2J, db/db	In bred	8374	6657
		Transgenic: NOS1,NOS2, ApoE,	Inbred	766	766
2	Rat	Outbred: SD, CF, DR,	Out bred	4872	2470
		Inbred: Wister, Lew, SHR	Inbred	2518	944
3	Hamster	Syrian golden	Out bred	1467	673
		Syrian/golden	Inbred	754	396
4	Gerbil	Mangolian	Out bred	522	463
5	Mastomys	Coucha	Out bred	414	486
6	G. pig	Duncan Hartley	Out bred	1078	267
7	Rabbit	NZW & Belgian	Out bred	571	439
8	Monkey	Rhesus	Out bred	32	47
9	Sheep	Australian Marino	Out bred	1	1
TOTAL				25327	14976

5.4. New animal strains procured

Species	Strains	Source
Rat	SD	National Institute of Immunology, New Delhi
Mice	CBA/J, DBA/2, Balb/C & C57bl/6	

5.5. Experimental animal sales and supplies

Animal Species	In-house supply (CSIR-CDRI)		Out-side sale and supply		Total Animals Supplied	Total Animal cost (Rs)
	Nos.	Amount (Rs)	Nos.	Amount (Rs)		
Mouse	13567	23,08940	1523	4,15400	15,090	27,24340
Rat	5953	15,47050	1320	787560	7273	23,34610
Hamster	1829	7,31600	135	74,250	1964	80,5850
Masto-mys	85	34,000	0	0	85	34,000
Gerbil	75	30,000	0	0	75	30,000
Guinea pig	0	0	227	3,69000	227	3,69000
Rabbit	83	1,24500	290	6,51200	373	7,75700
Total	**21592**	**47,76090**	**3495**	**22,97410**	**25087**	**70,73500**

5.6. Experimentation on Non Human Primates

Non human primate facility of LAF is also approved by the CPCSEA for experimentation on monkeys for the studies and experiments in the area of regulatory toxicology, anti-malarial and anti-leishmanial screening of novel compounds and vaccines. Eco-friendly NHP rehabilitation unit has been developed according to the norms of the CPCSEA to rehabilitate the surviving monkeys after termination of the experiment. Proper management and due veterinary care is extended to these animals round the clock by the expert veterinarians

Two CPCSEA approved research projects on Rhesus monkeys were performed during this period as per details given below:

1. S007-867: 28 days Toxicity study in rhesus monkey by oral route PI: Dr Sharad Sharma
2. Preclinical efficacy evaluation of potential anti malarial compound triphasphate salt of CDRI S0011-1793 PI: Dr Renu Tripathi

Samples screened for health monitoring of NHPs:

- Screening for endo-parasirtes: 98
- Screening for ectoparasiters: 49
- PPD-testing for Tuberculosis: 128
- Chest radiography (X-Ray): 79
- Hematology examination: 60
- Serum biochemical examination: 60
- Post mortem examination: 28

5.7. Parasitological monitoring of animals

- For detection of ectoparasites, like mites, lice etc living in the skin, samples of the piece of the hair or deep skin scrapping were collected and examined microscopically
- Faecal samples were collected for detection of endo-parasites or their eggs/ova by means of

microscopic examination. Direct smear technique was performed to detect the infection

- Total 1488 samples were screened, out of which 1238 samples were collected from rodent colonies (mouse, rat, hamster, mastomys and gerbil), guinea pigs (120 nos) and rabbits (130 nos)
- Observation showed occasional presence of cestode (*H. nana*) infection in rodents (< 10%), nematode (*Syphacia spp,* < 5%) and mite infestation (< 3%). There was rare incidence of pinworm infection in rabbit colony
- After parasitological monitoring, periodic prophylactic treatment was provided using anthelmintics like albendazole, praziquantal or ivermectin to keep the animal colony healthy

5.8. Pathological monitoring of animals

Animals from the breeding colonies showing clinical symptoms or moribund were isolated and humanely sacrificed and their gross pathologies were recorded. Representative tissue samples were also collected and preserved for further confirmative histopathological diagnosis as per details given below:

Species	No of animals examined	Gross pathologies observed	Remarks
• Rat (SD and Wistar) • Mice (swiss, Balb/c,C57BL/6) • Hamster	74 6 12	Generalized congestion and hemorrhages, gastro-enteritis, bacterial abscess, External injuries, ecto-parasitic infestation and wet tail disease	No occurrence of any outbreak of disease in any animal colony

5.9. Microbial monitoring of animals

Rodent colonies were screened regularly for potential bacterial infections that affect biomedical research outcome and can have adverse effects on health of the animals. List of the pathogens screened is summarized as below:

Animal strains covered	Bacterial infections screened	Remarks
• Mice • BALB/c , C57/BL6j , Swiss and Transgenic / Knockout mice • Rat: Sprague Dowley • Hamster (Golden)	*Helicobacter pylori* *Corynebacterium kutcheri* *Streptococcus pneumonia* *Pasteurella multocida* *P. pneumotropica* *Pseudomonas* *Salmonella typhi* *Klebsiella pneumonia* Group B-Streptococci *S.aureus* *Bordetella bronchiseptica*	• Most of the animal colonies were found to be free from infection • No outbreak of any disease was reported during the period. • Hygienic conditions were periodically reviewed and improved to overcome the infections if any

5.10. Virological monitoring of animals

- Six mice pathogens viz. Mouse hepatitis virus (MHV), Mouse parvovirus (MPV), Minute virus of mice (MVM), Sendai virus (SV), Lymphocytic choriomeningitis (LCMV) as well as *Mycoplasma pulmonis* infections were serologically monitored in rodent colonies (BALB/c, & C57/BL6j mice) at regular intervals to assure their health quality. Transgenic animals which were housed in IVC system were also checked. Few animal colonies which showed undesirable infection were removed and replaced with fresh infection-free stock. Transgenic mice colony was found to be 100% free from pathogens that were screened in health monitoring program

Fig: Agarose gel electrophoresis profile of PCR amplified SSLP markers in C57BL/6j

- The *Mycoplasma pulmonis* and viral infections viz.: rat coronavirus (RCV), rat parvo virus (RPV) were also checked in SD rats before these animals were introduced into the breeding colony
- Colony was further expended using animals exhibiting sero-negative observations

5.11. Formulation and quality monitoring of laboratory animal feed:

- About 100 quintal of animal feed was prepared in-house for feeding rabbits, guinea pig and monkeys
- About 550 quintal quantity of certified rat and mice feed was procured from commercial source for feeding the rats and mice colonies maintained in breeding and experimental colonies including GLP
- In-house feed was monitored for proximate values including crude fiber, crude fat, crude protein, total ash and moisture contents
- Besides, other quality testing parameters included were: Yeast & moulds, Bacterial load (*E.coli, Salmonella),* Aflatoxin, Pesticide residues, and heavy metal contaminants. The values observed were within desirable limits

L to R : First row : Dr. Dhanajay Hansda, Dr. V. Raja Kumar, Dr. D.S. Upadhayay,
Second row: Dr. Rituraj Konwar, Dr. Himangshu Vora, Dr. Shishir Kumar Gupta, Dr. Rajdeep Guha

5.12. Genetic monitoring of animals

- A panel of seven SSLP markers (D4Mit15, D6Mit39, D4Mit53, D5Mit79, D6Mit102, D9Mit172, and D18Mit228) was used as primary genetic screen to genetically monitor the common mice strains (Balb/c, C57BL/6J, C3H/HeJ, A/J, AKR/J, NZB) available in the facility
- Animal colonies of C3H/HeJ and AKR/J strains were found to be genetically contaminated, hence were discontinued and discarded

5.13. Training programmes organized:

- "Scientific and Technical Awareness Training Program in Animal Ethics & Experimentation" for 32 candidates from JNU and AcSIR courses was conducted in two batches, from Aug 21 to Aug 23, 2017 and Aug 28 to Aug 30, 2017.
- 3-Week specialized training program from Aug 28 to Sep 15, 2017 was organized for Mohd. Zahid, from Dept of Biochemistry, Lucknow University.

5.14. Ethics in animal experimentation programmes of the institute

- Keeping in view the animal welfare and ethics, entire animal experimentation programme of the institute including relevant animal protocols was periodically reviewed and duly approved by the CPCSEA recognized Institutional Animal Ethics Committee (IAEC) of the institute
- The IAEC has been reconstituted and functioning in accordance with the regulations and guidelines of the CPCSEA in order to protect the welfare issues of animals during the course of experimentation so as to generate reliable and consistent scientific findings
- Depending upon requirement the IAEC meetings were convened periodically during the year. More than one hundred ongoing and fresh animal research proposals including in-house, collaborative and sponsored/extramurally funded were reviewed and granted approvals. Two CPCSEA approved experiments on monkeys were completed. With recommendation of the IAEC one proposal requiring rhesus monkeys has been sent to CPCSEA, the approval is awaited

6. Tissue & Cell Culture Laboratory

The Tissue and Cell Culture Laboratory is engaged in maintaining and providing the cell cultures to the user scientist within and outside of this institute. Provision of

Dr. Ramesh Sharma, Dr. Neena Goyal and Mr. Ajay Singh Verma

cell cultures to various research/academic organizations is made available on payment basis. The laboratory at the moment has 18 plus cell types actively being propagated for the Institute scientists and few more in the frozen state. In addition, *in vitro* anti cancer phenotype based screening has also being conducted using various cancer cell lines

Task carried out/ services rendered during reporting period:

- Provision of 132 Cell Culture Flasks to user scientists under various projects
- Incorporation of 24 New Cell Lines in Repository
- Training in Cell & Tissue Culture Techniques provided to people within and outside of the Institute.

7. Information Technology Services

A) Software Development/Maintenance: Computer Center has developed, implemented and maintained the following software systems during the reporting period

- Software enhancement, maintenance and support for old and new SnP Software
- Compound Submission and Bio-Assay Reporting (CBRS) System and its enhancement for natural compounds
- CDRI internet and intranet website
- Requisition for Bio-evaluation of compounds from CDRI Repository
- Online Request / Reporting for Small Molecule X-ray Diffraction Facility
- Website for Recruitment of Project Assistants etc.
- Online Sample Submission/Analysis and Equipment Booking software for SAIF
- Enhancement of Bill tracking System for DA level tracking
- Biometric based attendance system for contractual staff of old campus, new campus (Engineering Section, Animal house)

Er. Kural Srivastava, Santosh Shukla

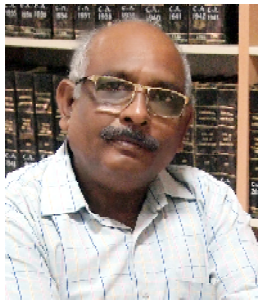
- Biometric based system for NIPER Rae Bareilly and Lucknow campus
- Biometric based attendance system for students/ Project staff/Trainee
- Enhancement of AEBAS Record Management System(AEBAS+) for regular staff
- MIS application for AEBAS Record Management System for regular employees
- Up-gradation of MoES database Application
- Feature enhancements in HRMS system for students (Leave Management and Hostel Allotment)
- Software for online Digital Herbarium
- Online Electrical/Civil Job cards
- Software for dispensary automation (under-implementation)
- Instrument online pre-booking system
- Subject expert database, Alumni database, online registration for seminars etc.
- Android mobile application for IT helpdesk
- Implementation of latest DSPACE software
- SMS(Through GSM Modem and SMS Gateway) and Landline/Mobile Call based monitoring/alert system for Server room temperature monitoring
- Customization of Desktop Biometric devices for attendance of regular staff
- Animal Issue Software
- Co-operative Society Database
- Database for GPF Statement
- Online Budget Monitoring System
- Online Guest House Booking System (under-implementation)
- Visitor Management System (under-development)
- Vendor Registration Software for CSIR-HQ
- Software for Wireless Controller log

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 SAN systems
- Comprehensive IT support to institute wide users comprising of approximately 1000 clients
- Web hosting services for several publicly accessible websites including institute's internet website (www.cdri.res.in)
- Support provided for implementation of e-procurement System
- Maintenance of PCs as per Standard Operation Procedure(SOP) for Protection and validation of Hardware and Software under GLP

- Hosting of CDRI tenders on NIC Central Public Procurement Portal
- Helpdesk for ERP & AEBAS user support
- Skype & Videoconferencing facility
- Operation and Management of CCTV and access control systems
- ICT support for Audiovisual arrangements
- Operation and Management of Telephone exchange

8. S&T Knowledge Resource Centre



To achieve the mission & mandate of the institute Knowledge Resource Centre have been engaged in imparting the scientific information among the researchers including students of CSIR-CDRI. Knowledge Resource Centre of CSIR-CDRI also provides information on Biomedical Research in general and drugs and pharmaceutical in particular, to users all across India in academia, drug industry and research institutions. Apart from that large number of students and faculty visited the library during 2016- 2017 as well as about 1373 walk in users from universities and other academic institutions. Present collection of books has reached to 22914 including hindi books and bound volumes numbers are 73969. Apart from regular journals subscription, SciFinder, Web of Science, Grammarly, R&D Insight and other databases were added this year along with resources like Current Protocols in Molecular Biology, Current Protocols in Pharmacology, Annual Reviews, and Methods in Enzymology. The centre also manages, maintains and updates the institute's web OPAC based on KOHA and institutional repository which is available online.

In addition, centre provides services to the scientists of the institute and other scientific organizations in photography, power point presentations, exhibitions, display panels, posters, designing of covers and layouts for institutional publications.

9. Laboratory Engineering Services

The Lab Engineering Services division continued to provide engineering services to the Institute to maintain the infrastructure for R&D work. The major works carried out during reporting period are as follows:

- New facilities of centralized compressed air, Nitrogen, LPG & Vacuum, distilled water supply at the user bench in laboratory has been provided
- Most sophisticated laboratory set up i.e. reaction hoods, chemical storage cabinet and safety Measures
- Laboratory follows safety provision along with most sophisticated optical fume sensor, fire alarms and computer controlled fire alarm panels

L to R : First row : Er. Pervez Mahmood, Er. Kamal Jain, Mr. D.K. Viswakerma, Mr. Jai Prakash, Mr. Sidho, Hembrom
Second row: Er. M.K. Shukla, Mr. Ajay Kumar, Mr. Bharma Singh, Mr. Madhuker Saroj

- CSIR-CDRI is committed to share environmental & social responsibility therefore, facility of Effluent treatment plant for treatment of laboratory waste and sewage treatment plant for treatment of domestic waste water has been created in Jankipuram campus
- The laboratory compliances all the statuary norms from various state and central agencies and committed to follow the guidelines issued by various agencies time to time
- Laboratory has integrated water lines to reuse of ETP/STP treated water in garden hydrant line to optimize water consumption

10. Grievance Redressal Cell

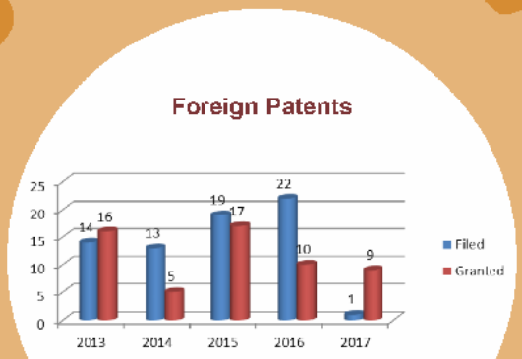
For prevention of sexual harassment of women at workplace no complaint was received at grievance Redressal cell during the reporting period.

11. Other Lab Services

Instrumentation Centre provided efficient and economical repair, maintenance and upkeep of different sophisticated analytical, biomedical, electronics and laboratory equipments in CSIR-CDRI and CDRI-SAIF. Due to non-availability of imported components/spares, equivalent indigenous substitute were used to ensure the smooth functioning of equipments. Tracing of part of circuit were carried out whenever circuit diagram/service manual was not available. Technical specification verification was carried out for the procurement of state of the art new equipments. Division helped the user scientists to prepare broad based technical specification and to choose right equipment to suit their application. Laboratory equipments of different divisions of institute were calibrated as per GLP guidelines as per user requirement. Division reviewed the SOP (Instrument Maintenance) of different Instruments.

L to R : Mr. Ranveer Singh, Mr. N.K. Agarwal, Dr. W. Haq, Mr. Manoj Kumar Rawat

Research Output



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1 Publications

2016

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2 Patents

Patents Granted Abroad

1. **European Patent No.:** 3039010 **Date of Grant:** 11.10.2017
Title: Novel Aryl Naphthyl methanone oxime derivatives for the treatment of Hematological Malignancies and solid tumors
Inventors: Sabyasachi Sanyal, Atul Kumar, Naibedya Chattopadhyay, Jawahar Lal, Arun Kumar Trivedi, Dipak Datta, Srikanta Kumar Rath, Tahseen Akhtar, Shailendra Kumar Dhar Dwivedi, Manisha Yadav, Bandana Chakravarti, Abhishek Kumar Singh, Jay Sharan Mishra, Nidhi Singh & Anil Kumar Tripathi

2. **Canadian Patent No.:** 2720038 **Date of Grant:** 13.06.2017
Title: Novel donor-acceptor fluorene scaffolds:a process and uses thereof
Inventors: Atul Goel, Sumit Chaurasia, Vijay Kumar, Sundar Manoharan & RS Anand

3. **Canadian Patent No.:** 2753993 **Date of Grant:** 25.04.2017
Title: Substituted Polymeric nanomatrix associated delivery of Kaempferol in rats to improve its osteogenic action
Inventors: Prabhat Ranjan Mishra, Ritu Trivedi, Girish Kumar Gupta, Avinash Kumar, Varsha Gupta, Srikanta Kumar Rath, Kamini Srivastava, Naibedya Chattopadhyay & Anil Kumar Dwivedi
Supporting Staff: Mahesh Chandra Tewari & Geet Kumar Nagar

4. **German Patent No.:** 2686337 **Date of Grant:** 02.11.2016
Title: Novel Dolastatin Mimics as Anticancer agents
Inventors: Tushar Kanti Chakraborty, Gajula Praveen Kumar, Dulal Panda & Jayant Asthana

5. **French Patent No.:** 2686337 **Date of Grant:** 02.11.2016
Title: Novel Dolastatin Mimics as Anticancer agents
Inventors: Tushar Kanti Chakraborty, Gajula Praveen Kumar, Dulal Panda & Jayant Asthana

6. **Great Britain Patent No.:** 2686337 **Date of Grant:** 02.11.2016
Title: Novel Dolastatin Mimics as Anticancer agents
Inventors: Tushar Kanti Chakraborty, Gajula Praveen Kumar, Dulal Panda & Jayant Asthana

7. **Spanish Patent No.:** 2670722 **Date of Grant:** 12.10.2016
Title: Chiral 3-aminomethylpiperidine derivative as inhibitors of collagen induced platelet activation and adhesion
Inventors: Dinesh Kumar Dikshit, Madhu Dikshit, Tanveer Irshad Siddiqui, Anil Kumar, Rabi Sankar Bhatta, Girish Kumar Jain, Manoj Kumar Barthwal, Ankita Misra, Vivek Khanna, Prem Prakash, Manish Jain, Vishal Singh, Varsha Gupta & Anil Kumar Dwivedy
Supporting Staff: Surendra Singh, CP Pande, Kanta Bhutani, M S Ansari & Devendra Singh

8. **French Patent No.:** 2670722 **Date of Grant:** 12.10.2016
Title: Chiral 3-aminomethylpiperidine derivative as inhibitors of collagen induced platelet activation and adhesion
Inventors: Dinesh Kumar Dikshit, Madhu Dikshit, Tanveer Irshad Siddiqui, Anil Kumar, Rabi Sankar Bhatta, Girish Kumar Jain, Manoj Kumar Barthwal, Ankita Misra, Vivek Khanna, Prem Prakash, Manish Jain, Vishal Singh, Varsha Gupta & Anil Kumar Dwivedy
Supporting Staff: Surendra Singh, CP Pande, Kanta Bhutani, M S Ansari & Devendra Singh

9. **Great Britain Patent No.:** 2670722 **Date of Grant:** 12.10.2016
Title: Chiral 3-aminomethylpiperidine derivative as inhibitors of collagen induced platelet activation and adhesion
Inventors: Dinesh Kumar Dikshit, Madhu Dikshit, Tanveer Irshad Siddiqui, Anil Kumar, Rabi Sankar Bhatta, Girish Kumar Jain, Manoj Kumar Barthwal, Ankita Misra, Vivek Khanna, Prem Prakash, Manish Jain, Vishal Singh, Varsha Gupta & Anil Kumar Dwivedy
Supporting Staff: Surendra Singh, CP Pande, Kanta Bhutani, M S Ansari & Devendra Singh

Patents Filed Abroad

1. **United States Application No.:** 15/635457 **Date of Filing:** 28.06.2017
Title: Pharmaceutical composition for the prevention and/or treatment of bone related disorders
Inventors: Ritu Trivedi, Prabhat Ranjan Mishra, Sulekha Adhikary, Naseer Ahmad, Dharmendra Chaudhary, Naresh Mittapelly, Sudhir Kumar, Kapil Dev & Rakesh Maurya
Supporting Staff: Satish Chandra Tiwari

Patents Granted in India

1. **Patent No.:** 289560 **Date of Grant**: 14.11.2017
Title: Polymeric nanomatrix associated delivery of Kaempferol in rats to improve its osteogenic action
Inventors: Prabhat Ranjan Mishra, Ritu Trivedi, Girish Kumar Gupta, Avinash Kumar, Varsha Gupta, Srikanta Kumar Rath, Kamini Srivastava, Naibedya Chattopadhyay & Anil Kumar Dwivedi
Supporting Staff: Mahesh Chandra Tewari & Geet Kumar Nagar

2. **Patent No.:** 288809 **Date of Grant**: 27.10.2017
Title: ***Mycobacterium tuberculosis*** specific protein rv3303c and its use in rapid diagnosis of M. tuberculosis infection
Inventors: Ranjana Srivastava, Parvez Akhtar & Brahm Shanker Srivastava

3. **Patent No.:** 288476 **Date of Grant**: 17.10.2017
Title: (E)-5-(2-nitrophenyl)-1-phenyl-3-[2-(2,6,6,-trimethylcyclohex-2-enyl)vinyl]-4,5-dihydro-1H-pyrazole and its analogs
Inventors: Shivaji Narayanrao Suryawanshi, Suman Gupta, Neena Goyal,Avinash Tiwari, Monika Mittal & Preeti Vishwakarma
Supporting Staff: Manju

4. **Patent No.:** 286210 **Date of Grant**: 09.08.2017
Title: Novel substituted amino functionalized 6-(1-aryl vinyl)-1,2,4-trioxanes and a process for preparation thereof
Inventors: Chandan Singh, Naikade Niraj Krishna, Sunil Kumar Puri , Ambuj Kumar Kushwaha & Ashok Kumar
Supporting Staff: Ashok Kumar Sharma

5. **Patent No.:** 285336 **Date of Grant**: 18.07.2017
Title: 5-[trimethoxy phenyl] -1-thiomethyl -N-arylamino-penta-1,4-dien-3-ones
Inventors: Shivaji Narayanrao Suryawanshi, Suman Gupta, Nishi & Sushmita Pandey
Supporting Staff: Manju

6. **Patent No.:** 284986 **Date of Grant**: 07.07.2017
Title: Improved process for a preparation of Bivalirudin
Inventors: Wahajul Haq

7. **Patent No.:** 282259 **Date of Grant**: 31.03.2017
Title: Novel donor-acceptor fluorenes, fluorenones and their pi-conjugated systems: Scaffolds: A process and uses thereof
Inventors: Atul Goel, Sumit Chaurasia, Vijay Kumar, Sundar Manoharan & Raghubir Singh Anand

8. **Patent No.:** 281991 **Date of Grant**: 29.03.2017
Title: 2,3-dideoxy hex-2-enopyranosid-4-uloses and their derivatives as antitubercular agents and a process for preparation thereof
Inventors: Mohammad Saquib, Smriti Sharma, Arun Kumar Shaw, Manish Kumar Gupta, Yenamandra Subrahmanya Prabhakar, Brahm Shankar Srivastava & Ranjana Srivastava
Supporting Staff: Arun K Pandey & Sandeep Kumar Sharma

9. **Patent No.:** 279758 **Date of Grant**: 30.01.2017
Title: Novel 1-[(4 -diphenyh methyl tyl)-piperazin-1-yl]-3-aryloxypropan-2-ol
Inventors: Kalpana Bhandari & Ram Raghubir
Supporting Staff: Anoop Kumar Srivastava & Tarun Lata Seth

Patents Filed in India

1. **Patent Application No.:** 201711030707 **Date of Filing:** 30.08.2017
Title: Combination of Clofazimine and Imatinib for effective therapy of drug-resistant myeloid leukemia
Inventors: Sabyasachi Sanyal, Harish Kumar, Naibedya Chattopadhyay, Ravishankar Ramachandran, Arun Kumar Trivedi, Sonal Shree, Anagha Ashok Gurjar, Sourav Chattopadhyay, Sapana Kushwaha, Abhishek Kumar Singh, Shikha Dubey, Kiran Lata, Riyazuddin Mohammed, Jiaur Rahaman Gayen & Anil Kumar Tripathi
Supporting Staff: Achche Lal Vishwakarma

2. **Patent Application No. :** 201711017657 **Date of Filing:** 19.05.2017
Title: Substituted methanopyrido [2, 1-a] isoindolones as mAChR modulators for treating various associated pathophysiological conditions
Inventors: Ganesh Pandey, Rajesh Varkhedkar, Divya Tiwari, Prem Narayan Yadav, Shalini Dogra & Yusuf Hussain

3. **Patent Application No:** 201711014439 **Date of Filing:** 24.04.2017
Title: A method for the detection of *Leptomonas seymouri* in leishmania sample
Inventors: Amogh Anant Sahasrabuddhe & Lova Prasadareddy Kajuluri

3 Paper Presented in Scientific Conventions

2017

15th Annual Meeting of Society for Free Radical Research-India (SFRR-INDIA-17), Bhabha Atomic Research Center, Mumbai (09-12 January)

- Evaluation of comparative protective effect of Quercetin, Rutin, Apigenin, Naringin, Chlorogenic acid and Resveratrol on HT-29 cells, Sakshi Mishra, S Srivastava, PK Pandey, J Dewangan, A Divakar, SK Rath

International Conference on Reproductive Health with Emphasis on Strategies for Infertility, Assisted Reproduction and Family Planning and Indian Society for the Study of Reproduction and Fertility (ISSRF) annual meeting, All India Institute of Medical Sciences (AIIMS), New Delhi.(All India Institute of Medical Sciences (AIIMS), New Delhi (23-25 January)

- ILK targeting inhibits MCP1- induced migration, proliferation, and adhesion potential of human endometriotic cells through FAK and RAC1, Upendra Kumar Soni and Rajesh Kumar Jha
- PKC-α can regulate the activity of RCA1 in ovarian follicular development, Vaibhave Ubba, Upendra Kumar Soni, Sangappa Basanna Chadchan and Rajesh Kumar Jha
- Finding of oocyte maturation markers in mouse model, Bilal A Hakim, Amar Nath, Saurabh K Agnihotri, Ankit K Agrawal, Ankita Jain, Deependra Singh, Rituraj Konwar & Monika Sachdev
- Effect of HIV-1 Nef on the integrity of the Blood Testis Barrier (BTB), Deependra Singh, Saurabh K Agnihotri, Ankit K Agrawal, Ankita Jain, Bilal A Hakim, Manjeet Kumar, Raj K Tripathi & Monika Sachdev

27th Annual Meeting of the Indian Society for the Study of Reproduction and Fertility (ISSRF) and International Conference on Reproductive Health with Emphasis on Strategies for Infertility, Assisted Reproduction and Family Planning (ISSRF-2017), New Delhi (23-25 January)

- Cell signalling associated with sperm motility initiation during ejaculation, Archana Devi, Bhavana Kushwaha, Aastha Pandey, Rahul Vishvkarma, Lokesh Kumar, Santosh K Yadav, J.P. Maikhuri, Gopal Gupta
- Investigation of the Role of Extracellular PGI in Sperm Motility, Lokesh Kumar, Rahul Vishvkarma, Santosh Kumar Yadav, Aastha Pandey, Bhavana Kushwaha, Archana Devi, J P Maikhuri, Gopal Gupta
- Temperature sensitivity of spermatogenesis- lactate metabolism and germ cell apoptosis, Aastha Pandey, Santosh K Yadav, Lokesh Kumar, Bhavana Kushwaha, Archana Devi, JP Maikhuri, Gopal Gupta
- CAMK2D and DAXX- Important Mediators of apoptosis of testicular germ cells under Heat Stress, Santosh K. Yadav, Aastha Pandey, Lokesh Kumar, Bhavana Kushwaha, Archana Devi, JP Maikhuri, Gopal Gupta
- Microtubule polymerization-Associated proteins Play indispensable role in embryo implantation, Vinay Shukla, Rohit Kumar, Pooja Popli, Jyoti B Kaushal, Pushplata Shankhwar, Kalyan Mitra, Anila Dwivedi
- Oviductal Glycoprotein 1: role in sperm protection against oxidative stress and enhancing sperm capacitation, Pooja Popli, Jyoti B Kaushal, Vinay Shukla, Rohit Kumar, Lokesh Kumar, Gopal Gupta, Anila Dwivedi
- Oviductal factor in ovum maturation and fertility: Role of Peroxiredoxin-6, Pooja Popli, Vinay Shukla, Jyoti B Kaushal, Rohit Kumar, Anila Dwivedi

International Conference on 'Biotechnological Advancements in Free Radical Biology and Medicine' Integral University, Lucknow (January 23-25)

- Chetomin induces cell death in human breast cancer cells via inhibition of PI3K/mTOR pathway, Jayant Dewangan and Srikanta Kumar Rath

23rd ISCB International Conference (ISCBC 2017), Chennai (February 08-10)

- Lipid delivery of NMITLI118RT+: A promising therapy for ischemia induced neuro-degeneration, Hafsa Ahmad, Abhishek Arya, Satish Agrawal, Rakesh Shukla, Anil Kumar Dwivedi

Interface of Chemical Biological in Drug Research, SRM University Chennai, India (February 08-10)

- Synthesis of novel N-Substituted maleimide derivative as spermicidal agents, Suyash Pant, Gopal Gupta, VL Sharma

International conference on Reproductive Biology and Comparative Endocrinology & 35th Annual Meeting of the SRBCE organized by Department of Animal Biology, University of Hyderabad, Hyderabad (09-11 February)

- Estrogen- mediated activation of Hh/Gli1signalling cascade involves GSK3β-mediated mechanism in endometrial hyperplasia, Jyoti B Kaushal, Suparna Kumari, Pooja Popli, Vinay Shukla, Pushplata Sankhwar, Kanchan Hajela and Anila Dwivedi
- Role of Peroxiredoxin 6 in regulating early pregnancy events in rabbit, Pooja Popli, Vinay Shukla, Jyoti Bala Kaushal, Rohit Kumar, Anila Dwivedi
- Sorcin is involved during process of implantation via regulating VEGF/p-PI3K/p-Akt pathway in the endometrium, Kanchan Gupta, Vijay K Sirohi, Suparna Kumari, Vinay Shukla, Murli Manohar, Pooja Popli and Anila Dwivedi

International Conference of Recent Advances in Cradiovascular Research: Impact on Health and Diseases, Vallabhbhai Patel Chest Institute, University of Delhi, Delhi (09-11 February)

- A study on the involvement of Fatty acid synthase in right ventricle hypertrophy associated with pulmonary hypertension, Neetu Singh, Kumaravelu Jagavelu, Kashif Hanif

International conference on updates in cancer prevention and research, Babasaheb Bhimrao Ambedkar University, Lucknow, (14-16 February)

- Role of natural polyphenol in enhancement of antitumor action of polyether ionophore via involvement of oxidative stress, Jayant Dewangan, Divya Tandon, Sonal Srivastava, AmanDivakar, Prabhash Kumar Pandey, Sakshi Mishra and Srikanta Kumar Rath
- Hypoxia: An approbation for tumorigenesis, angiogenesis, metastasis and resistance in tumors, Aman Divakar, Jayant Dewangan, Sonal Srivastava, Sakshi Mishra, Prabhash Kumar Pandey, and Srikanta Kumar Rath
- Piperine potentiates the anti-proliferative efficacy of cyclo-oxygenase 2 inhibitor celecoxib in human colon cancer cells, Sonal Srivastava, Jayant Dewangan, Aman Divakar, Sakshi Mishra, Prabhash Kumar Pandey and Srikanta Kumar Rath
- Toxic effects of Nandrolone-decanoate on the human hepatocellular carcinoma cell-line Hep3B", PK Pandey, J Dewangan, A Divakar, S Mishra, S Srivastava, SK Rath

International Conference on Emerging Materials and Applications (ICEMA-2017) Allahabad, India (Allahabad University) (20-22 February)

- *In vitro* Toxicity Studies on Ceria Doped Hydroxyapatite Nanoparticles: A Potential Biomaterial, VK Mishra, R Trivedi

Indian Peptide Symposium 2017 (IPS-2017), Mumbai (23-24 February)

- A small fragment (GSP) derived from intestinal hormone glucose dependent insulinotropic polypeptide (GIP) improves glucose transport and exert beneficial lipid metabolic effects on 3T3-L1 adipocytes, Mohd Sayeed and Jimut Kanti Ghosh
- Identification of GXXXXG motif in Chrysophsin-1 and its implication in the design of analogs with cell-selective antimicrobial and anti-endotoxin activities, AK Tripathi, T Kumari, MK Harioudh, PK Yadav, M Kathuria, PK Shukla, K Mitra, JK Ghosh
- Peptides designed on phenylalanine zipper template showed Cell-selective, antimicrobial and anti-endotoxin activities and induced apoptosis in breast cancer cells MDA-MB-231, AK Tripathi, T Kumari, A Tandon, M Sayeed, T Afshan, M Kathuria., PK Shukla, K Mitra, JK Ghosh
- A short peptide derived from human TLR4 self assembles shows TLR4 agonist like property and acts as a potent adjuvant, A Tandon, M Pathak, MK Harioudh, S Ahmad, Mohd Sayeed, T Afshan, MI Siddiqi, K Mitra, SM Bhattacharya, JK Ghosh

National Conference of Young Researchers 2017 on Frontiers in Life Sciences & Environment, Goa University, Goa India (16-17 March)

- Pyrrolidine-Acridine hybrid in Artemisinin-based combination: a pharmacodynamicstudy, Swaroop Kumar Sandey, Subhasish Biswas, Sarika Gunjan, Bhavana Singh Chauhan, Sunil Kumar Singh, Sarika Singh, Sanjay Batra and Renu Tripathi
- Antimalarial potential of Quinazoline glycoconjugates and Quinazolines, Sarika Gunjan, Kanchan Yadav, Vishwadeepak, Atul Kumar and Renu Tripathi

Empowering Drug Discovery by Pharmaceutical and Clinical Research, NIPER, Raebareli, India. (24-25 March)

- Design and synthesis of novel N-Substituted maleimide derivatives as sperm function modulato, Suyash Pant, Gopal Gupta, VL Sharma
- S-015-728 an anti tubercular CDRI candidate drug: preclinical pharmacokinetic assessment, BishwajeebanBarik, Mohammed Riyazuddin, Athar Husain, Guru R. Valicherla, Arun K Sinha, Jiaur R. Gayen

National conference on Biotechnology and Environment, Jamia Millia Islamia, New Delhi (11-12 April)

- *In vitro* toxicity assessment of Di-ethyleneglycolmonoethyl ether on Neuronal cell line, Vartika Channa, SonalSrivastava, Sakshi Mishra, Prabhash Kumar Pandey, Srikanta Kumar Rath

27th National Congress of Parasitology, NIMHANS, Bengaluru, India (25-27 April)

- Role of TNFR2 inhibitor in triglyceride deposition during malaria, Bhavana Singh Chauhan, Sarika Gunjan and Renu Tripathi
- Drug sensitivity evaluation of Trypanthrin derivatives with potent antimalarial property by screening against blood stages of *Plasmodium,* Sarika Gunjan, Kanchan Yadav, Vishwadeepak, Atul Kumar and Renu Tripathi.
- Role of artemisinins and mefloquine in cytoadhesion inhibition in *P. falciparum* –BB19 in vitro model, Prince Joshi, Hemlata Dwivedi and Renu Tripathi

Annual Conference of Indian Pharmacy Graduate Association, Lucknow (30 April)

- Pre-clinical pharmacokinetic investigation of novel CDRI drug candidate molecule having anti-tubercular activity, Shilpi Mishra, Mohammed Riyazuddin, Athar Husain, Bishwajeeban Barik, Guru R Valicherla , Arun K Sinha, and Jiaur R Gayen

National Seminar on Socio-Economic Impact of Ecological ignorance in Development Raising Disastrous possibilities, Govt PG College (Kumaon University)Dwarahat, Almora, Uttarakhand (6-7 May)

- *In vitro* biosynthesis of anti-oxidative compounds through plant tissue culture technology in *Taraxacum officinale* Weber, Neha Sahu and KR Arya
- Standardization of callus induction and proliferation from *Nerium oleander* L., Renu Nimoriya, Amar Jeet, Pankaj Singh, Sumit Kumar Singh and DK Mishra

6th Pharmaceutical Sciences World Congress, 2017, Stockholm, Sweden (21-24 May)

- Novel Self-nano emulsifying drug delivery system bearing docetaxel with enhanced bioavailability and anticancer in experimental cancer model, Jaya Gopal Meher, Manish K. Chourasia

8th International Conference on Children's Bone Health, Wurzburg, Germany (10-13 June)

- Identification and characterization of a novel microRNA inhibiting osteoblast functions by suppressing actin polymerization, Aijaz A John, Ravi Prakash, Jyoti Kureel, Divya Singh

25th International Conference on Bioencapsulation, La Chapelle sur Erdre (Nantes), France (3-6 July)

- Lapatinib nanocrystals for enhanced activity against breast cancer, SG Agrawal, H Ahmad, A Arya, Sikandar Roshan, AK Dwivedi
- HA coated Ormeloxifene loaded PCL nanoparticles for targeting breast cancer, SG Agrawal, H Ahmad, A Arya, AK Dwivedi

50th Annual Meeting of the Society for the Study of Reproduction (SSR), Washington D.C., USA (13-16 July)

- Tubulin polymerization promoting protein 3 (TPPP3) plays significant role in embryo implantation and decidualization via targeting β-catenin, Vinay Shukla, Pooja Popli, Kanchan Gupta, Jyoti B Kaushal, Pushplata Shankwar, Anila Dwivedi
- Identification of differentially expressed microRNAs involved in preparation of uterine receptivity during pre-implantation period of pregnancy
- Ormeloxifene suppresses embryo implantation via inducing miR-140 and down-regulating insulin-like growth factor-1 receptor during peri-implantation period in rats, Vijay K Sirohi, Kanchan Gupta, Rohit Kumar, Vinay Shukla and Anila Dwivedi

1st IBRO/APRC, Banasthali School of Neuroscience, Banasthali (21-26August)

- NMITLI118RT+: A neuroprotective lead in experimental stroke, Hafsa Ahmad, Sheeba Sazi Samuel, Rakesh Shukla, Anil Kumar Dwivedi

Scientific Writing and Plagiarism, Lucknow (29 August)

- "CD44 targeted polymeric nanoparticles for improved breast cancer chemotherapy, Satish Agrawal, Hafsa Ahmad, Abhishek Arya, Anil Kumar Dwivedi

European Respiratory Congress-2017, Milan Italy (09-12 September)

- Identifying polymorphic genes in *Mycobacterium tuberculosis*' clinical isolates as potential biomarkers, Apoorva Narain, Surya Kant, Ajay K Verma, Kanchan Srivastava, Kishore K Srivastava

Annual Molecular Parasitology Meeting XXVIII, Woods Hole, MA, USA (10-14 September)

- Elucidating the functions of plasmepsin VIII in *Plasmodium berghei,* BS Mastan, SK Narwal, S Dey, S Mishra, KA Kumar

8th East Asia Symposium on Functional Dyes and Advanced Materials. (EAS8 2017), CSIR-National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram (20-22 September)

- Design and Synthesis of Donor-Acceptor Based Fluorescent Molecules and their Live Cell Imaging Applications, Deepak Purohit, Ashutosh Raghuvanshi, Ashutosh Sharma, Shahida Umar, Ajay Kumar Jha, Aamir Nazir, Kalyan Mitra and Atul Goel
- Pyranones Derived Fluorescent Dyes for Multi-Colour Organic Light Emitting Devices, Chandra Prakash Sharma, Ashutosh Sharma, Sumit Chaurasia, Vijay Kumar, Manish Dixit, RS Anand and Atul Goel

- Design and Synthesis of Donor-Acceptor Based Fluorescent Molecules and their Live Cell Imaging Applications, Deepak Purohit, Ashutosh Raghuvanshi, Ashutosh Sharma, Shahida Umar, Ajay Kumar Jha, Aamir Nazir, Kalyan Mitra and Atul Goel
- Pyranones Derived Fluorescent Dyes for Multi-Colour Organic Light Emitting Devices, Chandra Prakash Sharma, Ashutosh Sharma, Sumit Chaurasia, Vijay Kumar, Manish Dixit, R S Anand and Atul Goel

The 5th Scientific Meeting of the Asian Federation of Osteoporosis Societies-2017 (AFOS), Kuala- Lumpur, Malaysia (06-08 October)

- Role of miR-672-5p in postmenopausal induced osteosarcopenia and its mechanism of action in sustaining musculoskeletal health, N Ahmad, R Trivedi

Society for the study of Xenobiotics (SSXINDIA), Bengaluru (25 October)

- CYP inhibition and metabolite identification studies of Novel fracture healing CDRI molecule S007-1500 , Mamunur Rashid, Sandeep Kumar Singh, Yaseen Malik, Isha Taneja, KanumuriSivaramaraju, Wahajuddin
- Tissue distribution study of Novel anti-osteoportic CDRI compound S007-1500 in SD rat using validated LC-ESI-MS/MS method, Sandeep Kumar Singh, Mamunur Rashid, Dheeraj Jha, Yaseen Malik, Isha Taneja, Wahajuddin

Advances in Reproductive Health, Lucknow (28-29 October)

- Effect of N-012-0001 on Male Reproductive System, AK Agrawal, SK Agnihotri, BA Hakim, D Singh, M Aggrawal, MC Tiwari, R Sachan, T Narender & M Sachdev

3rd International Toxicology Conclave, Lucknow (05-06 November)

- Design and Development of Phosphatidylserine Coated Polymeric Nanoparticle Bearing Amphotericin B for Treatment of Experimental Visceral Leishmaniasis, Pankaj K Singh, Manish K Chourasia
- Evaluation of Synergistic Cytotoxic Efficacy of Cisplatin in Combination with a Nanoconstruct of Pentacyclic Triterpenediol from *Boswellia serrata*, Md. Noor Alam, Manish K Chourasia

13th National Congress of Indian Society for Bone and Mineral Research, PGIMER, Chandigarh (10-12 November)

- MicroRNA-1187 inhibits osteoblast differentiation and *in vivo* bone formation in ovariectomized osteopenic mice, Aijaz A John, Ravi Prakash, Divya Singh
- CDRI Compound 341- A potential agent that improves bone quality and restores trabecular micro-architecture in ovariectomized mice, Ravi Prakash, Manisha Dixit, Gaurav Madhukar, T Narendra and Divya Singh
- Methoxyisoflavone formononetin promotes bone fracture healing in femur osteotomy mouse model, Krishna Bhan Singh, Manisha Dixit, Kapil Dev, Rakesh Maurya, Divya Singh
- Bone healing potential of neutralizing IL-17 antibody in cortical bone defect model, Reena Rai, Manisha Dixit, Krishna Bhan Singh, Ravi Prakash and Divya Singh

- 2-D Flake-like Architecture of Hydroxyapatite Modified with Sr2+ Ions: A Potential Biomaterial Showing In-vitro Osteogenic Efficacy VK Mishra, R Trivedi
- Dietary flavonoid Kaempferol inhibits glucocorticoid induced bone loss by promoting osteoblast survival, S Adhikary, R Trivedi
- Ethyl acetate fraction from passiflora promotes rat femoral fracture healing by the BMP-2 signaling pathway, N Ahmad, R Trivedi
- Prevention of Dexamethasone-induced apoptosis of osteoblastic cells by Benzofuron pyron derivative, AK Tripathi, P Kothari, R Trivedi

AAPS Meeting, San Diego, California, USA (12-15 November)

- Stearylated Arabinogalactan: Mitigating Challenges in Hepatic Disorders Through a Targeted Approach, M Marwah, V Dhawan, M Venkataraman, BS Mohanty, PN Srivastava, K Nagarsekar, j Thamm, F Steiniger, A Fahr, P Chaudhari, S Mishra, M Nagarsenker
- Formulation and Assessment of Inhalable Particles Containing Kanamycin Monosulphate and Pyrazinoic Acid for the Treatment of Drug Resistant Tuberculosis, A Srivastava. A Misra
- In Situ Hydrophobic Ion Paired, Pseudo-Cell Like Mesoporous Silica Nanoparticles forSynergistic Co-Delivery of Metformin and Topotecan, VT Banala, S Sharma, P Barnwal, S Urandur, RP Shukla, N Mittapalley, G Pandey, PR Mishra

Association of Microbiologists of India & International Symposium on Microbes for Sustainable Development: Scope & Applications (MSDSA-2017), BBA University, Lucknow (16-19 November)

- Detection of Plasmodium induced neutral lipid deposits in host liver with newly synthesized fluorescent probes of CDRI, Bhavana Singh Chauhan, Sarika Gunjan, Hemlata Dwivedi, Ashutosh Sharma, Atul Goel and Renu Tripathi.
- A SYBR Green 1-based fluorescence test: To assess combination index between arteether and anticancer medicine 5-Fluorouracil on asexual stage of *Plasmodium falciparum*, Kanchan Yadav, Sarika Gunjan, Prince Joshi, and Renu Tripathi
- Anticytoadhesion potential of artemisinin derivatives in in vitro model of cerebral malaria, Prince Joshi, Hemlata Dwivedi, Renu Tripathi

37th Annual Conference of Society of Toxicology India, STOX-17, PGMIER, Chandigarh (November 17-19)

- Deoxynivalenol; Prevelance, Toxicity and Prevention, Sakshi Mishra, S Srivastava, A Divakar, S Kumar, SK Rath

Symposium on Molecular Medicines for Life Style Diseases: Emerging Targets and Approaches, CSIR-CDRI, Lucknow (20-21 November)

- miR 376c inhibits Osteoblastogenesis by targeting Wnt3 and ARF-GEF-1 facilitated augmentation of Beta-Catenin transactivation, Aijaz A John, Jyoti Kureel, Ravi Prakash, Divya Singh
- Micro-RNA- 409 inhibit osteoblast differentiation and Bone formation by targeting LRP-8, Ravi Prakash, Aijaz A John and Divya Singh
- Antibody-mediated neutralization of IL-17, leads to enhanced bone repair via increased osteogenesis in mid diaphyseal femoral bone defect model, Krishna Bhan Singh, Manisha Dixit , Reena Rai, Ravi Prakash, Divya Singh
- The molecular effects of testicular heating causing male Infertility, Aastha Pandey, Santosh K. Yadav, Singh Rajender, Gopal Gupta
- A flavonoid isolated from the bark of *Ulmus wallichiana* modulates the lipopolysacchride induced neuronal death, Shubhangini Tiwari, Parul Gupta, Abhishek Singh, Sonam Gupta, Rakesh Maurya, Sarika Singh
- miR-99a Induced M2 Polarization Reduces Adipose Tissue Inflammation & Type-II Diabetes, Anant Jaiswal, Sukka Santosh Reddy, Mohita Maurya, Preeti Maurya, Manoj Barthwal
- Ox-LDL Induces Metabolic and Inflammatory Re-programming of Dendritic cells, Amit Kumar and Manoj Kumar Barthwal
- CDR267-F018 ameliorates collagen induced arthritis in mice model, Priya Gupta, Amit Kumar, Manoj Kumar Barthwal
- S-glutathionylation profile in M1&M2 BMDM & Stromal Vascular Fraction from db/db mice, Mohita Maurya, Anant Jaiswal, Manoj Barthwal
- Cilostazol Mitigates Cardiac Remodeling and Dysfunction in Accelerated Model of Left Ventricular Hypertrophy, SS Reddy, MK Barthwal
- CDR-267-F018 Protects from LPS induced Endotoxemia, Heena Agarwal and Manoj Kumar Barthwal
- Augmented NOS expedited differentiation of K562 and murine hematopoietc progenitor cells into neutrophils, Samreen Sadaf, Deepika Awasthi, Abhishek K Singh, Sachin Kumar, Manoj K Barthwal and M Dikshit
- Role of IRAK in Abdominal Aortic Aneurysm, Preeti Maurya, Sukka Santosh Reddy, Himalaya Singh, Anant Jaiswal, Kumarvelu Jagavelu,Manoj Kumar Barthwal
- A study to investigate role of inducible nitric oxide synthase in hematopoiesis, homeostasis and during stress conditions, Priyanka Dhankani, Hobby Aggarwal, Anil Kumar Meena, Kumaravelu Jagavelu, Sharad Sharma, Madhu Dikshit, Sachin Kumar
- Inducible nitric oxide synthase deficiency preserves vascular function despite systemic insulin resistant in diet induced mouse model of obesity, Priya Pathak, Jitendra S Kanshana, Sanjay C Rebello, Babu Nageswararao Kanuri, Sachin Kumar, Kumaravelu Jagavelu and Madhu Dikshit
- *Xylocarpus Moluccensis* fraction rescues heart from pathological hypertrophy, Manhas A, Goyal D, Tripathi D, Biswas B, Singh H, Singh A, krishan S, Srivastava MN, Narender T, Diwedi AK, Dikshit M, and Jagavelu K
- p47phox S-Glutathionylation sustains ROS generation in activated neutrophils, Sheela Nagarkoti, Megha Dubey, Deepika Awasthi, Vikas Kumar, Tulika Chandra, Sachin Kumar and Madhu Dikshit
- Altered metabolic homeostasis and gut microbiome predispose iNOS-/- mice to insulin resistance, Aggarwal H, Pathak P, Kanuri BN, Nagarkoti S, Gupta A, Gayen JR, Kumar S, kumaravelu J and Dikshit M

- Augmented NOS expedited differentiation of K562 and murine hematopoietc progenitor cells into neutrophils, Samreen Sadaf, Deepika Awasthi, Abhishek K Singh, Sachin Kumar, Manoj K Barthwal and M Dikshit
- In-vivo anti-obesity activity of flavopiridol: A phase III anti-cancer candidate molecule, Durgesh Kumar, Salil Varshney, Abhishek Gupta, Muheeb Beg, Kripa Shankar, Sujith Rajan, Ankita Srivastava, Sanchita Gupta, Vishal Balaramnawar, Achchhe Lal Vishwakarma, Anil N Gaikwad
- In vitro anti-adipogenic activity of Flavopiridol: A phase III anti-cancer candidate molecule, Salil Varshney, Durgesh Kumar, Abhishek Gupta, Muheeb Beg, Kripa Shankar, Sujith Rajan, Ankita Srivastava, Sanchita Gupta, Vishal M. Balaramnavar and Anil N. Gaikwada,
- Photogedunin isolated from *Xylocarpus granatum* shows potential anti-adipogenic activity in-vitro, Sanchita Gupta, Salil Varshney, Abhishek Gupta, Durgesh Kumar , Kripa Shankar, Sujith Rajan, Ankita Srivastava,T. Narender and Anil N. Gaikwad
- Elucidation of antinociceptive mechanism of histamine H3 receptor (H3R) antagonism in neuropathy, Ajeet Kumar, Deepmala and Prem N Yadav
- Isocoumarin analogue activates neurotrophin receptors TrkB and modulates synaptic proteins and neuron dendritic arborisation, Boda Arun Kumar , Shalini Dogra ,Kasireddy Sudarshan, Ishani Bose, Shreyas Vaidya Prasad, Indrapal Singh Aidhen and Prem Narayan Yadav
- Standardized herbal extract Picroliv protects from alcohol induced Liver dysfunction, Abhinav Singh, Himalaya Singh, Amit Manhas and Kumaravelu Jagavelu
- CDRI compound exhibiting potent antiangiogenic effect by inhibiting filopodia formation, Himalaya Singh, Abhinav Singh, Amit Manhas, Preeti Sharma and Kumaravelu Jagavelu
- An Investigation on the role of Mitogen-Activated Protein Kinase (MAPK)-Activated Protein Kinase 2 (MK2) in pulmonary hypertension, Mohammad Shafiq, Kumaravelu Jagavelu and Kashif Hanif
- Involvement of Renin Angiotensin Aldosterone System in the Regulation of Endothelial Cell Autophagy, Moon Jain and Kashif Hanif
- MPTP Exposure Enhance Self Renewal Capacity and differentiation of Neural stem cells in Hippocampus of Adult Mice, Akanksha Mishra, Sonu Singh, Sachi Bharti and Shubha Shukla
- Astrocyte exhibits protecting mechanism on neuron upon 6-OHDA induced Neurotoxicity, Jitendra Singh, Akanksha Mishra, Sonu Singh and Shubha Shukla
- Stressful Life event with High Fat Food Consumption Triggered Pathogenesis of Metabolic Disorder, Parul, Seema Singh, Sonu Singh, Akanksha Mishra and Shubha Shukla

International Vaccine Conference, ICGEB, New Delhi, India (27-29 November)

- Reverse genetics approach to characterize Phospholipase DDHD1 in *Plasmodium berghei*, PN Srivastava, SK Narwal S Mishra
- *Plasmodium bergheiS14* protein regulates sporozoites gliding motility and infectivity, A Ghosh, SK Narwal, R Gupta, HH Choudhary, S Mishra
- *Plasmodium* PKAc is dispensable in mosquito and liver stages of malaria life cycle but essential in the blood-stage, HH Choudhary, R Gupta, S Mishra
- *Plasmodium berghei* Stearoyl-CoA delta 9 desaturase is essential for liver stage maturation, SK Narwal, HH Choudhary, A Ghosh, S Mishra
- Modulation of host cell SUMOylation facilitates efficient development of *Plasmodium berghei* and *Toxoplasma gondii*., M Mulaka, D Singh, SR Reddy, BS Mastan, S Mishra, KA Kumar

International Scientific Meeting and Workshop, "Malaria Parasite Biology: Strategies for Drug and Vaccine Development", ICGEB, New Delhi (29 November-01 December)

- *Plasmodium falciparum* organellarGTPases, EngA and Obg, involved in mitoribosome biogenesis and mtDNA interaction, Kirti Gupta and Saman Habib
- Cellular localization and functional characterization of YihA homologs of the malaria parasite, Ankit Gupta and Saman Habib
- Identification of a DNA base excision repair endonuclease targeted to the *Plasmodium falciparum* mitochondrion, Anupama Tiwari, Jitendra Kuldeep, MI Siddiqi and Saman Habib
- Biochemical characterization of components of mitochondrial [Fe-S] clusters synthesis in *Plasmodium falciparum,* Mohd Sadik and Saman Habib

Malaria Workshop, ICGEB, New Delhi, India (30 November -01 December)

- A *Plasmodium berghei* serine threonine kinase PBANKA_031140 regulates the expression of MSP1 on hepatic merozoites and is required for timely initiation of blood stage infection, R Jillapali, SK Narwal, SK Kolli, BS Mastan, SR Reddy, S Mishra and KA Kumar

HarGobind Khorana Memorial Symposium on Genes, Genomes and Membrane Biology, Mohali (03-05 December)

- *Plasmodium falciparum* GTPases, EngA and Obg are involved in mitoribosome biogenesis and organellar DNA interaction, Kirti Gupta and Saman Habib

National Conference of Association of Clinical Biochemists of India (ACBIOCON 2017) King George Medical University, Lucknow (03-05 December)

- Fatty Acid Synthase: A new therapeutic target for pulmonary hypertension, Kashif Hanif

British Society for Immunology Congress 2017 (BSI 2017), Brighton, UK (04-07 December)

- Augmentation of Strong T-cell Mediated Immunity using Dehydroepiandrosterone and Low Dose Miltefosine in

Leishmania donovani Infected Balb/c Mice. Abstract No. P323., Rahul Shivahare, Wahid Ali, Preeti Vishwakarma, Uma Shankar Singh, Sunil Kumar Puri and Suman Gupta

- Molecular and Immunological Characterization of Recombinase-A from *Wolbachia Endosymbiont* of Lymphatic Filarial Parasite Brugiamalayi, Mamta Gangwar, Ruchi Jha, Manish Goyal and Mrigank Srivastava

National Conference in recent advances in Biomedical Science: Diagnosis and Research (BIOMEDCON 2016), New Delhi (16 December)

- *In vitro* and *in vivo* Toxicity Evaluation of Di-ethylene glycol monoethyl ether, Sonal Srivastava, Nidhi Gupta, Navodayam Kalleti and Srikanta Kumar

International conference on Natural and Artificial Molecular Machines, IIT Mumbai (18-20 December)

- Role of epigenetic mechanisms in epithelial-to-mesenchymal transition of colon cancer cells, Sonal Srivastava, Sakshi Mishra, Jayant Dewangan and Srikanta Kumar Rath

International conference on Functional Biology and Molecular Interactions: Applications in Health and Agriculture (FBMI 2017), University of Lucknow (20-22 December)

- Contamination of a Trichothecene mycotoxin in cereals: An overview of the global status, Sakshi Mishra, S Srivastava, J Dewangan, A Divakar, PK Pandey and SK Rath

Contemporary Facets in Organic synthesis (CFOS-2017), IIT, Roorkee (22-24 December)

- Green syntetic approach for regioselective synthesis of 3-chalcogenyl indoles via Cooperative catalysis, Danish Equbal, Aditya G Lavekar Saima and Arun K Sinha

2018

International Congress of Cell Biology 2018: The Dynamic Cell: Molecules and Networks to Form and Function, Hyderabad (27-31January)

- Mycobacterial ESAT-6 Regulates Macrophage Prdx-1 through p38 MAPK for Intracellular Survival:, Shivraj M Yabaji, Alok K Mishra, Aditi Chatterjee, Rikesh K Dubey, Kanchan Srivastava and Kishore K Srivastava
- Two component response regulator PrrA is Phosphorylated at Aspartate and non-Aspartate Residues during Growth and Intracellular Survival of Mycobacteria, Alok K Mishra, Shivraj M Yabaji, Rikesh K Dubey, Ekta Dhamija and Kishore K Srivastava
- Comparative global interaction networks of histidine kinases in fast- and slow grower mycobacteria, Alok K Mishra, Shivraj M Yabaji, Ekta Dhamija and Kishore K Srivastava
- Mycobacterial Tyrosine Kinase Program Macrophage for Intracellular Survival through Galectin-3, Swati Jaiswal and Kishore K Srivastava
- Diversification in VNTRs and DRs in the clinical isolates of pulmonary tuberculosis in concordance to host cellular environment, Apoorva Narain, Ajay K Verma, DK Tripathi, Kishore K Srivastava and Surya Kant

4 Networks and Linkages

1. Mission Mode Project (FTT)

Code	Project Title	Principal Investigator	Date of Start	Expected date of completion
MLP0103	Anti-osteoporosis Candidate Drug 99/373	Director	21.07.2016	20.07.2018
MLP0104	Anti-malarial Candidate Drug 97/78	Director	21.07.2016	20.07.2018
HCP0010	CSIR Phytopharmaceutical Mission	Dr N Chattopadhyay	08.12.2017	07.12.2020
NWP0100	CSIR Skill Initiatives	Dr DN Upadhyay	21.08.2017	Long term

2. On-going Grant-in-Aid Projects

Project Title	Principal Investigator	Date of Start	Expected date of completion
Department of Biotechnology			
Genetic manipulation and drug targeting approaches against *Plasmodium berghei* sporozoite proteins S14, Serine threonine protein Kinase -9 and Liver stage specific Acyl - CoA Synthase	Dr Satish Mishra	10.10.2013	09.10.2018
Investigating the extra-ribosomal functions of ribosomal proteins during stress and infection	Dr Niti Kumar	13.11.2013	12.11.2018
Asembly of Iron-Sulphur [Fe-S] Cluster on critical proteins of the plasmodium apicoplast	Dr Saman Habib	11.10.2013	10.10.2018
Quest for corannulene based polyfunctional molecules in nanobiotechnology and nanomedicine: Transporting and translocating properties of corannulene derived carrier systems	Dr Gautam Panda	24.03.2015	23.03.2018
Profiling and characterization of early phase differential-mi-RNA(s) responsible for downstream development of insulin resistance in Hmsc derived-adipocytes	Dr Anil N. Gaikwad	28.04.2015	27.04.2018
Tissue specific transcripts and cardical glycoside profiling of calotropis plant after different biotic and abiotic elicitor	Dr Vineeta Tripathi	20.04.2015	19.04.2018
Mechanistic studies on napthaquinone based anticancer agents in breast cancer	Dr Durga Prasad Mishra	29.07.2015	28.07.2018
Design, development and performance evaluation of hybrid systems comprising novel cationic lipids intended to deliver therapeutic siRNA to solid tumors	Dr Manish K Chourasia	15.02.2016	14.02.2019
Mesenchymal stem cells with a polymeric scaffold may improve cardiac function in a mouse myocardial model	Dr Madhu Dikshit	03.05.2016	02.05.2018
Induction of autophagy as a strategy for treatment of tuberculosis	Dr Amit Misra	01.06.2016	31.05.2019
Deciphering the roles of secreted proteases in host-*Mycobacterium tuberculosis* interaction : Implications for novel drug discovery and vaccine development	Dr Arunava Das Gupta	13.07.2016	12.07.2020
RhoA GTPase in neutrophil chemotaxis and functions during inflammation	Dr Sachin Kumar	31.05.2016	30.05.2021
Induction of mitochondrial cell death and reversal of anticancer drug resistance via multifunctional immunotherapeutic nanoemulsion	Dr Manish K Chourasia	03.10.2016	02.10.2019
Understanding the role of RBR-E3 Ubiquitin ligase in *P. falciparum* and exploring its potential for Pharmacological intervention	Dr Niti Kumar	08.11.2016	07.11.2019
Evaluation of TGF-β mediated signaling mechanism in the endometriosis using mouse model	Dr Rajesh Kumar Jha	08.11.2016	07.11.2019
Synthesis and antiparasitic activities of quinoline-tetrahydropyrimidine hybrids with special reference to anti-malarial, anti-leishmanial and anti-filarial activities	Dr Renu Tripathi	13.10.2016	12.10.2019
Study to establish infection of L.donovani through intradermal route in hamsters and its pathological validation	Dr Amogh A Sahasrabuddhe	31.03.2017	30.03.2019
Characterization of *L.donovani* S-adenosyl methionine Decarboxylase : Spermidine Synthase interactions	Dr J V Pratap	25.06.2017	24.06.2020
Small molecule inducers of redox stress targeting antibiotic resistance	Dr Sidharth Chopra	05.07.2017	04.07.2020
Functional characterization and validation of drug target potential of a unique triacyl glycerol synthase of *Mycobacterium tuberculosis*	Dr Y K Manju	17.07.2017	16.07.2020
Exploring the role of nucleotide binding oligomerization domain proteins (NODs)-mediated inflammation in diet induced insulin resistance	Dr Akhilesh K Tamarkar	25.07.2017	24.07.2020
Deciphering Organellar Genome maintenance in the malaria parasite	Dr Saman Habib	25.09.2017	24.09.2020
Regulation of pancreastatin to control the energy homeostatis in diabetes	Dr J.R. Gayen	30.12.2017	29.12.2020

Project Title	Principal Investigator	Date of Start	Expected date of completion
Department of Science & Technology			
Sophisticated Analytical Instrument Facility (SAIF)	Director	01.04.1975	Long term
Target oriented delivery of chemotherapeutiv agent in leishmanisasis via macrophage scavenger receptors	Dr Manish K Chourasia	01.06.2014	30.11.2017
Exploring the potemtial of heterodienophile in Hauser-kraus annulations	Dr Namrata Rastogi	01.06.2014	31.05.2017
Investigations on the immunomodulatory properties of cyclic and linear host defence peptides	Dr Mukesh Pasupuleti	10.07.2014	09.07.2017
Development of sugar amino acid derived peptides self assembling selectively on bacterial membranes, forming ion pores and killing bacteria including MTB	Dr RS Ampapathi & Dr Vinita Chaturvedi	20.05.2015	19.05.2018
Skeletal effect of stimulation of receptor activator of NF-Kb ligand (RANKL) from osteoblast by theophylline and the mechanism of action of the drug	Dr Naibedya Chattopadhyay	03.06.2015	02.06.2018
E3 ubiquitin ligases in breast cancer: Identification of novel interacting proteins of E3 ubiquitin ligase E6AP from breast cancer cells	Dr Arun Kumar Trivedi	03.06.2015	02.06.2018
Design and development of plants secondary metabolite LC-MS/MS library to explore the chemistry of medicine plants	Dr Sanjeev Kanojiya	01.10.2015	30.09.2018
Original biocompatible phosphorus dendrimers as a new strategy to tackle pulmonary tuberculosis	Dr K K Srivastava	16.11.2015	15.11.2018
In vivo studies of GIT enzyme resistance insulin compound	Dr J R Gayen	04.01.2016	04.01.2018
Design and synthesis of natural, un-natural analogues of calothrixins A, B and evaluation of antimalarial and anticancer activity	Dr Kumkum Srivastava	12.01.2016	11.01.2019
Do transmembrane protein kinase PERK, IRE1 and activation transcription factor 4 and 6 (ATF4 & 6) are involved in neuronal death?	Dr Sarika Singh	07.04.2016	06.04.2019
Enantioselective Organocatalysis: A novel approach to use acetal as pro-nucleophile and hydroxylactam as pro-electrophile via co-oerative catalysis	Dr Dipankar Koley	27.09.2016	26.09.2019
Targetting the DnaG-DnaB interaction in Mycobacterium tuberculosis to identify and validate suitable small molecule inhibitors.	Dr Y. K. Manju	28.09.2016	27.09.2019
Dissecting the role of Drp1, a Rint1 family protein during DNA damage response and its implication on cell cycle checkpoint pathway in fission yeast *S.pombe*	Dr Shakil Ahmed	30.09.2016	29.09.2019
Adipocyte biology and insulin resistance: Metabolic homeostasis using naturally occurring bio-active/dietary lipids	Dr Anil N Gaikwad	27.09.2016	26.09.2019
Quest for druuggable targets against filarial manifestation of Tropical Pulmonary Eosinophilia (TPE): a mass spectrometry based global proteome analysis of eosinophilia	Dr Mrigank Srivastava	30.12.2016	29.12.2019
Decarboxylative cross couplings en route to the synthesis of heterocycles.	Dr Sanjay Batra	04.01.2017	03.01.2020
NMR based metabolic profiling of osteogenic phytoconstituents in *Dalbergia sissoo*	Dr Sanjeev Kumar Shukla	21.02.2017	20.02.2020
Understanding the role of CTD phosphorylation of RNA polymerase II for the transcription during mitosis	Dr Sohail Akhtar	22.03.2017	21.03.2020
Novel small molecules as selective and positive allosteric modulators (PAM) of 5 HT2c receptors: Discovery and development of potential anti-obesity agents	Dr Prem N Yadav	27.06.2017	26.06.2020
Application motivated organic synthesis (AMOS): Enroute to new chemical entities through chemical genetics approach	Dr A K Srivastava	01.08.2015	31.07.2018
Synthesis and therapeutic evaluation of new LpxC inhibitors as potent anti-bacterial agents	Dr Sidharth Chopra	19.07.2017	18.07.2020
Applications of experimental charge density and crystal structure prediction approaches in multi- component crystal development and for studying intermolecular interactions in protein-ligand complexes	Dr T S Thakur	17.08.2017	16.08.2020
Synthesis of privileged heterocycles via visible light photoredox catalyzed cascade reactions	Dr Namrata Rastogi	04.09.2017	03.09.2020
In vitro biosynthesis and enrichment of indole alkaloids from *Alstonia scholaris* and elucidation of their metabolic pathway	Dr D K Mishra	23.06.2017	05.10.2020
Role of autophagy in vascular smooth muscle cell remodelling and phenotype	Dr Manoj K Barthwal	09.10.2017	08.10.2020

Project Title	Principal Investigator	Date of Start	Expected date of completion
JC BOSE Fellow			
(i) Vaccine development against(VL),(ii) Studies to investigate the role of Th17 cells in the pathology of VL in comparison to Th1/Th2 paradigm in experimental animal models (iii) Development of experimental models (iv) understanding of drug resistance mechanism(v) Antileishmanial drug discovery and augmentation in drug efficacy by immunomodulation and delivery approach	Dr Anuradha Dube	09.08.2016	08.05.2019
DST-RAMALINGASWAMI Re-Entry Fellowship			
Discovery of novel cell-autonomous host defense 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	08.08.2022
DST-INSPIRE Fellow			
Deciphering the role of Ccr4-Not complex in human malaria parasite *Plasmodium falciparum*	Dr Manish Goyal	10.06.2013	09.06.2018
New approaches to the fluorinated N-heterocycles via amine radical cation pathway	Dr Sushobhan Chowdhury	08.09.2017	07.09.2022
DST-Ramanujan Fellowship			
Aptamer Anchored Smart Multifunctional Dendrimer-BSA Nano architectures for the Effective Treatment of Drug Resistant Non-Small Cell Lung Cancer	Dr P Kesharwani	20.04.2017	19.04.2022
DST-Woman Scientist Scheme-A			
Protective effect of topical application of celecoxib and/or n-acetyl cysteine on deoxynivalenol; mycotoxin induced skin inflammation,genotoxicity and tumorigenecity in mice	Dr Sakshi Mishra Mentor : Dr Sk Rath	01.07.2016	30.06.2019
Identification of shikimate kinase as a drug target against *Mycobacterium tuberculosis*	Dr Sapna Pandey Mentor :	16.01.2017	15.01.2020
Unveiling the role of host BTF3 protein in immune regulation against intracellular bacterial infections : A CRISPR/Cas9 system directed study	Dr Kavita Rawat Mentor :	23.10.2017	22.10.2020
DST-YOUNG SCIENTIST SCHEME			
RNAi mediated functional analysis of biomarkers for endometrial receptivity	Dr Rohit Kumar Mentor : Dr Anila Dwivedi	06.04.2015	05.04.2018
DST-National Post Doctoral Fellowship			
Activity guided isolation of anticancer agents from Indian medicinal plants and synthetic modifications of major bioactive constituents	Dr Rashmi Gaur Mentor : Dr K. V. Sashidhara	01.02.2016	31.01.2018
Investigation of uptake and efflux transporters role in first line prescription medicines and CDRI candidate drug disposition, potential drug combination and pharmacological effects by experimental therapeutic studies	Dr Sadaf Jahan Mentor : Dr Wahajuddin	15.03.2016	14.03.2018
Modulation of systemic immune response and pathology in DBA-1 mouse model of rheumatoid arthritis by Fasciola gigantic-derived immunomodulatory proteins (IMP)	Dr Yasir Khan Mentor : Dr Naibedya Chattopadhyay	16.03.2016	15.03.2018
Functional evaluation of miRNA regulators during early embryonic development of mice	Dr Amar Nath Mentor : Dr Monika Sachdev	01.04.2016	31.03.2018
Assessment of the toxicity potential of anabolic-androgenic steroids: a toxicogenomic and proteomic approach	Dr Prabhash Kumar Pandey Mentor : Dr Sk Rath	18.04.2016	17.04.2018
Synthesis and characterization of hydroxyapatite nano drug vehicles for effective drug delivery and their *in vitro* / *in vivo* studies in bone	Dr Vijay Kumar Mishra Mentor :	14.07.2016	13.07.2018
Application of common vegetables derived fluorescent carbon nanoparticles in *in vivo* multianalyte sensing	Dr Vikram Singh Mentor : Dr Atul Goel	11.08.2016	10.08.2018
Isolation, characterization of novel antimalarial compounds from potent Indian medicinal plants which being practicised by various Indian Tribes against malaria and evaluating the efficacy of their combination against drug resistant *Plasmodium falciparum* as an excellent alternative drug	Dr M Nagarajan Mentor : Dr Sanjeev K Shukla	01.09.2016	31.08.2018
Identification and Characterization of complete BRCA1C terminal missense mutations in cancer predisposition using heterologous yeast model	Dr Islam Husain Mentor : Dr Sohail Akhtar	29.03.2017	26.06.2019

Role of antidepressants in the regulation of bone morphogenesis	Dr S K Maurya Mentor : Dr N Chattopadhyay	31.03.2017	30.03.2019
Exploring the role of Notch/Nrf-2 signalling in amelioration by favonoids in endometriosis	Dr Radhika Kapoor Mentor : Dr Anila Dwivedi	03.04.2017	02.04.2019
Evaluation of stress dependent functional responses and gene expression in ras1 and allied mutants of *Schizo saccharomyces pombe* cells as a functional study fortargeting Ras-Redox pathway in cancer therapy	Dr Noosrat Masood Mentor : Dr Shakil Ahmed	07.04.2017	06.04.2019
Targeting epigenetic alterations in regulating Aldehyde Dehydrogenase (ALDH) expression in Triple Negative Breast Cancer (TNBC) *in vitro* and *in vivo*	Dr Akhilesh Singh Mentor : Dr Dipak Dutta	07.04.2017	06.04.2019
Deciphering the role of negative regulators of TLR mediated signaling in parasite survival during experimental malaria	Dr Rahul Shivahare Mentor : Dr Renu Tripathi	10.04.2017	09.04.2019
Rationale design of polyamine-conjugated new antimicrobial peptidomimetics and studies on their mode of action against different microorganisms including multidrug resistant bacteria	Dr RP Dewangan Mentor : Dr JK Ghosh	11.04.2017	10.04.2019
Understanding protein quality control system and exploring its pharmacological potential in Mesenchymal Stem Cells (MSCs)	Dr Bhagyashri Gupta Mentor : Dr Niti Kumar	01.05.2017	30.04.2019
Targeted co-delivery of gemcitabine and betulinic acid using hyaluronic acid functionalized amphiphilic PLGA-PEG copolymer nanoparticles for the treatment of pancreatic cancer	Dr Md. Noor Alam Mentor : Dr Manish K Chourasia	08.06.2017	07.06.2019
Structural and functional characterization of oxidative stress proteins from Mycobacterium tuberculosis as potential drug target against tuberculosis: A cross talk with Fenton reaction	Dr Radhey Shyam Kaushal Mentor : Dr R Ravishankar	12.06.2017	11.06.2019

Project Title	Principal Investigator	Date of Start	Expected date of completion
Indian Council of Medical Research			
Design synthesis, evaluation and identification of novel dually effective spermicidal agents with-trichominal activity for prophylactic contraception	Dr Gopal Gupta	15.06.2014	14.06.2017
Validation of WNT pathway modulation and efficacy study in primary osteoporosis, fracture healing and secondary osteoporosis for repositioning of clofazimine	Dr Naibedya Chattopadhyay	15.06.2014	14.06.2017
Studies on the effects of obesogens in male germ cells an exploratory study.	Dr D P Mishra	15.06.2014	14.06.2017
Preclinical development of Kaempferol with enhanced drug delivery for superior osteogenic activity.	Dr Ritu Trivedi	15.06.2014	14.06.2017
Lead identification of non steroidal molecule with anti-proliferative activity for management of endometrial hyperplasia.	Dr Anila Dwivedi	15.06.2014	14.06.2017
Preclinical development of orally active, rapid fracture healing agent	Dr Divya Singh	15.06.2014	14.06.2017
Studying mechanism of pro-fertility activity of *Mucuna pruriens*, *Withania somnifera* and *Asparagus racemosus* in spermatogenically compromised rat model and identification of active phyto-constituents	Dr Rajender Singh	15.06.2014	14.06.2017
Xenobiotics and cytokines metabolizing enzymes gene polymorphisms in acquired aplastic anemia.	Dr R K Tripathi	01.03.2015	28.02.2018

Project Title	Principal Investigator	Date of Start	Expected date of completion
Ministry of Earth Science			
Biological evaluation, discovery of novel bioactive compounds & coorination of the MOES project Drug from Sea	Dr PK Shukla	01.11.2012	30.09.2017
Synthesis and bioevaluation of chemical libraries of B- carboline based mimics of marine natural products	Dr Sanjay Batra	20.04.2015	19.04.2018
Ligand and structure based screening of designed and synthesized chemical library around psammaplin A against DNA methyltransferase 1 (DNMT1) and diversity oriented synthesis of Pachastrissamine as anticancer agents	Dr Gautam Panda	01.02.2016	31.01.2019

Project Title	Principal Investigator	Date of Start	Expected date of completion
INSA			
Deciphering the role of SOCS proteins in regulating pro/anti-inflammatory response during experimental visceral leishmaniasis	Dr Susanta Kar	01.03.2016	28.02.2019
(i)Vaccine development against visceral leishmaniasis (ii) studies to investigate the modulation of Th17 pathways in VL in relation to potential vaccine (iii) Development of a new test model for rapid screening of antileishmanials	Dr Anuradha Dube	01.04.2016	31.03.2021
AYUSH			
Exploration, identification and isolation of bone fracture healing agents from Indian folk traditional plants *Pholidota articulate* and *Coelogyn cristata* (Orchidaceae)	Dr Brijesh Kumar	09.01.2018	08.01.2021
BIRAC, SRISTI AHMEDABAD			
RGB Emitting carbon quantum dots from vegetables/fruits extract and their applications	Dr Vikram Singh Mentor : Dr Atul Goel	06.07.2017	05.07.2019
Emeritus Scientist			
Standardized phytopharmaceuticals for the prevention and treatment of bone related disorders and cardiovascular health: End to end pre-clinical development	Dr Rakesh Maurya	06.01.2017	05.01.2020
Design, synthesis and biological evaluation of ATP synthase inhibitors as potential antitubercular agents	Dr AK Saxena	17.07.2017	16.07.2019
CSIR Young Scientist Award			
Elucidation of functional inactivation of cdx2 expression in colon cancer cells: possible role of E3 ubiquitin ligases in regulating steady state levels of cdx2 protein expression via ubiquitination.	Dr Arun K Trivedi	01.04.2014	31.03.2019
Department of Atomic Energy			
Design and synthesis of donor-acceptor based new organic fluorescent dyes and their applications.	Dr Atul Goel	06.01.2016	05.01.2021
Indian Council of Agricultural Research			
Study the effect of mesenchymal stem cell transplantation on ovarian function and fecundity in goats.	Dr Monika Sachdev	01.02.2017	31.01.2020
Lady Tata Memorial Trust, Mumbai			
Elucidating mechanisms underlying breast cancer invasion and metastatis: Role of E3 ubiquitin ligase Fbw7 in suppressing breast tumorigenesis	Dr Arun K Trivedi	06.07.2017	05.07.2020

Sponsored Project

Project Title	Funding Agency	Principal Investigator	Date of Start	Expected date of completion
Licensing agreement of plant extract A-4744	Pharmanza Herbal Pvt. Ltd., Gujarat	Dr N Chattopadhyay	10.04.2015	09.04.2020
Synthetic microbicidal vaginal spermicides: Design, synthesis and biological evaluation	HLL, Thiruvanantpuram	Dr Gopal Gupta	22.06.2015	21.06.2018
Toxicology study of RISUG implanted in the Uterus of Rats	IIT, Kharagpur	Dr RK Singh	25.05.2016	24.05.2018
In vitro screening of ARP compounds	Advance Research Products, LLS, 608, 21st Avenue, Paterson, NJ07513, USA	Dr Kumkum Srivastava, Dr Satish Mishra	24.05.2016	23.05.2018

5 Human Resource Development

1. Ph. D. thesis submitted

S. No.	Name of Student	Title	Name of Supervisor
		Jawaharlal Nehru University (JNU)	
1.	Dharmendra Choudhary	To evaluate the role of natural and synthetic compounds during post- natal bone growth in rodents	Dr Ritu Trivedi
2.	Mandala Hari Babu	Inter and intramolecular functionalization of alkynes for the synthesis of Bio-active molecules	Dr M.S. Reddy
3.	Shahnawaz Ali Bhat	Study on glial activation and neurogenesis in rat model of chronic hypertension	Dr Kashif Hanif
4.	Mohd. Nizam Mansoori	To study the role of anti- inflammatory or pro-inflammatory cytokine(s) in attenuation or progression of estrogen deficiency induced bone loss	Dr Divya Singh
5.	Sunil Kumar	Application of mass spectrometric techniques in qualitative and quantitative analysis of phytoconstituents and identification of chemical markers by chemometric technique in *Phyllanthus* and *Rauwolfia* spp	Dr Brijesh KUmar
6.	Dipendu Das	Design, synthesis and biological evaluation of sugar amino acid based lipopeptide mimics and studies towards the total synthesis of sesquiterpenoid based bioactive natural products	Dr W. Haq
7.	Parul Chauhan	Design and synthesis of functionalized quinoline as antidiabetic agents	Dr P.P. Yadav
8.	Shalini Dogra	Molecular mechanisms of kappa opioid receptor action in depression	Dr Prem N. Yadav
9.	Mehraj-U-Din Lone	Redox regulation of mTORC2: A study to unravel the role of super oxide anions	Dr Smrati Bhadauria
10.	Puli Saihidareddy	Chiron substrate approach to the synthesis and screening of biological active molecules and their analogues	Dr Y.S. Prabhakar
11.	Rafat Ali	Synthesis of Conformationally Rigid Cyclic Amino Acids, Novel Peptides and Peptide Conjgates of Biological Importance	Dr W. Haq
12.	Rishabh Sharma	Characterization of threonine dehydratase, a putative gene of branch chain amino acid biosynthetic pathway and study of its role in *Mycobacterium tuberculosis* growth	Dr Sudheer K. Singh
13.	Surendra Puri	Design and development of novel methodologies viv inter or intra molecular activation alkynes	Dr M.S. Reddy
14.	Deshmukh Amit Laxmikant	Characterizing the role of human DNA replication proteins involved in lagging strand DNA synthesis & maturation	Dr Dibyedu Banerjee
15.	Deependra Kumar Singh	Human DNA ligase inhibitors and their potential role as anticancer molecules	Dr Dibyedu Banerjee
16.	Alok Kumar Singh	Molecular studies on host-pathogen interaction in the context of brain infection caused by pathogenic mycobacteria	Dr Arunav D. Gupta
17.	Deepa Keshari	Characterization of phosphoserine aminotransferase, a putative gene of serine biosynthesis pathway and study of its role in *Mycobacterium smegmatis* growth	Dr Sudheer K. Singh
18.	Isha Soni	Studies of antimicrobial resistance mechanism in bacteria	Dr Sidharth Chopra
19.	Soumya Bhattachrya	Synthetic application of formyl-derivatives for preparing heterocyclic scaffolds of biological interests	Dr Sanjay Batra
20.	Bhuttu Khan	Design, synthesis and biological evaluation of hydroxamic acid based linear and cyclic peptidomimetics and metal Catalyzed C-H activation	Dr Dipankar Koley
21.	Sonu Singh	Study on Wnt signaling in rodent model of Parkinson's disease	Dr Shubha Shukla
22.	Subodh Kumar Jaiswal	Synthesis and Investigation of Heterocyclic molecules as possible Antithrombotics/anticoagulants	Dr Kanchan Hajela
23.	Deepika Awasthi	Nitric oxide mediated regulation of reactive oxygen/ nitrogen species generation, cell proliferation and apoptosis in leukemic cell lines and neutrophils	Dr Madhu Dikshit
24.	Swati Gupta	Synthesis and biological evaluation of some new spermicidal and anti- stroke agents	Dr A.K. Dwivedi
25.	Jitendra Singh Kansana	Elucidation of novel oxidative & nitrosative mechanisms during at herosclerosis progression	Dr Madhu Dikshit
26.	Pooja Popli	Identification of oviductal factors playing role in fertilization and early embryonic Development	Dr Anila Dwivedi

27.	Shilpika Pandey	Molecular and Functional Studies of Rv3272, putative Cell Wall Protein in *Mycobacterium tuberculosis*	Dr Arunava Dasgupta
28.	Ajay Kumar Jha	Design and synthesis of donor acceptor based pyranone derived new fluorescent molecules	Dr Atul Goel
29.	Ashutosh Arun	Identification of new compound(s) active against breast cancer and determination of their mode of action	Dr Rituraj Konwar
30.	Dipika Goyal	Study of Damage associated molecular patterns (DAMPs) and its mutation in the regulation of Liver Cirrhosis	Dr Kumaravelu Jagavelu
31.	Lova Prasadreddy K	Functional studies on actin-related proteins in *Leishmania*	Dr Amogh A. Sahasrabuddhe
32.	Karade Sharanbasappa Shrimant	Molecular and structural characterization of magnesium transporter *Vibrio* and a putative CoA transferase from *Mycobacterium tuberculosis*	Dr J. Venkaesh Pratap
33.	Shalini Singh	Synthesis of Peptidomimetics and Peptide Conjugates for the Development of Molecules of Therapeutical Significance	Dr W. Haq
34.	Sandeep Kumar Bansal	Identification of genetic variants contributing to the etiology of male infertility	Dr Rajender Singh
35.	Raju Cillara	Isolation, characterization of natural products and synthesis of bioactive flavonoid analogues	Dr T. Narender
36.	Dinesh Kumar Verma	Neuroinflammation induced alterations in neuronal and non-neuronal cells: Age and gender based analysis	Dr Saika
37.	Mohammad Asad	Development of New Synthetic Methods for the Synthesis of N-Heterocycles and their Bio -evaluation as ER/Ligase Inhibitors	Dr Kanchan Hajela
38.	Nafees Ahamad	Understanding the role of Wat1/Pop3, a WD containing protein during stress response in fission yeast *Schizosaccharomyces pombe*	Dr Shakil Ahmed
39.	Aditi Chaterjee	Molecular and functional characterizations of protein tyrosine phosphatases and their prospective roles in subverting the growth and survival of mycobacteria	Dr Kishore K. Sriastava
40.	Abhishek Gupta	Insulin resistance associated functional and immuno-metabolic alterations in adipocytes	Dr Anil N. Gaikwad
41.	Yogesh Kumar	E3 ubiquitin ligases and their role in regulating protein stability particularly in osteogenesis	Dr Arun K. Trivedi
42.	Kiran Lata	Molecular mechanisms of selected mycobacterial proteins involved in nucleic acid metabolism	Dr R. Ravishankar
43.	Shasuzzama	Functional Characterization of miRNAs in Age Associated Neurodegenerative Diseases: Studies Employing Genetic Model System *Caenorhabditis elegans*	Dr Aamir Nazir
44.	Ravi Kumar Thakur	Synthesis of novel glycohybrids and their Bioevaluation	Dr Atul Kumar
45.	Kirti	Investigation of ribosomal assembly cofactors involved in organellar ribosome biogenesis in *Plasmodium falciparum*	Dr Saman Habib
46.	Padam Singh	Activity and mechanism of action of a synthetic thiophene containing trisubstituted methane as a potential drug for tuberculosis	Dr Vinita Chaturvedi
47.	Shikha Singh	Synthesis and functionalization of fused phenoxazine derivatives and related N- heterocyclic molecules as biodynamic agents	Dr Prem P. Yadav
48.	Kartikey Singh	Synthesis and Bioevaluation of sugar and heterocycle derived hybrid as new chemotherapeutic agents	Dr W. Haq
49.	Praveen Pandey	Understanding molecular mechanism of lead anticancer molecule(s) from *Sphaeranthusindicus*	Dr Jayanta Sarkar
		Academy of Scientific & Innovative Research (AcSIR)-CSIR-CDRI	
50.	Jyotsana Singh	Identification and mechanism of action of molecules targeting epithelial-mesenchymal transition (EMT) in breast cancer cells	Dr Rituraj Konwar
51.	Shweta Sharma	Development of smart and functional nanocarriers for the effective delivery of chemotherapeutic agents against cancer	Dr Prabhat Ranjan Mishra
52.	Guru Raghvendra Varlicherla	Investigation of Mechanism of Action of a Novel Antidiabetic Peptide in Rodent Models of Peri-/Post-Menopausal Diabetes and its Preclinical Pharmacokinetic Evaluation	Dr J.R. Gayan
53.	Aditi Sharma	Elucidating the role of Dendritic cells and Macrophages during early phase of infection with filarial nematode *Brugia malayi*	Dr Mrigank Sharma
54.	Ravi Kumar	Design of one-pot strategies with alkyne based substrate for the synthesis of small organic molecules of biological interest	Dr M.S. Reddy
55.	Dipti Arha	Deciphering the role of NODs in inflammation-induced Hepatic Insulin Resistance and implication of Natural molecules in Type 2 Diabetes management	Dr Akhilesh K. Tamrakar

56.	Bhaskar	Molecular and Biochemical Characterization of Chaperonin (HSP60) of Leishmania donovani	Dr Neena Goyal
57.	Sujit Rajan	Mechanistic studies of early phase differential miRNA(s) contributing to the development of insulin resistance in hMSC derived adipocytes	Dr Anil N. Gaikwad
58.	Mahendra Shukla	Population PK-PD modelling of furosemide for anti-hypertensive effect & Bioavailability enhancement studies of curcumin	Dr Jawahar Lal
59.	Ankita Srivastava	Progression of Adipocyte Insulin Resistance: Deciphering roles of miR-27b and PP2A subunit PPP2R5B	Dr Anil N. Gaikwad
60.	Abhishek Arya	Nanocarriers for codelivery of bicalutamide and antioxidants for effective management of prostate cancer	Dr A.K. Dwivedi
61.	Yuvraj Singh	Nanocarriers for effective Delivery of Doxorubicin Hydrochloride in Breast Cancer	Dr Manish K. Chourasia
62.	Shyam Sundar Pal China	Studies on the role of globular adiponectin in postmenopausal osteo-sarcopenia and its mechanism of osteoprotection	Dr Naibedya Chattopadhyay
63.	Priyanka Tripathi	Engineered Nanoconstructs for Improved Delivery of Chemotherapeutic Agents for the treatment of Leishmaniasis	Dr Prabhat Ranjan Mishra
64.	Manisha Bateria	Evaluation of Preclinical ADME Properties of Novel Antithrombotic Agent, S-002-333 and its Isomers	Dr Rabi S. Bhatta
65.	Rachumaliu Ramakrishna	Evaluation of Preclinical Pharmacokinetics and Mechanism of action of Antihyperlipidemic agent, 16-Dehydropregnenolone	Dr Rabi S. Bhatta
66.	Kanuri Babu Nageswarrao	Hepatic and Cardiac Redox Modulations in dietary models of dyslipidemia	Dr Madhu Dikshit
67.	Anagha Ashok Gurjar	Repurposing of FDA-approved drug in Skeletal Muscle Atrophy	Dr Sabyasachi Sanyal
68.	Agrawal Satishkumar Gopikishan	Nano-engineered formulations for effective management of breast cancer	Dr Anil Kumar Dwivedi
69.	Bhawna Singh Chauhan	Study of malaria parasite/toxin induced pathogenesis & its reversal	Dr Renu Tripathi
70.	Mukund Murarai Das Pramnik	Novel Reactions of Diazo Compounds and Diazonium Salts under Basic and Visible Light Photoredox Catalyzed Conditions	Dr Namrata Rastogi
71.	Sandeep Kumar Mishra	Effect of Saroglitazar (a dual PPR agonist) on adult neurogenesis in rat model of dementia : Involvement of Wnt signaling pathway	Dr Rakesh Shukla
72.	Tushar Jain	Molecular characterization of Tac 1p, a Zn-finger transcription factor regulating MDR genes in Cadida ablicans and screening for novel anti-Candida agents	Dr Dibyedu Banerjee
73.	Gajendra Singh	Structural Studies of Gramicidin-S Analogs, SIX-3 HD mutants and Interaction of SMAC mimetics with BIR domains of XIAP protein	Dr Ravi S. Ampapathi
74.	Richa Srivastava	M2 Polarized Tumor Associated Macrophages: Deciphering the Role of mTORC2 during Phenotype Switchin	Dr Smrati Bhadauriya
75.	Sukanya Pandeti	Isolation, Chemical transformation & Synthesis of Biological importance Natural products and Mass spectral analysis	Dr T. Narender
76.	Srankhala Maheswari	Chemokine Receptor CXCR4 in Apoptosis Evasion: Signaling and Therapeutic Opportunities	Dr Deepak Datta
77.	Shivam Maurya	Green Catalytic Synthesis of Novel aza/oxa Heterocyclic Based Privileged Structures as Potential Anti-tubercular Agents	Dr Atul Kumar
78.	Naveen Parmar	Dissecting the role of negative regulators of TLR signaling pathway in pathogenesis of experimental Visceral leishmaniasis	Dr Susanta Kar
79.	Salman Sahid	Structural Characterization of the stereochemical configuration of active site residues of bacterial peptidyl-tRNA hydrolase	Dr Ashish Arora
80.	Preeti Maurya	Role of Interleukin-1 Receptor Associated Kinase in Vascular Smooth Muscle Cell Function and Vascular Remodeling	Dr Prem N. Yadav
81.	Diva Maheswari	Structural and Biophysical characterization of Rab5a from Leishmania donovani, Glia maturation factor from Caenorhabditis elegans	Dr Ashish Arora
		Banasthali Vidyapeeth	
82.	Ashwani Kumar Verma	Development of Engineered Naoparticulate Drug Delivery System for Oral vaccination	Dr Anil K. Dwivedi

2.1 Training to Post Graduate Students

During the calendar year, a total of 143 Post-graduate students from 50 Colleges/Universities and their affiliated colleges from all over the country were selected on merit basis and were imparted training in various disciplines of drugs and pharmaceutical research for 4-10 months duration.

2.2 Training to Post Graduate Students

CSIR-CDRI being a mentor institute for the NIPER Raebareli, imparted one year project training in biomedical research to 30 M.S. (Pharm) Pharmaceutics & Medicinal Chemistry specialization students.

2.3 Training under cooperation with INSA & NASI

Under the programme, **08** INSA & NASI fellows from different institutes were provided training in different aspects of biomedical research.

2.4 CSIR-CDRI Skill Development Initiatives

During reporting period, we conducted three courses, two in chemical science and one in biological science. Total 51 candidates, from all over the country, registered online, themselves,for these courses. Finally 15 candidates participated in these courses. 14 in Chemical science and one in Biological Science. Programe was started on August 21, 2017 and was Inaugrated by Dr. Jayant Krishna. Programme Coordinator is Dr. D.N.Upadhyay & Course Nodal Officers are Dr. Y.S.Prabhakar and Dr. Brijesh Kumar in Chemical Science and Dr. Kalyan Mitra is in Biological Science.

Our second batch of two courses which has already been started in February 2018 and will be started in the Month of March 2018. Till date total 27 candidates have registered in these two courses.

3. Training program attended by CSIR-CDRI staff

In the reporting year following Scientist/Technical staff from CSIR-CDRI attended various training programs and workshops for updating their knowledge and expertise in different disciplines.

Name of Staff	Title of the Programme	Place	Date
Dr Jiaur R. Gayen	GLP Training	CSIR-CDRI, Lucknow	12 May, 2017
Dr A.K. Trivedi	IAS-SRFP-2017	Anna University- Tiruchirappalli (BIT) campus	05 June -31July, 2017
Dr Jiaur R. Gayen	GLP Training	CSIR-CDRI, Lucknow	8-9 August, 2017
Dr Mukesh Pasupuleti	GLP certification	CSIR-CDRI, Lucknow	8-9 August, 2017
Dr Jiaur R. Gayen	GLP Training	India Habitat Center, Delhi	31 August, 2017
Dr K.V. Shashidhara	CSIR Leadership Development Programme	CSIR-NBRI, Lucknow	13-17 November, 2017
Dr Ritu Trivedi	CSIR Leadership Development Programme	CSIR-NBRI, Lucknow	13-17 November, 2017
Dr P.R. Mishra	CSIR Leadership Development Programme	CSIR-NBRI, Lucknow	13-17 November, 2017
Dr Sanjeev Shukla	CSIR Leadership Development Programme	CSIR-NBRI, Lucknow	13-17 November, 2017
Dr Sanjeev Yadav	CSIR Leadership Development Programme	CSIR-NBRI, Lucknow	13-17 November, 2017
Dr Bidyut Purkait	CSIR Leadership Development Programme	CSIR-NBRI, Lucknow	13-17 November, 2017
Dr Bhupendra N. Singh	DST Training Programme on Multi-Disciplinary Perspectives on Science, Technology and Society	NIAS, IISc, Bangaluru	11–22 December, 2017
Dr Mukesh Pasupuleti	VenturEast-CDRI workshop on entrepreneurship	CSIR-CDRI, Lucknow	15 December, 2017
Dr Jiaur R. Gayen	ISO-17025 Training	NITS, Noida, NCR-Delhi	19-22 December, 2017
Dr Rabi Sankar Bhatta	GLP Inspectors Training	India Habitat Center New Delhi	19-23 December, 2017

6 Honours and Awards

Dr Madhu Dikshit

- JC Bose National Fellowship
- AstraZeneca Oration Award 2017
- Prof. N.R. Dhar Memorial Lecture Award 2017 by The National Academy of Sciences, India.

Dr Divya Singh

- 1st Dr Mridula Kamboj Innovators Award 2017, by CSIR-Central Drug Research Institute, Lucknow

Dr Ritu Trivedi

- Indira Gandhi Sammaan 2017, by Navonmesh for contribution in the field of Science

Md. Sohail Akhtar

- Raman Research Fellowship By CSIR

Dr Vinita Chaturvedi

- ISCB Distinguished Women Scientist Award-2018, in Biological Sciences by Indian Society of Chemists and Biologists, India.

Dr Akhilesh K. Tamrakar

- ICMR-International Fellowship by Indian Council of Medical Research, New Delhi, India

Dr Arun K. Trivedi

- Lady Tata Memorial Trust-Young Researcher Award 2017

Dr Sakshi Mishra

- 3rd Best Oral Presentation by Society of Toxicology India, STOX 2017
- Travel Award by Society for Free Radical Research-India (SFRR-INDIA-17)

Dr Kashif Hanif

- Professor Suresh C Tyagi Award at International Conference on Recent Advances in Cardiovascular Research at Vallabhbhai Patel Chest Institute (University of Delhi), 9-11 Feb 2017

Dr Vikram Singh

(N-PDF of Dr Atul Goel)

- Gandhiyan Young Technological Innovation Award (GYTI)-2017, By SRISTI, India
- Best Oral Award at Lucknow Christian Degree College, Lucknow, 8-9 Nov. 2017

Dr Kumaravelu Jagavelu

- NS Dhalla Poster Award at International Conference on Recent Advances in Cardiovascular Research at Vallabhbhai Patel Chest Institute (University of Delhi), 9-11 Feb 2017

Mr. Shashikant Dighe

(Student of Dr Sanjay Batra)

- Dr MM Dhar Memorial Distinguished Career Achievement Award-2017 for Chemical Sciences
- Sailife- NOST Best Thesis award-2017

Dr Atul Goel

- Rajib Goyal Prize in Applied Sciences by Kurukshetra University, 11 April, 2017
- 1st Dr Mridula Kamboj Innovators Award 2017, by CSIR-CDRI, Lucknow

Dr Sajid Khan

(Student of Dr Musthapa M. Meeran)

- Dr MM Dhar Memorial Distinguished Career Achievement Award-2017 for Biological Sciences

Mr. Rizwanul Haq

(Student of Dr Aamir Nazir)

- Dr JM Khanna Memorial Distinguished Career Achievement Award-2017 for Pre-clinical & Clinical Sciences

Mr. Moon Jain

(Student of Dr Kashif Hanif)

- Dr. CC Kartha Travel Award at International Conference on Recent Advances in Cardiovascular Research at Vallabhbhai Patel Chest Institute (University of Delhi), 9-11 Feb 2017

Mr. Ravi Kumar

(Student of Dr M.S. Reddy)

- Dr JM Khanna Memorial Early Career Achievement Award 2017

Mr. Anant Jaiswal

(Student of Dr Manoj Barthwal)

- Best poster presentation during Molecular Medicines for Lifestyle Disease: Emerging Targets and Approaches-2017 at CDRI Lucknow 20-21 Nov., 2017

Ms. Shagun Krishna

(Student of Dr M.I. Siddiqi)

- Dr Swarn Nitya Anand Memorial Early Career Achievement Award 2017 for Women Research Scholars

Ms. Gitu Pandey

(Student of Dr P.R. Mishra)

- CEFIPRA-ESONN Fellowship 2017 by CEFIPRA

Mr. Aijaz Ahmad John

(Student of Dr Divya Singh)

- New Investigator Award, 8th International Conference on Children's Bone Health held at Wurzburg, Germany By ICCBH in association with European Calcified Tissue Society, 10-13 June 2017

Ms. Hafsa Ahmad

(Student of Dr A.K. Dwivedi)

- First prize in paper presentation in 23rd ISCB International Conference, SRM University, Chennai, 8-10 Feb. 2017
- Selected as 'National Student' at IBRO/APRC, Banasthali Univ., 21-26 Aug. 2017.

Mr. Ravi Prakash

(Student of Dr Divya Singh)

- Best poster presentation at 13th National Congress of Indian Society for Bone and Mineral Research held at PGIMER, Chandigarh by ISBMR, 10-12 Nov. 2017.

Mr. Satish Agrawal

(Student of Dr A.K. Dwivedi)

- First prize in poster presentation in Scientific Writing and Plagiarism, Amity Institute of Pharmacy, Lucknow, 29 Aug 2017

Ms. Aastha Pandey

(Student of Dr Gopal Gupta)

- Best Oral/Poster Presentation (2nd Prize) By CSIR-CDRI, Lucknow

Mr. Harish Kumar

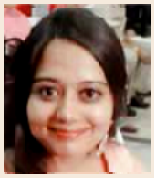
(Student of Dr S. Sanyal)

- Best Poster Award in ICUCPR & IPCBBAU at Babasaheb Bhimrao Ambedkar University, Lucknow

Ms. Pavneet Kaur

(Student of Dr Neena Goyal)

- Best poster Award in 27th National Conference of Parasitology held at NIMHANS, Bengaluru, 25-27 April 2017



Ms. Bhavna Singh

(Student of Dr Renu Tripathi)

- Best Poster Award at National Conference of Young Researchers 2017 on New Frontiers in Life Sciences & Environment, Goa

Ms. Kirti Gupta
(Student of Dr Saman Habib)

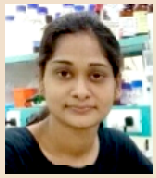
- Best Poster Award at Har Govind Khorana Memorial Symposium on Genes, Genomes & Membrane Biology held at NABI, Mohali, 03-05 Dec. 2017

Ms. Kanchan Yadav
(Student of Dr Renu Tripathi)

- Best Poster Award at 27th National Conference of Parasitology, Bengaluru

Ms. Kanchan Gupta
(Student of Dr Anila Dwivedi)

- Best Poster Award by International Conference on Reproductive Biology and Comparative Endocrinology and the 35th Annual Meeting of the SRBCE



Ms. Sonal Srivastava
(Student of Dr S.K. Rath)

- Best poster award by The society of Biomedical Laboratory Scientists (India)

Mr. Ashish Kumar Tripathi
(Student of Dr Ritu Trivedi)

- First prize in Basic Science by the 13th Annual meeting of ISBMR 2017

Ms. Suman Bharti
(Student of Dr Y.K. Manju)

- Best Poster Presentation award at World Congress on Genetics, Genomics and Personalized Medicine-2017, IISc, Bengaluru

Ms. Priyanka Kothari
(Student of Dr Ritu Trivedi)

- First prize in Basic Science Quiz by the 13th Annual meeting of ISBMR 2017

Mr. Shivraj M Yabaji
(Student of Dr K.K. Srivastava)

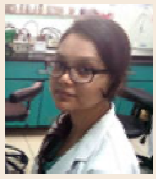
- ISCB special award for best paper presentation, International Congress of Cell Biology, Hyderabad

Mr. Naseer Ahmad
(Student of Dr Ritu Trivedi)

- International Young Trainee Award by the 5th Scientific Meeting of the AFOS-2017 at Hilton, Kuala Lumpur, Malaysia

Ms Anupama Tiwari
(Student of Dr Saman Habib)

- Best poster award at ICCB-2018 by Asian Pacific Organization of Cell Biology



Rajib Goyal Prize in Applied Sciences to Atul Goyal

Gandhian Young Technological Innovation Award (GYTI) 2017 to Dr Vikram Singh

Other Activities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1 Major Events Organized

66th Annual Day Celebrations and 42nd Sir Mellanby Oration

CSIR-CDRI celebrated its 66th Annual Day on the 17th February, 2017. On this occasion, in the morning session, the prestigious 42nd Sir Edward Mellanby Memorial Oration was delivered by Professor Gagandeep Kang, Executive Director, Translational Health Science Technology Institute (THISTI). The topic of her talk was "Vaccines and Public Health in India". In her oration she outlined the Impact of vaccine, challenges in India and the future of vaccines. She mentioned that in 17th century small pox took the lives of 40 million people per annum now eradicated globally with the help of vaccines. Further India has become Polio free only because of its vaccine.

The second part of the celebrations started with the graceful presence of Padma shri Professor V S Chauhan, Chairman Executive Committee, NAAC as the Chief Guest and Professor Gagandeep Kang, as president of the function. Dr Madhu Dikshit, Director CSIR-CDRI welcomed the Chief Guest, other dignitaries and presented a detailed account of the achievements made by CSIR-CDRI during the reporting period (2016-17).

Professor V S Chauhan, in his address discussed the interrelation between Science and Society significantly impacted by health, education, food security, communication, environment, energy, GMO's, economic development and social behavior. Later, Institute's Annual Report for 2016-17 was released by the dignitaries on the dais and announcement of prestigious CDRI Awards-2017 for Excellence in Drug Research was made. These awards have been conferred on CSIR's Foundation Day in September this year. The CDRI Awards 2017 for Excellence in Drug Research in Life Sciences category has been awarded jointly to Dr Suvendra Nath Bhattacharyya, Principal Scientist, CSIR-IICB, Kolkata and Dr Jayandharan Giridhara Rao, Associate Professor, IIT, Kanpur. In the Chemical Sciences category, the award has gone jointly to Dr Chada Raji Reddy, Principal Scientist, CSIR-IICT, Hyderabad and Dr Jayanta Haldar, Associate Professor, JNCASR, Bengaluru.

Excellence awards to the top publications and granted patent in 2016-17, were also conferred. Besides, Excellence awards viz. Dr MM Dhar Memorial Distinguished Career Achievement Award-2017 for Chemical Sciences awarded to Shashikant Dighe & for Biological Sciences awarded to Mr Sajid Khan, Dr JM Khanna Memorial Distinguished Career Achievement Award-2017 for Pre-clinical & Clinical Sciences was awarded to Mr Rizwanul Haq, Dr JM Khanna Memorial Early Career Achievement Award 2017 was given to Mr Ravi Kumar and Dr Swarn Nitya Anand Memorial Early Career Achievement Award 2017 for Women Research Scholars to Ms Shagun Krishna was conferred. Further, the institute felicitated the employees completing 25 years of service. The program concluded with the vote of thanks proposed by Dr A K Dwivedi, Chairman organizing committee.

The 18th Indo-US Flow Cytometry Workshop

The 18th Indo-US Flow Cytometry Workshop was organized with the objective of Applications of Flow Cytometry in Drug Development and Research at CSIR-CDRI and CSIR-IITR, jointly on 22-24 February 2017. The inauguration function was held at CSIR-CDRI. Director, Dr Madhu Dikshit welcomed the guests and participants and briefed about the objectives of organizing the workshop. Professor Alok Dhawan, Director, CSIR-IITR, delivered a talk on Historical perspective, Challenges, Vision for future.

Dr Awtar Krishan, Emeritus Professor University of Miami School of Medicine and Co-Chair of the Education Committee and Chair of the Asia Task Force of the International Society for Advancement of Cytometry (ISAC) discussed the Overview of International Society for the Advancement of Cytometry. Dr H Krishnamurthy from Central Imaging and Flow Cytometry Facility National Centre for Biological Sciences, Tata Institute for Fundamental Research, Bengaluru talked about Overview of Indo-US flow Cytometry workshop. Vote of thanks was proposed by Dr J Kumaravelu.

National Science Day Celebrations

CSIR-CDRI, Lucknow celebrated National Science Day 2017 on 28th February, 2017 with the theme of year **"Science and Technology for Specially Abled Persons"**. About 125 Specially Abled students from *Drishti Samajik Sansthan* participated in this event along with more than 180 students from SR Group of Institutions, Lucknow. Students visited the lab and interacted with scientists and learned about the new developments in drug discovery.

In the afternoon a special program was organized for Specially Abled Students from *Drishti Samajik Sansthan* to get them acquainted with the latest science & technology developments. They interacted with scientists and research students. Drawing and painting competition based on theme "Science in Surrounding" was organized, in which participants have drawn their imaginations on paper. Few sports event like musical chair jump and race were also organized to make them more interactive and comfortable to the new environment. These Specially Abled students also performed some dance numbers to show-off their spirit and enthusiasm towards life. Prizes were given to the winners of competitions and to the participants.

On this occasion an interactive lecture on "Scientists Popularizing Science" was delivered by Shri Umesh Kumar Rustagi, Project Coordinator & Curator, Regional Science City, Lucknow. In his lecture he emphasized on the need of popularizing the science in society. In his lecture, he mentioned that scientists must remain in regular touch with society so that they can understand the need of common people and at the same time people will have the idea of what the scientist are doing for their benefits.

National Workshop on the application of HRMS and LC-HRMS/MS

SAIF, CSIR-CDRI organized three days National Workshop on the application of HRMS and LC-HRMS/MS Instruments for the Analysis of Natural Products (Small molecules) from 27-29 March 2017. The objective of the workshop was to increase the awareness of using LC-MS and HRMS instruments for natural product chemists. Total 20 participants came from different parts of India participated in it. This workshop was aimed to cover basics of liquid chromatography (LC) followed by High Resolution Mass Spectrometry (HRMS). HRMS and LC-MS/MS in combination are the best and suitable tools to identify, characterize and quantify the molecules. The outcome of this workshop benefited in improving understanding of participants towards the techniques and their applications in research activity. This also helped them to assess their molecules for the right type of analysis and systematic interpretation of data to know their compounds. All the participants were able to see the HPLC/UPLC-HRMS, MS/MS and MS experiments on the instrument and interpretation of data by expert.

World Health Day Celebrations

CSIR-CDRI on the occasion of "World Health Day" organized a student motivation and health awareness program for students of B. Pharma along with their faculties from Shambhunath Institute of Pharmacy, Jhalwa, Allahabad on 7th April, 2017. The major objective of the program was to motivate the young students for pursuing their career in science and explore the recent knowledge of drug discovery and research.

During the motivation program, Dr Sanjeev Yadav briefed about the achievements of CSIR-CDRI and objective of celebrating "World Health Day". He further mentioned, Depression is on top of the list of causes of ill health, hence World Health Organization (WHO) declared the theme of the year as "Depression: let's talk". According to the latest estimates from WHO, more than 300 million people are now living with depression, an increase of more than 18% between 2005 and 2015. Lack of support for people with mental disorders, coupled with a fear of stigma; prevent many from accessing the treatment they need to live healthy, productive lives.

Further, the students and faculties visited the exhibit of achievements of CSIR-CDRI and various labs. In Pharmaceutics Division, Dr Amit Mishra, interacted with the students and talked about basics and advance research in the field of Pharmaceutics. Dr Wahajuddin, discussed about the various research aspects of Pharmacokinetics and Metabolism. In Pharmacology Division, Dr Anil Gaikwad interacted with the students as well as faculties and briefed about the recent advances of drug discovery and development and motivated the students for persuing their career in science. Dr RK Singh talked about the importance of toxicological studies in drug development. Students and faculties have taken a glance of hands-on working for drug development in various labs personally and interacted with research students also. Dr Manoj Kumar Mishra, Director, Shambhunath Institute of Pharmacy Jhalwa, Allahabad thanked Director, Dr Madhu Dikshit for providing this opportunity and scientists and staff for organizing such interactive program.

National Technology Day Celebrations

CSIR-Central Drug Research Institute celebrated the National Technology Day on 11th May 2017 by organizing a distinguished lecture on "GM crops – Ideology versus scientific facts" by Professor Deepak Pental Ex-Vice-Chancellor of the University of Delhi and currently INSA Senior Scientist at Centre for Genetic Manipulation of Crop Plants, University of Delhi.

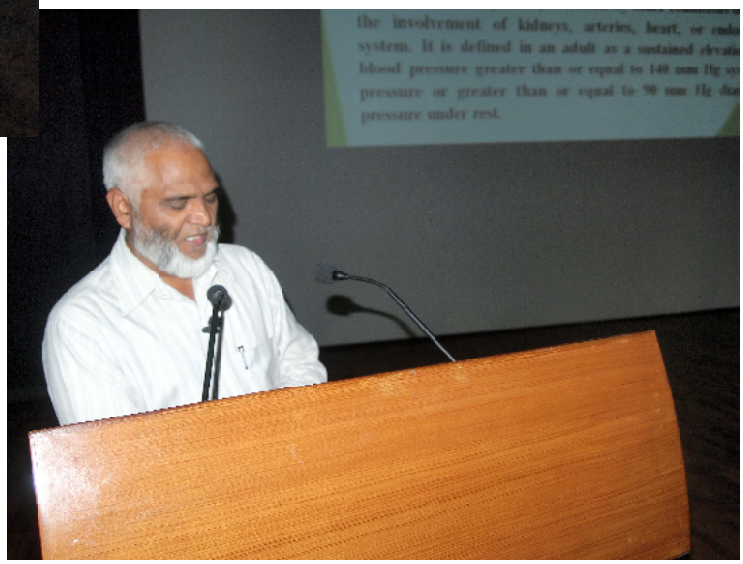
The program initiated with the welcome address of Director Dr Madhu Dikshit. Thereafter Guest of Honour Professor Deepak Pental delivered distinguished lecture and Professor SK Barik, Director; CSIR-NBRI presided over the function. The program was concluded with the vote of thanks proposed by Dr R Ravishankar.

World Hypertension Day Celebrations

World Hypertension Day was celebrated at CSIR-CDRI on 17th of May to raise public awareness about the hypertension, its preventive measures and complications. Chief Scientist, Dr Asim Ghatak welcomed the guests and briefed about the objectives of celebrating the day.

During the program, Dr Sanjeev Kumar Ojha, Principal Scientist, CSIR-NBRI delivered a talk on Ayurvedic aspect of hypertension and its treatment. In his talk he mentioned how the Ayurvedic treatment can help for prevention and cure of diseases. How the traditional herbal medicines and balanced life style help in the prevention of diseases. Dr Maqbool Ahmad Khan, Deputy Director, Central Research Institute of Unani Medicine, Lucknow briefed about the Unani Medicine System for Treatment of Hypertension. He discussed the origin and development of Unani Medicine system and their management protocols for prevention of Hypertension. Later, Dr Vivek Bhosale, Scientist, CSIR-CDRI talked about Modern Medicine System for Treatment of Hypertension and briefed the new advance allopathic medicine involved in prevention and cure of hypertension.

Dr Madhu Dikshit in her presidential remark congratulated the speakers for their informative and motivational talks for prevention and treatment of hypertension. She emphasized on the collaborative approach of all the three medicine system for better understanding of diseases and their treatment.



After these informative lectures, as the theme of this year's celebration was "Know your BP", Blood Pressure check up camp was organized in the supervision of Dr Shalini Gupta, Medical Officer, CSIR-CDRI. The check up camp was attended by all the scientists, administrative, technical and supportive staff and young research scholars. Almost 400 participants get their BP checked and took the guidance for prevention and cure of hypertension. Dr Kashif Hanif, Scientist, CSIR-CDRI proposed the vote of thanks.

World No Tobacco Day celebration

CSIR-CDRI, Lucknow in association with Department of Public Health Dentistry, KGMU, Lucknow organized an awareness program and Oral Health Check up camp during World No Tobacco Day celebrations at CDRI on 31st May, 2017 to raise the public awareness about the adverse effect of tobacco consumption. Chief Scientist, Dr Asim Ghatak welcomed the guests and briefed about the objectives of celebrating the day. During the celebrations, Dr SK Sonkar, from KGMU, Lucknow delivered a lecture on, "Tobacco and Health Issues" and mentioned various shocking issues regarding tobacco uses. He said, 21% people over 15 years use tobacco worldwide and Tobacco kills one out of ten adults each year.

Further, Dr Gaurav Mishra from Department of Public Health Dentistry, KGMU, Lucknow, discussed about the preventive measures for tobacco control. He said, Tobacco use is mainly concentrated among poor and is a significant cause of health disparity between rich and poor. Tobacco spending also drains resources from households that could have been spent on other basic needs, such as food, education and shelter.

Director, Dr Madhu Dukshit in her presidential remark, thanked the speaker for their eye opening talks and also thanked to Dr Gaurav Mishra for taking initiative for organizing Oral Health Care camp at CDRI. After the popular lecture, in afternoon an oral health check up cap was organized by the team of Dr Gaurav Mishra along with resident doctors of Department of Public Health Dentistry, KGMU, Lucknow. About 200 participants get their check up done during the camp. A follow up study was also conducted on the participants who have taken part in last year's camp.

Dr Vivek Bhosale, proposed the vote of thanks for guest speakers and resident doctors for conducting the oral Health check up camp and the team of organizing committee and participants for making this awareness program successful.

3rd International Yoga Day Celebration

CSIR-CDRI celebrated the 3rd International Yoga day on 21st June 2017 in its staff club campus-"Suket". Dr Deenanath Patel, Senior Resident Surgeon, BRD Medical College, Gorakhpur demonstrated and instructed various asana as par the AYUSH guidelines. Initially he demonstrated the basic asana and afterwards he demonstrated the complex asana like Sheershasana. Dr Patel also discussed the uses of air, water and food for healthy life. He mentioned, for keeping our self healthy and hydrated one should take at least 10-12 glass of water per day and never gulp the water directly always take it sip by sip. Besides this, he has given many other tips for healthy and energetic lifestyle so that we can protect ourselves from various diseases.

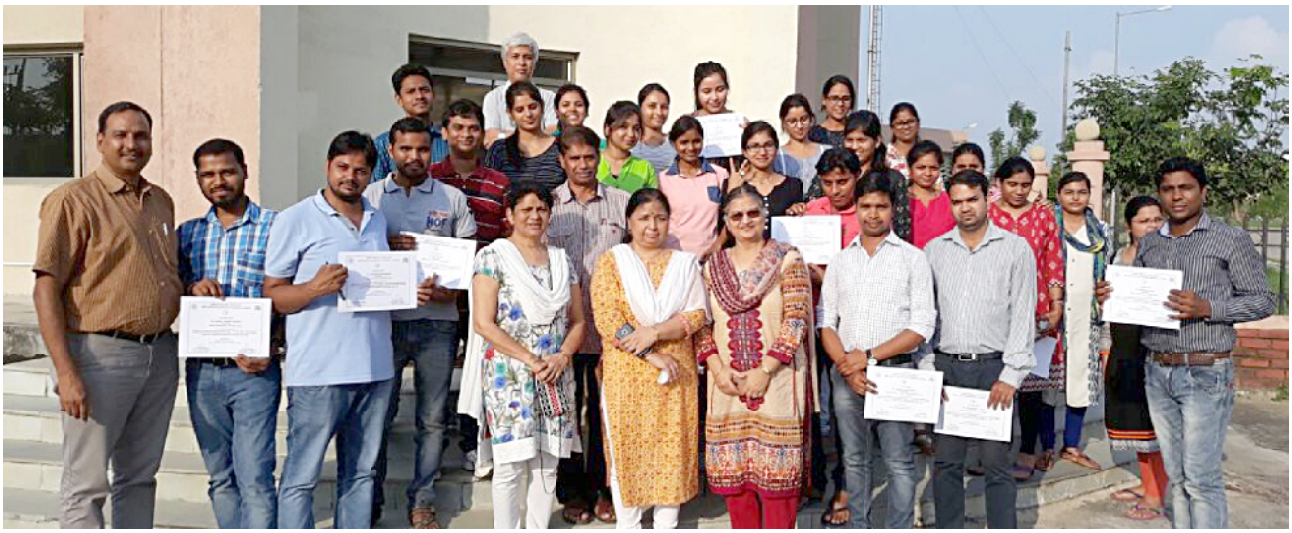
After the yoga session, fruits were served to the participants. Dr Ashish Arora, coordinator of the program proposed vote of thanks to the guest yoga instructor and participants for promoting the yoga for healthy life.

Flow Cytometry Workshop

CSIR-CDRI in collaboration with Thermo Fisher Scientific organized a three day workshop from August 2-4, 2017. The objectives of the workshop were to introduce the participants with "Basics of Flow Cytometery and its application and to provide the Overview of Thermo Fisher Scientific Flow Portfolio. Participants learned the data analysis and Wet Lab demonstration with their samples during the workshop. The workshop coordinators from CSIR-CDRI were Dr Anikl Gaikwad, Dr Mrigank Srivastava and Dr Sachin Kumar, while from Thermo Fisher Scientific, Dr Nandini Basak, Mr. Tribhuwan Bind and Mr. Udit Mangal were the coordinators. Participants get benefitted with specialized lecture and hands-on experimentation during the workshop.

Scientific and Technical Awareness Training Program in Animal Ethics & Experimentation

Scientific and Technical Awareness Training Program in Animal Ethics & Experimentation for 32 candidates from JNU and AcSIR courses was conducted in two batches, from Aug 21 to Aug 23, 2017 and Aug 28 to Aug 30, 2017.



Skill Development Program

Shri Jayant Krishna, Executive Director & Chief Operating Officer, National Skill Development Corporation inaugurated the Skill Development Program at CSIR-Central Drug Research Institute, Lucknow on 26th August 2017. Various certificate courses in Skill Development such as 'Skill Development in Advanced Spectroscopic (NMR, MASS, UV/IR) techniques', 'Skill Development in Microscopy (Electron Microscopy, Confocal and Intra vital Microscopy) and Flow Cytometry', 'Skill Development in Regulatory Safety studies and Animal experimentation' and 'Skill Development in Computational Approaches to Drug Design & Development' are being run as a part of CSIR Integrated Skill Initiative under the aegis of Skill India, Government of India Program here at CDRI. Director, Dr Madhu Dikshit briefed about the objectives of CSIR Integrated Skill Initiative and welcomed the Chief Guest Shri Jayant Krishna on this occasion. She also welcomed the participants reached from all corners of the country.

Two days HPLC/UPLC workshop

Two day HPLC/UPLC workshop was organized in SAIF, CSIR-CDRI on 05-06 September 2017 in collaboration with Waters India (P) Ltd. This workshop was organised exclusively for the participants who are doing specialized work in this field. 20 participants took hands-on demonstration on the instrument however lectures was attended by many other research scholars. Welcome address and Introduction to workshop was given by Dr. Brijesh Kumar. Dr. Vishal Khatavkar explained the Liquid Chromatography Technologies. Mr Anuj Gupta talked about Effective Method Development Approach - Column Selection Criteria & Critical Parameters and Dr Yogesh Sharma explained the Live method development on HPLC. After that participants did hands-on experimentations. On the Second day of workshop, Dr. Vishal Khatavkar described the UPLC - Basics and Method development and Dr Yogesh Sharma, talked about Robust Method Development and Live method development on UPLC. After the Hands-on experimentations the workshop was concluded with certificate distribution and vote of thanks by Dr Brijesh Kumar.

CSIR-CDRI/NRDC Industry-Academia Conclave

The first CDRI-Industry Conclave jointly organized by CSIR-CDRI and NRDC-DSIR on 15-16 September 2017. The conclave was aimed to create, showcase and capture values/assets of Drug Research being carried out at CDRI and to serve as a platform for having an open-minded debate about active measures to be taken for bridging the gap between industry and CDRI so that better and faster technology/product driven research could be carried out. The key speakers were Dr Madhu Dikshit, Director, CSIR-CDRI, Dr H. Purushottam Chairman & Managing Director of National Research Development Corporation, Dr. G.N. Singh, Drug Controller General of India and Padmashri Dr. Nityanand.

The Inaugural session was initiated by Dr. Madhu Dikshit, in her deliberation she emphasized on the need of having better synergy between Industry and CDRI through effective collaborations. She emphasized the need of joining hands together for successful development of synthetic drugs and phyto-pharmaceuticals and natural products into drugs.

Dr. H. Purushottam, the Chairman & Managing Director of National Research Development Corporation apprised the audience about need of bridging the gap between Industry and CDRI. Since its inception, NRDC has catalysed 4900 technology transfer successfully; out of them 40% technology transfer endeavours were from CSIR. He apprised the delegates about the ways in which NRDC could effectively catalyze the amalgamation of Industry and CDRI for meeting the larger goal of development and marketing of technology and products.

The Drug Controller General of India Dr G.N. Singh emphasized on adopting an integrative approach where industry and CDRI may work together to find solutions to societal problems affecting common people. He also called upon the industry and CDRI Scientists to pass on information actively and not work in isolation because in developed countries, such an integrative approach has reaped sustainable benefits in all the areas. He informed that as an initiative in this direction, DCGI has now decided to reach out to key laboratories like CDRI on its own so as to facilitate the knowledge and technology sharing endeavors.

Former Director Padmashri Dr. Nitya Anand called upon Industry and CDRI to come together to develop measures against drug resistant communicable and non-communicable diseases. He also suggested putting in concerted efforts for repositioning old drugs for newer indications. In additions he suggested industry and CDRI to jointly make active efforts for making best use of traditional systems of ayurvedic/homeopathic and unani medicines.

Inaugural session was followed by panel discussions on both the days on various topics such as “Basic Research is the foundation for Innovation”, “Technology Transfer: Industry Expectations and Concerns” and “Funding and Costing for Collaborative Drug Discovery and Development”. Eminent personalities participated in these panel discussions. “All the panellists agreed unanimously that there are ample funding opportunities for both academia and industry and for that they need to brain storm and identify the areas where they can complement each other effectively.”

76th CSIR Foundation Day Celebrations & CDRI Award Felicitation Ceremony

CSIR-Central Drug Research Institute, Lucknow celebrated the 76th CSIR Foundation Day Celebrations on 22nd September 2017. Director, CSIR-CDRI, Dr Madhu Dikshit welcomed the guests on this auspicious occasion and said we feel proud to be a part of CSIR which was established in 1942. It has contributed significantly to the growth of Indian science & industry and in nation building. The CSIR has been ranked ninth amongst a total of 1,207 government institutions, according to the Scimago Institutions ranking World Report 2017.

On this occasion, Padma Shri, Dr Vijaylakshmi Ravindranath, Ex-Director National Brain Research Centre, Manesar Gurugram graced the occasion as chief guest. Dr Vijaylakshmi delivered a talk on, "The Changing Demography of India and Challenges in Neuroscience". In her talk she mentioned that India will have the largest number of people in the working age group of 15-59 years and will become the largest contributor to the global workforce. But this demographic change is creating new challenges for mental health. The demographic dividend will become the demographic disaster if population of nation is not mentally healthy. Almost 48 million people suffer from dementia worldwide. Incidence expected to increase in developing countries. More than 100 million people in India are over 60 year of age. Dementia may start early in the age of 30 year. Life style related disorders are the main cause of neurological disorders.

Dr V P Kamboj, Ex- Director, CSIR-CDRI presided over the function. In his presidential remark he mentioned, CSIR-CDRI,is an epitome Institute of this mega organization through its outstanding contributions in terms of Products and Technologies for affordable healthcare. CDRI Awards-2017 was bestowed to the winners after their award oration for their excellent contribution in Drug Research. CDRI Award-2017 in Biological Science-I was conferred to Dr. Suvendra Nath Bhattacharyya from, CSIR-IICB,Kolkata. Dr Bhattacharyya delivered award oration and discussed about his novel findings on microRNA (miRNA), focusing on its compartmentalization, regulation and mediation as well as its alteration in Leishmania invaded macrophage and neighbouring non-macrophage cells.

The CDRI Award-2017 in Biological Science-II was conferred to Dr Jayandharan Giridhara Rao, from IIT-Kanpur. Dr. Rao delivered award oration entitled "Adeno-associated virus-biology, bioengineering and potential in gene therapy". In his oration he discussed about his novel findings for gene therapy. Gene therapy is an attractive strategy for effective long-term cure for many of the genetic and infectious diseases. The CDRI Award-2017 in Chemical Science-I was conferred to Dr C Raji Reddy, from CSIR-IICT, Hyderabad. Dr. Reddy delivered award oration about his novel findings related Synthesis of 50 New Chemical Entities which were screened against various therapeutic targets such as metabolic syndrome, candida sp. etc, resulting one hit compound, taken up to the lead optimization as anti-fungal agent under phase-II clinical trials, and an efficient process has been developed for this hit compound.

The CDRI Award-2017 in Chemical Science-II was conferred to Dr Jayanta Haldar, from JNCASR, Bengaluru. In his award oration Dr. Haldar said Antimicrobial resistance (AMR) has exacerbated the threat of infectious diseases with an estimated figure of 700,000 deaths annually. By 2050, it is predicted to cause 10 million deaths annually and cost the world $100 trillion, if left unchecked. The susceptibility of bacteria like *Staphylococci* and *Enterococci* to antibiotics of last resort such as *vancomycin, daptomycin* and *linezolid*, are steadily decreasing, leaving few options for treatment. He briefed about his new findings for New Drug Discovery: Small Molecular Therapeutics for Infectious Diseases Semi-synthetic and Strategies to Overcome Drug resistance.

The first Dr Mridula Kamboj Memorial Innovation Award for Researcher was conferred to Dr Atul Goel and Dr Divya Singh of CSIR-CDRI for their outstanding contribution for drug development. Similarly First Dr Mridula Kamboj Memorial Innovation Award for Young Students were given to winners of science competitions from various school students of Lucknow (Army Public School Cantt., Central School Aliganj, Central Academy Jankipuram, KVK IIM, KVK AMC and Navoday Vidyalay Piparsand). During the felicitation ceremony in after noon, mementoes were given away to colleagues completing 25 years of service in CSIR and to colleagues superannuated during Sep 2016 Aug 2017. Academic Excellence awards were given to wards of CDRI colleagues. The 76th CSIR Foundation Day Celebrations ended with the vote of thanks proposed by Mr. Suman Mallik.

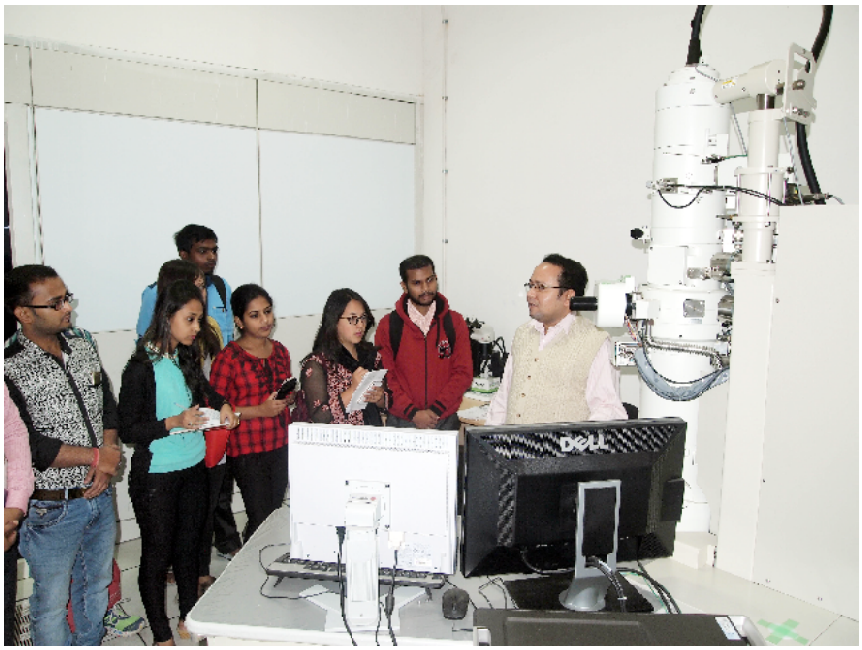
OPEN DAY celebration on 76th CSIR foundation day

CSIR-CDRI celebrated an OPEN DAY on the occasion of 76th CSIR foundation day on 26 September 2017. During the “OPEN DAY” more than 1250 students from 20 schools and colleges visited the institute and interacted with the scientists to understand the working with major and unique facilities. An exhibition of technologies, processes and products developed by CSIR-CDRI was arranged in the auditorium complex. Students and teachers took keen interest in exhibition and appreciated the scientific contributions of CSIR-CDRI. Science model exhibition and quiz competitions were organized for school children in which more than 12 schools participated.




Biological EM internal Workshop

Electron Microscopy Unit, CSIR-CDRI, organized a two days workshop on Electron Microscopy from 02-03 October 2017. The objective of the workshop was to increase the awareness regarding uses of EM in biological research. Total 10 participants from different labs of CSIR-CDRI participated in it. This workshop was aimed to cover basics of different Electron Microscopy Techniques and hands-on experimentation to know in details. The outcome of this workshop benefited in improving understanding of participants towards the techniques and their applications in research activity.



Medical Camp

Medical Camp (Free Health check-up) organized by MEDANTA MEDICITY Hospital, Gurgaon at CSIR-CDRI Dispensary, Jankipuram, Lucknow on 26-27 October 2017. The camp was inaugurated by Dr Naibedya Chattopadhyay. The check up camp was attended by all the Scientists, Administrative, Technical and supportive staff and young research scholars. Almost 400 participants got free consultation, basic blood investigation, ECG, 2D Echo, Cardiology and Neurology consultation.

Satarkta Jagrookta Saptah

A Vigilance awareness week was solemnized from 30 October to 4 November in CSIR-CDRI which began with the Oath taking ceremony by the Director of the Institute. Several competitions like essay writing, debates etc. were organized. A lecture on "Preventive Vigilance and Conduct Rule" was delivered by Mr RK Sharma, Senior Deputy Secretory, CSIR on 31 October. A week long program was concluded with a lecture on Vigilance and prize distribution by Chief Guest Shri Amitabh Thakur IPS (IG-Rules & Manuals).

Swachh Bharat Abhiyan Pakhwara

Swachh Bharat Abhiyan, is a national campaign by the Government of India. The mission has targeted aims for bringing behavioral changes to people and motivate health practices, spreading cleanliness awareness among them. To contribute in the mission, CSIR-CDRI, Lucknow organized "Swachh Bharat Abhiyan Pakhwara" from 01-15 November 2017 Scientist, Technical & Administrative staff and research scholars of the institute participated enthusiastically in this program. Many other programs essay writing, Quiz, plantaion and for cleanliness of Premises, offices and laboratories were also organized during this Pakhwara.

World Science Day

To celebrate the World Science Day CSIR-CDRI organized Student motivation program and invited a batch of 50 students along with faculty of Pharmacy, Naraina Vidya Peeth Group of Institution, Panki, Kanpur on 10 November 2017.

Symposium on "Molecular Medicines for Lifestyle Diseases: Emerging Targets and Approaches"

CSIR-Central Drug Research Institute organized a symposium titled "Molecular Medicines for Lifestyle Diseases: Emerging Targets and Approaches" from 20-21 November, 2017. The symposium was inaugurated with the welcome note from the Director, Dr Madhu Dikshit. She expressed her gratitude to the organizing committee for the wonderful symposium for felicitating her on her superannuation. During the inaugural function, Chief Guest, Professor Tapas Kundu, from JNCASR, Bangalore, delivered a keynote lecture detailing about Epigenetics: life beyond our genes and its implications in behaviour and health.

Padma Shri Dr Nitya Anand in his presidential remark emphasized on healthy life style for keeping ourselves healthy. Later, in various scientific sessions, various lectures and talks were conducted to discuss the new drugs and strategies for the treatment of lifestyle diseases. The symposium was full of energy with very informative approaches to handle the threatening burden of Lifestyle related diseases. Later in evening, a special session was organized to felicitate Dr Madhu Dikshit for her contributions to science. She shared her journey with science. Many eminent personalities present in symposium also shared their memories with her.

National Workshop on Identification and characterization of Phytochemicals using HRMS Instruments at CSIR-CDRI Lucknow

National Workshop on Identification and characterization of Phytochemicals using HRMS Instruments at CSIR-CDRI Lucknow on 27-29 November 2017 was organized to increase awareness of using LC-MS and HRMS instruments for natural product chemists. Total 20 participants came from different parts of India to participate in it. This workshop was aimed to cover basics of liquid chromatography (LC) followed by High resolution mass spectrometry (HRMS).

HRMS and LC-MS/MS in combination are the best and suitable tools to identify, characterize and quantify the molecules. The outcome of this workshop benefited in improving understanding of participants towards the techniques and their applications in research activity. This also helped them to assess their molecules for the right type of analysis and systematic interpretation of data to know their compounds. All the participants were able to see the HPLC/UPLC-HRMS, MS/MS and MS^n experiments on the instrument and interpretation of data by experts.

NGCMA Accredited Good Laboratory Practice (GLP) Test Facility at CSIR-CDRI, Lucknow

Padma Shri Dr Nitya Anand, inaugurated the NGCMA Accredited Good Laboratory Practice (GLP) Test Facility at CSIR-CDRI, Lucknow on 28 November 2017. On this occasion he congratulated the team CSIR-CDRI lead by Dr Madhu Dikshit, for their efforts for getting this accreditation. He said though Institute is already following the Good Laboratory Practices since its inception but due to change in the global scenario for R & D in drug and pharmaceutical sector, the need of accreditation was felt. So it's good that institute got this accreditation. Director Dr Madhu Dikshit also appreciated the dedication and perseverance of her team of scientists and technical officers involved in this. On this occasion she said CSIR-CDRI got certified for acute Toxicity and safety Pharmacology. CSIR-CDRI, Lucknow is the first Government laboratory to get certification for safety Pharmacology. This will surely enhance the confidence of developed countries in contributions made by the Institute in drug development and research. Out of 41 GLP certified labs in India, CSIR-CDRI became the third government organization after NIPER, Chandigarh and CSIR-IITR Lucknow, who got GLP certificate.

Professor Alok Dhawan took over the additional charge as Director of CSIR-Central Drug Research Institute, Lucknow

Professor Alok Dhawan took over the additional charge as Director of CSIR-Central Drug Research Institute, Lucknow on 30 November, 2017. He is currently heading the CSIR- Indian Institute of Toxicology Research, Lucknow. Dr Madhu Dikshit is superannuated on 30 November, 2017 after the 39 years of devoted research at CSIR-Central Drug Research Institute, Lucknow.




National Workshop on "Small Molecule Analysis by NMR Spectroscopy & Mass Spectrometry"

SAIF, CSIR-CDRI has organized a National Workshop on "Small Molecule Analysis by NMR Spectroscopy & Mass Spectrometry" during 13-15 December, 2017. The workshop provided an opportunity to experience the state-of-the-art NMR, LC-MS and LC-MS/MS techniques and initiate lively discussion among research scientists, academicians and young researchers to share their knowledge in the frontier areas of chemical sciences. The beginners have get a chance to familiarize themselves with NMR and LC-MS techniques and gain confidence by observing their applications and data interpretation as done in real situation. This Workshop was focused on the structure characterization of small molecules using NMR, LC-MS and MS/MS techniques. Total 24 participants (research scholars, faculty and industry participants) from different part of country have attended the workshop.

Workshop on Entrepreneurship in the Pharmaceuticals Sector with Ventureast

CSIR-Central Drug Research Institute in association with Ventureast organized a workshop on Entrepreneurship in the Pharmaceuticals Sector on 15th December, 2017. The aim of the workshop was to discuss the detailed know-how of Entrepreneurship development in Pharmaceutical Sector.

Ventureast is one of the longest standing Venture capital fund managers in India, investing since 1997 and managing close to $325+ million and is possibly the only Indian Fund Manager that has dedicated funds and teams for each sector- life sciences & healthcare, and separately for technology driven businesses.

The official from Ventureast discussed the Basic concepts of economics and management, how to Valuate a drug discovery/development company? What should be the Elements of a business plan for R&D driven businesses? And how the venture capital cycle in India and the West?

Scientists from CSIR-CDRI elaborated the Enterprise based on supergenerics, biosimilars, biobetters and Intellectual Property protection to the participants along with Case Studies.

It was a great opportunity for new entrepreneurs who dreams for Entrepreneurship in the Pharmaceuticals Sector.

National workshop on Applications of Transmission Electron Microscopy in Life Sciences

Electron Microscopy Unit, CSIR-CDRI, organized a three days National workshop on Applications of Transmission Electron Microscopy in Life Sciences from 23-25 January 2018. The objective of the workshop was to increase the awareness regarding uses of Transmission Electron Microscopy in Life Sciences. Total 15 participants from various part of the country including 4 Industry sponsored candidiate participated in it. This workshop was aimed to cover basics of Transmission EM Techniques and hands-on experimentation to know in details. The outcome of this workshop benefited in improving understanding of participants towards the techniques and their applications in research activity.

69th Republic Day Celebrations

The 69th republic day was celebrated with full enthusiasm at CSIR-CDRI. On this occasion Director, Professor Alok Dhawan greeted all the Scientists, Research students and staff and said, our republic has made great progress in scientific, economic and social sectors but the need to remodel our efforts in tune with changing aspirations and needs always remains. We are all aware of the expectations of the nation from scientific institution that were created just after independence. Science is the engine of economic growth and Nation wants us to introspect our direction of research and make necessary amendments for making effective contributions to our society.

Societal Activities

Students Motivation Programs for various Schools & Colleges

To initiate and promote experimentation and innovativeness in education and bringing confidence to society about relevance of Institute in terms of Social Impact various students motivation program were organized in the reporting period. A program for 125 specially abled students from Drishti Samajik Sansthan Lucknow and A batch of 180 students of B Tech Biotechnology along with 3 faculties from S.R. Group of Institutions, Lucknow was organized on National Science Day 28 February, 2017. Similarly, a program for 20 students of M Sc (Zoology) along with 2 faculties from Department of Zoology, College of Basic Science and Humanities, Bhubaneswar, Orissa University of Agriculture and Technology on 01 March, 2017, for Vardhman University, Vardhman (WB) on 03 March, 2017, for 30 students of M Sc (Botany) along with 10 faculties from Govt. V.Y.T.PG. Autonomous College Durg (C.G.) on 07 March, 2017, for students of B Pharma from Bhagwant Institute of Pharmacy, Bhagwantpuram, Muzaffarnagar, UP on 19 March, 2017, for students of B Pharma from Pranveer Singh Institute of Technology, Kanpur on 30 March, 2017, for B Pharma students and faculty of Global Institute of Pharmaceutical Education & Research (GIPER), Kashipur, (Uttarakhand) on 03 May, 2017, for 30 students along with faculty from Vivek College of Technical Education, Bijnor, UP on 11 September, 2017, for Students of Birla Balika Vidyapeeth, Pilani on 4 october 2017, for 40 students of B Pharmacy along with two faculties from Invertis Institute of Pharmacy, Invertis University, Bareilly, UP on 25 October 2017, for students of B Tech Bioinformatics & Biomedical Engineering with faculty, from SRM University Delhi-NCR, Sonipat, on 07 November 2017 and for a batch of 08 MSc students along with faculty from Department of Zoology, University of North Bengal, West Bengal on 21 November 2017 were organized.

Besides above, a special program was organized for 35 selected girls Icons from UP along with 06 facilitators from “Milaan: Be the Change”: a youth-led NGO that works to Enable, Educate, and Empower students from rural backgrounds on 09 June 2017. In continuation to the program “JIGYASA”, CSIR-CDRI invited a batch of 95 students of XI Class along with five faculties from Kendriya Vidyalaya No. 1, AFS, Chakeri, Kanpur, UP on 27th October 2017. The basic objective of these programs was to motivate the young minds to pursue their career in Science and explore the knowledge of Drug Discovery and Research.

Health Awareness and Outreach Programs for Rural Areas

The Institute has made significant accomplishments with generation of knowledge and nurturing potential leaders in healthcare sector to achieve its mandate “New Drugs & Technologies for affordable healthcare for all”.

CSIR-CDRI, time to time do awareness programs in villages on different disease areas related to health as per its mandate. In this series, in the leadership of Dr Sanjeev Yadav, Dr Anil Gaikwad and Dr Sharad Sharma, a group of 10 members organized a Health Awareness program on Diabetes in Junior High Schools (Boys), Itaunja, Junior High Schools (Girls), Itaunja and RP Memorial Inter College, Itaunja and received overwhelming response from students and their parents, School teachers and other villagers.

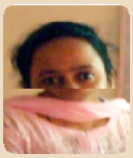
The objective of the program was to spread the awareness among the villagers about the disease. During the program Dr Gaikwad discussed in very interesting and easy way about the causes, symptoms, and basic precautions for prevention of diabetes. How they can get the details of their blood sugar level, what is the Body Mass Index (BMI), why weight control is necessary and what should be the diet plan before and after disease? Surprisingly, almost 20% people present in the program found high in their random blood sugar level and BMI status and suggested to contact as earliest as to their nearest CHC/PHC or Govt. Hospital for detailed diabetes check up. A small booklet about diabetes was also distributed to the participants for guidance.

Showcasing of Institute's achievements in various Festival & Exhibitions

To connect the science with society, CSIR-CDRI, Showcased its R&D activities and products in various Festival & Exhibitions. Institute participated in, International Exhibition for Pharmaceutical and Healthcare" (iPHEX-2017) at Hitex Exhibition Center, Hyderabad (April 27-29, 2017), CSIR Special Exhibition in Parliament, New Delhi (July 28 to August 11, 2017), CSIR Platinum Jubilee Science Exhibition CSIR-IICT, Hyderabad (September 2-6, 2017), CSIR Platinum Jubilee Technofest at CSIR-IITR, Lucknow (September 5-7, 2017), IISF-2017 CSIR Healthcare Pavilion Chennai (13-16 october 2017) Swadeshi Mela 2017 at Varanasi (10-12 October, 2017), Janpadiya Vigyan Mela, Bahraich UP (13 December 2017),The Grand State Mela organized by Pauranik Mouni Baba Mahotsav at Babero, Banda, UP (15-17 December 2017) and Annual Kisan Mela, CSIR-CIMAP, Lucknow (31 January 2018). A large number of eminent personalities, students and common man from different area visited & interacted with CSIR-CDRI team and discussed about the R&D activities in CSIR & CDRI.

2 Distinguished Visitors and Lectures

	Speaker & Address	Title of Lecture	Date
	**Prof Manfred P Schneider** FBC- Bergische Universitat Wuppertal, Germany	Microbial Lipases in Organic Syntheses: Enzyme Assisted Approaches to Bio-active Molecules	09.03.2017
	**Dr Raj P Chhabra** Chevron Corporation Chair Department of Chemical Engineering Indian institute of Technology, Kanpur	Ehics and Misconduct in Scientific Research	24.03.2017
	**Dr Sabari Sankar Thirupathy** Department of Bicteriology University of Wisconsin-Madison, USA	The Interplay between Replication and Transcription causes Genome Instability	16.03.2017
	**Dr Ana Paula Junqueira Kipnis** Institute of Tropical Medicine and Public Health, Fedral University of Goias, Brasil	Vaccine induced innate immune response and the different protective outcomes against TB	06.04.2017
	**Dr Manish Diwan** Daiichi Sankyo India Pharma Pvt. Ltd. Department of Pharmacology	Drug Discovery by responding to human disease mechanism	14.10.2017
	**Dr Tridib Chaira** Daiichi Sankyo India Pharma Pvt. Ltd. ·	Addressing ADME Issues,PK/PD,DDI and human dose estimation in drug discovery-Few case studies	14.04.2017
	**Dr Turani Kanta Barman** Daiichi Sankyo India Pharma Pvt. Ltd.	Multi-drug resistance crisis: My experiences in Drug Discovery and Animal models	14.04.2017
	**Ms. Anjusha Singh** Daiichi Sankyo India Pharma Pvt. Ltd.	IPR : Principals & Opportunities	14.04.2017
	**Dr. Anirudh K Singh** Scientist, Center for Microbial Pathogenesis, Research Institute at Nationwide Children's Hospital,USA	Streptococcal Glycosidases: The multifaceted virulence factors	26.04.2017

	**Dr Debprasad Chattopadhya** Director, ICMR-National Institute of Traditional Medicine Belgavi	A Journey from Tradition to Translation: Development of an Antiviral lead	14.07.2017
	**Shruti Devasthali** Manager- Equity & Grant Portfolio from Entrepreneurship Development Center (EDC)Venture Center, NCL Innovation Park, Pune	Science entrepreneurship with focus on creating start ups and leveraging government funding schemes like BIG	26.07.2017
	**Prof. Subrata Ghosh** Department of Chemistry, Indian Association for the Cultivation of Science (IACS) Kolkata	Chiron Approach to the Asymmetric Synthesis of small molecule Natural Products	29.07.2017
	**Dr Richa Pandey** Natural Products Division, CSIR Indian Institute of Chemical Technology, Hyderabad	Isolation and characterization of novel terpenic and other secondary metabolites from medicinal plants	11.08.2017
	**Dr Benoit Laleu** Associate Director, Medicines for Malaria Venture (MMV)	Current Pipeline of Antimalarial Therapies	16.08.2017
	**Dr Anjali Sharma** Registered Patent Agent, New Delhi	Effective Drafting of Pharmaceutical Patent Application	18.08.2017
	**Dr Shashi Kumar Gupta** Institute of Molecular and Translational Therapeutic Strategies, Hannover Medical School Hannover, Germany	Non-Coding RNA based therapy for cardiovascular diseases	11.10.2017
	**Dr KV Radhakrishnan** Principal Scientist, CSIR-NIIST, Trivendram	Tapping the potential of hottest hotspot of the world biodiversity:Phytochemical profiling of medicinal plants from SHAYADRI (Western Ghats)	11.10.2017
	**Prof Serge Mignani** Formerly Head of Medicinal Chemistry Department and Scientific Director, Sanofi, France	New strategies in medicinal chemistry to find and develop new drugs: Concise overview	12.10.2017
	**Shri Amitabh Thakur** IPS(IG-Rules & Manuals)	My Vision-Curruption Free India	03.11.2017

	**Prof Raghuram Rao Akkinepally** Director, National Institute of Pharmaceutical Education & Research (NIPER), Mohali	'NIPER journey in the past 25 years"	14.11.2017
	**Dr D Yogeswara Rao** Former Adviser, O/o PSA to GoI and former Head,TNBD Division,CSIR	Essentials of Technology Transfer	14.11.2017
	**Dr D Yogeswara Rao** Former Adviser, O/o PSA to GoI and former Head,TNBD Division,CSIR	Basic concept of Incubation centre	15.11.2017
	**Dr Andrea Pillmann,** Executive Editor, Springer Nature, Heidelberg, Germany	How to effectively publish and communicate your science internationally	16.11.2017
	**Dr Ashutosh Mangalam** Assistant Professor of Pathology, University of Iowa Health Care,Iowa City,USA	Gut Feeling: Breaking Down the Role of Gut Microbiome in Multiple Sclerosis	29.11.2017
	**Dr Rohit Saluja** Ramalingaswami Fellow, Department of Biochemistry AIIMS Bhopal	Interleukin (IL)-33: A New Therapeutic For Allergic Diseases	07.12.2017
	**Prof. Arun Tiwari** Platinum Jubilee Mentor CSIR- Indian Institute of Chemical Technology, Hyderabad	The Legacy and Life of Dr APJ Abdul Kalam	29.12.2017
	**Prof. Subhash C. Pandey** Director, Center for Alcohol Research in Epigenetics, University of Illinois at Chicago & Jesse Brown VA Medical Center Chicago, IL 60612, USA	Adolescent Alcohol Exposure and Brain : Epigenetic Reprogramming and Adult Psychopathology	08.01.2018
	**Dr Harshad Rami** EDL- Project Director ADD-UK; Glaxo SmithKline, UK	Introduction to DDW and GSK607- a human microdose study	11.01.2018
	**Prof. Leah Gheber** Ilse Katz Institute for Nanoscale Science and Technology Ben-Gurion University of the Negev, Beer-Sheva	Mitotic kinesin-5 nano-motors: from single molecules to physiological functions	22.01.2018
	**Dr Papri Banarjee** Program Manager, Bio-Innovation & Entrepreneurship from Centre for Cellular & Molecular Platforms (C-CAMP), Bengaluru	BIRAC BIG Scheme-12th Call; C-CAMP A BIG Partner	22.01.2018

3 Invited Lectures Delivered by Institute Scientists

Dr AK Sinha

- One pot-economy synthesis of bioactive polyphenolics: Opportunity for simplification and innovation, contemporary facts in organic synthesis (CFOS-2017), IIT Roorkee, 22 December, 2017
- Agrochemical security regulations: Possible threates and management, INDO-US Workshop on security of dual use agrochemicals, NASC Complex, Pusa, New Delhi, 01 August, 2017
- One pot-economy synthesis of bioactive natural and unnatural polyphenolic molecules: Opportunity for simplification and innovation, 6th National Symposium on Advances in Chemical Sciences (NSACS-GNDU-2017): Department of Chemistry, GNDU, Amritsar, 06 March, 2017
- Natural-product-inspired synthesis of bioactive polyphenolic molecules: Opportunity for simplification and innovation, organic molecules: Synthesis and applications (OMSA), Department of Chemistry, IIT Kharagpur, 17 February, 2017

Dr Anila Dwivedi

- Oviductal factor in ovum maturation and fertility: Role of peroxiredoxin-6, international conference on reproductive health with emphasis on the strategies for infertility, assisted reproduction and family planning & 27th Annual Meeting of ISSRF, AIIMS, New Delhi, 23 February, 2017
- Oviductal factors in ovum maturation and fertility, workshop on maternal and newborn care : Issues and challenges, organized at Institute of Science, Banaras Hindu University, Varanasi, 01 March, 2017

Mr Vinay Tripathi

- Role of premier science institutes in fostering scientific temperament in school and community-CSIR organized by CARE India in orientation & dissemination workshop for education officials on TRL approach on 29 August, 2017 at Lucknow.
- An overview IPR on frontier research in chemistry & biology interface on 12 January, 2018 at Manipal University, Jaipur.
- Authentic information support, better communication mechanism; crucial for Team-CSIR in National Workshop on Science, Technology & Innovation Policy on 24 January, 2018 jointly organized by CSIR-NISCAIR and DST at New Delhi.

Dr Renu Tripathi

- Cell based assays & animal models for anti-parasitic drug screening at CSIR-CDRI, ICMR, New Delhi, India 11 October, 2017

Dr Gopal Gupta

- Targeting the male germ cell for contraception – how easy and difficult, International Conference on Reproductive Biology and Comparative Endocrinology (ICRBCE) at the School of Life Sciences, Department of Animal Biology, University of Hyderabad, Hyderabad, 09 February, 2017

Dr Kishore K Srivastava

- Essential genes of mycobacteria as drug targets: limitations and strategies, LCC-CNRS Toulouse France, 22 June, 2017
- Evaluation of phosphorous dendrimers against MTB and ESKAPE, LCC-CNRS Toulouse France, 28 June, 2017

Dr Srikanta Kumar Rath

- Association of single nucleotide polymorphisms in cancers of head & neck, Mayfair Convention Centre Bhubaneswar at 26th meeting of IAOMP organized by SCB Medical college Cuttack, 19 November, 2017

Dr Brijesh Kumar

- Development and validation of LC- MS methods for identification and characterization of chemicals and their metabolite, LNJN National Institute of Criminology and Forensic Science, Delhi, 09 August, 2017

Dr Amit Misra

- Inhalable particles for treatment of pulmonary tuberculosis, Asian Federation for Pharmaceutical Sciences Conference 2017, Xiamen, China, 22 November, 2017
- Pharmacological elicitation of host macrophage responses in tuberculosis by targeted pulmonary drug delivery, World Tuberculosis Day, All India Institute of Medical Sciences, New Delhi, 24 July, 2017
- Quality by design, emerging challenges of pharmaceutical manufacturing in India; Institute of Studies in Industrial Development, Hyderabad, 04 March, 2017

Dr Saman Habib

- Protein translation and post-tanslational modifications in organelles of the malaria parasite', National Conference on Biotechnology and Enviroment-2017, Jamia Millia Islamia University, New Delhi, 10 April, 2017
- Plasmodium organelle functions and the possibility of anti-malarial intervention, TWAS-ROCASA Workshop JNCASR, Bengaluru, 08 September, 2017
- Ribosome assembly and post-translational [Fe-S] biogenesis in organelles of the malaria parasite', International Scientific Meeting and Workshop, "Malaria Parasite Biology: Strategies for Drug and Vaccine Development", ICGEB, New Delhi, 30 November, 2017

- Translation and protein modifications in organelles of the malaria parasite and the possibility of anti-malarial intervention, Functional Biology and Molecular Interactions, Department of Biochemistry, Lucknow University, 22 December, 2017

Dr PMS Chauhan

- Drug discovery: Perspectives and challenges in drug research: Design and synthesis of nitrogen heterocycles as novel therapeutic agents, Pragati Maidan, New Delhi, India, CIMS Medical & JBR Health Education & Research, USA, 05 August, 2017

Dr Y S Prabhakar

- *In silico* approaches for natural products towards the development of therapeutic materials / products, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore: Medicinal Plant Research and Translational Trends (MPRTT 2017) Coimbatore (Tamil Nadu), 19 December, 2017

Dr Atul Kumar

- Design and synthesis of anticancer agents, NIPER Raebareli, 24-25 March, 2017

Dr Gautam Panda

- Amino acids derived steroidal and non-steroidal Ligands as inhibitors of steroid 5-alpha-reductase in Cancer, Radiopharmaceuticals Division, Bhabha Atomic Research Centre (BARC), Trombay, Mumbai, 29 August, 2017

Dr Atul Goel

- Beauty of small organic molecules in Drugs, Diagnostics and Devices, at Kurukshetra University, Kurukshetra,11April, 2017
- Diversity oriented synthesis of donor-acceptor fluorescent compounds for cell imaging applications, Humboldt Colloquium in Bengaluru, India, 23-25 November, 2017

Dr K R Arya

- Bio-prospection and sustainable development of traditional bone healing plants of Uttarakhand Himalaya, National Seminar on Socio-Economic Impact of Ecological ignorance in Development Raising Disastrous possibilities at Govt PG College (Kumaon University) Dwarahat, Almora, Uttarakhand, 6 May, 2017

Dr Manoj K Barthwal

- Role of interleukin-1 receptor associated kinase in vascular remodeling at International Conference on Recent Advances in Cardiovascular Research: Impact on Health and Disease at Vallabhbhai Patel Chest Institute, University of Delhi, Delhi 09 February, 2017

Dr PR Mishra

- Self assembled nano-architects: Delivering drug at right time, at right place and in right concentration, Nanotechnology Conclave Juniper Hall, India Habitat Center, New Delhi, 31 August, 2017
- Meeting challenges with drug delivery strategies with special reference to Colloidal system, Altering Paradigm of Biomaterials in Drug Development, UIP, Allahabad, 07 October, 2017
- Rationalized approach using Nano-medicines: pH triggered intracellular delivery of doxorubicin for effective tumor regression, ACBICON 2017, King George Medical University, Lucknow, 05 December, 2017

Dr Jimut Kanti Ghosh

- Towards the design of new anti-infective peptides, Indian Peptide Symposium 2017 (IPS-2017) at Homi Bhabha Centre for Science Education (HBCSE) in Mumbai, 23 February, 2017

Dr Divya Singh

- Possible roles of IL-12 cytokine family in the management of post-menopausal osteoporosis, World Congress on Genetics, Genomics and Personalized Medicine, 2017 held at J.N. Tata Auditorium, Indian Institute of Science, Bengaluru, 16 November, 2017

Dr Aamir Nazir

- Identification and functional characterization of novel circRNA and miRNA molecules employing *C. elegans* model: Implications for age associated neurodegenerative diseases 44th Annual Conference of Association of Clinical Biochemists of India held at King George's Medical University, Lucknow, 06 December, 2017
- Studying the biology of small RNA molecules employing *C. elegans* model: Implications for Age Associated Neurodegenerative Diseases, International meeting on Non-mammalian models in biomedical research: Current status and future perspectives, held at Nitte University, Mangalore, 05 October, 2017
- Functional characterization of circular RNA and micro RNA molecules as potential theranostic tools against Parkinson's disease: Studies employing transgenic *C. elegans* expressing human alpha-synuclein, International conference on updates in cancer prevention and research, Babasaheb Bhimrao Ambedkar University, Lucknow, 15 February, 2017

Dr Ritu Trivedi

- Potential interplay between obesity and bone, 13th Annual meeting of ISBMR 2017, Chandigarh, 10 November, 2017
- Humble tree hiding surprising secrets: Translating *Dalbergia sissoo* into product for Osteoporosis, National Seminar on Indigenous herbs and bone health. Department of Biochemistry and Bioinformatics, Coimbatore, 21 June, 2017
- Dreams, Visions and Women, Isabella Thoburn College, Lucknow, 25 August, 2017

Dr Sanjeev K Shukla

- NMR Spectroscopy: Basic principles and applications in chemistry, regional institute of paramedical and nursing sciences, Zemabawk, Aizawl, Mizoram, 08 February, 2017
- Applications of NMR Spectroscopy, National Conference AAATDB-2017, at Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, 22 February, 2017
- NMR Spectroscopy in Drug Discovery, National Seminar on Instrumental Analysis in Pharmaceutical Sciences at Aryakul College of Pharmacy & Research, Lucknow, 09 September, 2017

Dr Rabi Sankar Bhatta

- Quantitative analysis using LC-MS/MS, Small Molecule Analysis by NMR Spectroscopy & Mass Spectrometry, CSIR-CDRI, Lucknow, 14 December, 2017

Dr Rajesh Kumar Jha

- RHOG can regulate RAC1-VAV axis in the ovarian follicular development, International Conference on Reproductive Health with Emphasis on Strategies for Infertility, Assisted Reproduction and Family Planning at All India Institute of Medical Sciences (AIIMS), New Delhi, 23 January, 2017
- Endometrial affair in livestock propagation strategies, Upstream Reproductive Technologies for Augmentation of Livestock Production at IVRI, Izatnagar, Bareilly, 20 September, 2017

Dr Satish Mishra

- Plasmodium mutants as experimental malaria vaccine: Implications for inducing pre-erythrocytic and cross stage immunity, National Centre for Biological Sciences, Bengaluru, India, 28 October, 2017
- Plasmodium SCD mutant as experimental malaria vaccine, 2nd Nucleofection (Transfection) Day, LONZA India Pvt Ltd. New Delhi, 18 January, 2017

Dr Mukesh Pasupuleti

- Nanotechnology-for robust and accurate delivery of Drugs to target sites, Bishop Heber College (AUTONOMOUS), Tiruchirappalli, Tamil Nadu, 09 September, 2017
- Host defence peptides : a key compoenent in innate immunity, Department of Zoology, Sri Venkateswara University, Tirupati, 22 December, 2016

Dr Mrigank Srivastava

- Being Eosinophils: The complexity and the conundrum during pathogenesis of Filarial manifestation of Tropical Pulmonary Eosinophilia, 86th Conference of Society of Biological Chemists (SBC-2017), organized by School of Life Sciences, Jawaharlal Nehru University (JNU), New Delhi, India, 17 November, 2017

Dr Sidharth Chopra

- Drugs for Bad Bugs: Who, what and Why?, IIT Delhi 10 October, 2017
- Drugs for Bad Bugs: Who, what and Why?, IIT Chennai, 15 November, 2017

Dr Monika Sachdev

- Restoration of dysfunctional gonads through mesenchymal stem cells, Summer School on Improving Reproduction Rate through Assisted Reproductive and Stem cell Technologies for enhancing production in Small Ruminants Organized by ICAR-Central Institute for Research on Goat, Makhdoom Sponsored by Indian Council of Agricultural Research, New Delhi, 6 July, 2017
- Bridging the gap between Academia and Industry, Indo-Global Education Summit 2017: Lalit Hotel, Connaught Place, New Delhi organized by The Indus Foundation, Hyderabad, 28 July, 2017
- Rejuvenation of dysfunctional gonads through mesenchymal stem cells, silver jubilee celebration of Society of Andrology, India: Advances in Reproductive Health organized by CSIR-Central Drug Research Institute, Lucknow, 28 October, 2017
- Restoration of male fertility through the recovery of Spermatogonial Stem Cells (SSCs), National training program: Spermatogonial Stem Cell Biology Organized by ICAR-Central Institute for Research on Goat, Makhdoom & Sponsored by Department of Biotechnology (Govt. of India), New Delhi, 13 November, 2017

Dr Kumaravelu J

- *Salubrious xylocarpus* moluccensis fraction in cardiovascular disease, Molecular Medicines for Lifestyle Disease: Emerging Targets and Approaches" (MMLD)-2017 at CSIR-Central Drug Research Institute, Lucknow, 21, November 2017

Dr K Hanif

- Fatty Acid Synthase: A new therapeutic target for pulmonary hypertension, 44th National Conference of Association of Clinical Biochemistry of India (ACBICON 2017) at KGMU Lucknow 3 December, 2017

Dr Dipankar Koley

- Acetal and Hydroxylactam: A new pair in asymmetric catalysis, Burdwan University, Burdwan, West Bengal, 23 December, 2017

Dr Pintu K Mandal

- Application of isocyanide-based MCRs for the synthesis of highly substituted azridinylglyco-conjugates, IIT Kharagpur [Emerging Chemistry and Biology of Carbohydrates (ECBC-2017)], 18 December, 2017

Dr Ajay Kumar Srivastava

- Development of post-IMCR Modifications En Route to New Chemical Entities (NCEs) for Drug Discovery Research, Indian Institute of Technology, Roorkee, 23 December, 2017

4 Visits and Deputations Abroad

	Scientist	Country of Visit	Purpose of Visit (Period of Deputation)
	**Dr Neena Goyal**	Spain	To participate in 6th World Congress on Leishmaniasis (WL6) (16th -20th May, 2017)
	**Dr Saman Habib**	France	to attend the Fellowship Review Committee Meeting of the International Human Frontier Science Organization (HFSP) (22nd to 24th January 2018)
	**Dr KK Srivastava**	France	CEFIPRA International Program (19th-30th June, 2017)
	**Dr Amit Misra**	USA	Invited for the meeting for Inhaled Therapies for Tuberculosis and Other Infectious Disease (16th to 17th October 2017)
		China	Invited to work for the committee and to attend the Asian Federation for Pharmaceutical Science Conference (AFPS2017) (21st to 23rd November 2017)
	**Dr Sanjay Batra**	UK	Invited for the RSC-NOST symposium on Organic and Biomoleculer Chemistry (03rd to 6th October 2017)
	**Dr Rajender Singh**	USA	To undertake research at University of Alabama (23rd Jan 2017 to 22nd Jan 2018)
	**Dr Md. Sohail Akhtar**	USA	To conduct research work under at Fox Chase Cancer Center, Philadelphia
	**Dr Aamir Nazir**	Austria	To attend The 13th International Conference on Alzheimer's & Parkinson's Diseases at Vienna (29th March to 02nd April 2017)
	**Dr Akhilesh Kumar Tamrakar**	Canada	To conduct the research work at McMaster University, Department of Biochemistry and Biomedical Science Hamilton (08th December 2016 to 07th June, 2017)

5 Membership of Distinguished Committees/Boards/Societies

Professor Alok Dhawan

Member of Distinguished Committees:

- Member, Award Committee, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, 2016- to date
- Member, Technical Advisory Committee (TAC) under the Child and Adolescent Labour (Prohibition and Regulation) Act, 1986, Govt. of India, Ministry of Labour & Employment, New Delhi, September, 2016- to date
- Member, Working Group on Environmental Health, Govt. of India, Ministry of Environment Forest and Climate Change, New Delhi, 2016- to date
- Member, Technical Evaluation Committee (TEC) to review the proposals for Inter-Sectoral Convergence & Coordination for Promotion and Guidance on Health Research, Govt. of India, Ministry of Health and Family Welfare, Department of Health Research, New Delhi, 2016- to date
- Member, Executive Council, The National Academy of Sciences, India, 2016- to date
- Member, Scientific Advisory Committee (SAC) of National Institute for Research in Environmental Health (NIRECH), Bhopal, 2016- to date
- Member, Research Council, CSIR-National Environmental Engineering Research Institute, Nagpur, 2015- to date
- Member, Research Council, CSIR-Central Institute of Medicinal & Aromatic Plants, Lucknow, 2015- to date
- Member, Research Council, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, 2015- to date
- Scientific Advisory Committee, National Institute of Occupational Health (ICMR), Ahmedabad, 2015- to date
- Chairman, CSIR-Task Force on Nanomaterials: Applications Impact on Safety, Health and Enviroment (NanoSHE), 2015- to date
- Chairman, CSIR-Task Force on Integrated NextGen Approaches in Health, Disease and Environmental Toxicity (INDEPTH), 2015- to date

Editor/Member of Editorial Boards:

- **Editorial Advisor** to the Issues in Toxicology Books Series, published by The Royal Society of Chemistry, UK, 2013- to date
- **Editor-in-Chief**, Journal of Translational Toxicology, American Scientific Publishers, USA, 2011- to date
- **Senior Editor**, Mutagenesis, Oxford University press, 2013- to date
- **Member, Editorial Board -** Mutagenesis, Mutation Research Reviews, Nanotoxicology, Xenobiotica.
- **Editor-in-Chief**, Journal of Bionanoscience, American Scientific Publishers, USA (2010-11)
- **Guest Editor, Journal of Biomedical Nanotechnology** (Volume 7, Number 1, 2011), American Scientific Publishers, USA
- **Guest Editor** of two issues of the journal **Nanotoxicology** (Volume 2, Supplement 1, 2008 and Volume 3 no.1, 2009) published by Taylor and Francis group, UK.
- **Editor** of a book entitled **The Comet Assay in Toxicology** published the Royal Society of Chemistry, UK under its series on **Issues in Toxicology, 2009.**
- **Editor** of a book entitled **"Genotoxicity Assessment: Methods and Protocols"** published by Humana Press under its much acclaimed ***Methods in Molecular Biology series.*** *Volume 1044, July, 2013.*

Fellow/Member of Scientific Societies:

- Fellow - Royal Society of Chemistry, U.K.
- Fellow - Academy of Toxicological Sciences, USA
- Fellow - The National Academy of Sciences, India
- Founder Fellow- Indian Nanoscience Society
- Fellow - Gujarat Science Academy
- Fellow - Society of Toxicology (India)
- Fellow - Academy of Science and Animal Welfare
- Fellow - The Academy of Environmental Biology
- Vice President - Environmental Mutagen Society of India
- Elected Member - National Academy of Medical Sciences, India
- Member - United Kingdom Environmental Mutagen Society, UK
- Member - Asian Association of Environmental Mutagen Societies, Japan

Dr Madhu Dikshit

Member of Distinguished Committees:

- Member, Expert Committee for NIPER Evaluation, NITI Aayog, New Delhi.
- Member, Governing Body, Council of Scientific & Industrial Research, New Delhi. (06-01-2017 to 05-01-2020)
- Member, Scientific Advisory Committee, Centre of Biomedical Research, Lucknow.

- Member, Functioning of Research Council under Ministry of AYUSH.
- Member, Board of Governors, Motilal Nehru National Institute of Technology, Allahabad.

Dr A K Dwivedi

- **Member**, Standing Committee of Experts in Drugs Pricing Control, New Delhi
- **Member**, Drugs Panel for New Drugs Manufacturing Licenses, Directorate of Medical & Health Services, U.P.
- **Life Member**, Indian Pharmaceutical Association.
- **Joint Secretary**, Indian Society of Chemists and Biologists, Lucknow.
- **Treasurer**, The Indian Society for Parasitology, Lucknow
- **Life Member**, Society of Biological Chemists, Bangalore.
- **Life Member**, UP Association for Advancement of Sciences & Technology

Dr Naibedya Chattopadhyay

Editorial Advisory Board Member:

- Biochemical Pharmacology
- American Journal of Physiology Endocrinology and Metabolism
- American Journal of Physiology Cell Physiology

Dr Arun K Sinha

- **Member,** Scientific Advisory Committee (SAC)
- **Member,** Centre of Innovative & Applied Bioprocessing (CIAB), Mohali, Punjab

Dr Anila Dwivedi

- **Member**, Executive Committee Member, Indian Society for Study of Reproduction and Fertility

Dr Gopal Gupta

- **Member,** National Advisory Committee, The International Conference on Reproductive Biology and Comparative Endocrinology (ICRBCE) and The 35th Annual Meeting of the Society for Reproductive Biology and Comparative Endocrinology (SRBCE-XXXV), University of Hyderabad, Hyderabad – 500 046, February 9-11, 2017
- **Member,** National Scientific Program Committee, ISSRF-2017, International Conference on Reproductive Health with Emphasis on Strategies for Infertility, Assisted Reproduction and Family Planning and the 27th Annual Meeting of the Indian Society for Study of Reproduction and Fertility, organized by the Division of Reproductive Biology, Maternal and Child Health, Indian Council of Medical Research, New Delhi, at 23-25 January, 2017

Dr Renu Tripathi

- **Member**, Expert selection committee for Prof. H. S. Srivastava Foundation Awards for year 2016-17

Dr PK Shukla

- **Member**, Steering Committee Member for NIPER, Ministry of Chemicals and Fertilizers, Govt. of India

Dr KK Srivastava

- **DBT nominee,** IBSC IIT Kanpur
- **Chairman,** IAEC, CSIR-CDRI Lucknow

Dr Sharad Sharma

- **Member,** Society of Toxicology, India
- **Member,** Laboratory Animal Science Association of India
- **Member,** Indian Medical Association
- **Member,** Indian Association of Pathologist and Microbiologist

Dr Saman Habib

- **Co-opted Member**, Programme Advisory Committee (PAC) on Biochemistry, Biophysics, Molecular Biology and Microbiology under the Science and Engineering Research Board (SERB) of the DST, Govt. of India (2016-2018).
- **Member,** Fellowship Review Committee, Human Frontier Science Program Organization (HFSPO), Strasbourg, France (2016-2019),
- **Member,** RAP-SAC, Centre for DNA Fingerprinting and Diagnostics, Hyderabad, 2016
- **Member,** Scientific Advisory Committee of the Bose Institute, Kolkata (2016),
- **Member,** Selection Committee of the AcSIR-Dr. APJ Abdul Kalam Summer Training Program, 2016-17
- **Member,** DBT Task Force on 'Basic Research in Modern Biology' (2017)

Dr R Ravishankar

- **Member,** Working group on new TB drugs (WGND)

Dr PMS Chauhan

- **General Secretary,** ISCB
- **Member,** Advisory Board Central University Gujarat

Dr RP Tripathi

- **Member,** Joint Working Group (JWG) on Fragrance and Flavor (Ministry MSME Govt. of India)
- **Member,** Lab Research Council, DRDE (DRDO) Gwalior
- **Editorial Board Member,** ARKIVOC
- **Editorial Board Member,** Journal of Organic Biological Chemistry

Dr Srikanta Kumar Rath

- **Member,** Review committee on Genetic manipulation, DBT, India

- **Member,** Sub-Committee on formulating biosafety guidelines to conduct and monitor Confined Research Trials (CRTs) on genetically engineered (GE) (SPT) Rice, DBT, India
- **Member,** Committee for Safety and Tolerability of excipients used in parental formulation in Subsequent New Drug , DCG(I), FDA, New Delhi
- **Member,** Committee for use of PET in packaging of drug formulations for pediatric use, geriatric use and for use in case of women and women of reproductive age group, The Ministry of Health and Family Welfare
- **Member,** Academic council, JNU, New Delhi
- **Member, Editorial Board**, Toxicology International

Dr Amit Misra

- **Member,** Indian Pharmaceutical Association
- **Member,** Organising Committee 5th Global Forum on TB Vaccines, New Delhi, India
- **Member,** UNDP Consultative Group 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
- **Vice-President (India),** Asian Federation for Pharmaceutical Sciences

Dr Neena Goyal

- **Member,** Society of Biological Chemists, India (Life member)
- **Member,** Indian Society for Parasitology, India

Dr Atul Kumar

- **Member,** Global Advisory Board member of SciFinder,
- **Member,** Chemical Abstracts Service (CAS), American Chemical Society (ACS), Columbus , USA,
- **Member,** Technical Evaluation Panel (TEP), BIRAC, New Delhi
- **Member editorial Board,** Current Green chemistry

Dr Sanjay Batra

- **Co-opted Member,** SERB- committee for Chemical Sciences for ECRA and N-PDF
- **Associate Editor,** RSC Advances (till October 2017)
- **Chief editor,** Anti-infective agents (till October 2017, resigned)
- **Fellow,** Royal Society of Chemistry
- **Fellow,** Fellow of National Academy of Sciences
- **Member,** Royal Society of Chemistry, UK
- **Member,** NOST, India
- **Member,** Governing Council, Chemical Research Society of India, Bengaluru

Dr Bhupendra N Singh

- **Member,** Screening committee for selection of Scientist in CSIR-CIMAP
- **Member,** Screening committee for selection of Technical Officer in CSIR-CIMAP
- **Member,** Local organizing committee of 58th International Annual Conference of Association of Microbiologists of India at BBDU, Lucknow (Nov 16-19, 2017)
- **External expert Member,** in CIMAP-IBSC committee
- **Appointed DBT Nominee**, in IBSC committee of BHU, Varanasi
- **Executive Member (Elected)** All India Society Cell Biology

Dr Gautam Panda

- **Member,** National Academy of Sciences, Allahabad
- **Member,** Chemical Research Society of India

Dr Atul Goel

- **Life Member,** Indian Science Congress, Kolkata

Dr K R Arya

- **Executive Member**, in the Board of Screening Committee of Twining R & D Programme for NER (Medicinal and & Aromatic Plants & Drug Development), Department of Biotechnology, Govt of India, New Delhi
- **Member,** in the panel of Project evaluation Committee, Department of Science & Technology (DST), New Delhi
- **Joint Secretary**, Society of Ethnobotanists, National Botanical Research Institute, Lucknow

Dr Jimut Kanti Ghosh

- **Member,** American Peptide Society

Dr PR Mishra

- **Member Editorial Board,** Recent Patents in drug delivery and Formulations (Bentham Sciences)
- **Member Editorial Board,** Journal of Pharmaceutical and Biomedical Sciences
- **Founder Member,** Indian Nanoscience Society.

Dr Kumkum Srivastava

- **Executive Committee Member**, Indian Society for Parasitology, India

Dr Manish K Chourasia

- **Member,** BIRAC Expert Committee for CRS and BIG grants

Dr Aamir Nazir

- **Life Member,** Indian Society of Cell Biology
- **Life Member,** Laboratory Animal Science Association of India

- **Fellow**, Society of Applied Biotechnology, India.
- **Academic Editor**, PLOS One.

Dr Ritu Trivedi

- **Member,** Society for Osteoarthritis Research (SOAR)

Dr Sarika

- **Life Member**, Laboratory Animal Science Association of India

Dr Rajender Singh

- **Member**, Senate of Academy of Scientific & Innovative Research

Dr Arun K Trivedi

- **Life member,** Biotech research society of India (BRSI)
- **Life member,** Indian association for cancer research (IACR)

Dr DK Mishra

- **Member of the Executive Council,** Society of Ethnobotanists

Dr Muhammad Wahajuddin

- **Member,** INYAS (Indian National Young Academy of Science) – INSA
- **Editorial Board Member**,Journal of Bioequivalence & Bioavailability
- **Editorial Board Member**, Analytica Pharmaceutica Acta
- **Editorial Board Member**, Pharmaceutical Regulatory Affairs
- **Life Member,** National Academy of Sciences (India)

Dr Vivek Bhosale

- **Member,** Institutional Ethics committee, CSIR-CIMAP, Institutional Ethics committee, State Ayurveda College, Lucknow

Dr Rabi Sankar Bhatta

- **Editorial Board Member**, Journal of Drug Formulation and Production
- **Member,** International Society for Study of Xenobiotics (ISSX), USA

Dr K Hanif

- **Member**, Indian Academy of Cardiovascular Sciences
- **Member**, Clinical Research Sub-committee of Central Council for Research in Unani Medicine

Dr Jiaur R Gayen

- **Editorial Board Member**, Journal of Endocrinology and Diabetes Research, UK
- **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,** The Indian Science Congress Association
- **Life-Member,** Laboratory Animal Science Association of India
- **Life-Member,** Society of Applied Biotechnology, India

Dr Monika Sachdev

- **Member**, Indian Society of Cell Biology, India since 1999
- **Member**, Society for Frontiers in Reproduction, USA, since 2005
- **Member**, Society for study of Reproduction, USA, since 2007
- **Member**, Indian Society for the Study of Reproduction and Fertility, since 2013
- **Member**, International Society of Transgenic Technology, since 2014.

Dr Mukesh Pasupuleti

- **Member**, Life member of American Peptide Society (APS), USA

Dr Mrigank Srivastava

- **Member,** American Society for Microbiology

Dr Rajesh Kumar Jha

- **Life Member,** Indian Society for the Study of Reproduction and Fertility (ISSRF)
- **Member,** Society for the Study of Reproduction (SSR)

The Staff

Director
Professor Alok Dhawan
PhD, DSc (*h.c.*; UK)
FNASc, FRSC, ATS (USA), FST, FAEB, FINS, FAScAW
(Additional charge from 30.11.2017)
Dr Madhu Dikshit, FNA, FASc, FNASc, JC Bose National Fellow (Retired on 30.11.2017)

BIOCHEMISTRY

Senior Principal Scientist
Neena Goyal, M.Sc., Ph.D., *In-Charge, Biochemistry & Academic Affairs Unit*
Neeloo Singh, M.Sc., Ph.D.
Vinita Chaturvedi, M.Sc., Ph.D.
Principal Scientist
Sabyasachi Sanyal, M.Sc., Ph.D.
Senior Scientist
AK Tamrakar, M.Sc., Ph.D.
Arun Kumar Trivedi, M.Sc., Ph.D.
Dipak Datta, M.Sc., Ph.D.
Principal Technical Officer
Ramesh Sharma, M.Sc., Ph.D.
B. Maity, M.Sc., Ph.D.
Senior Technical Officer (1)
Ajay Singh Verma, M.Sc.
Ishbal Ahmad, M.Sc.
Technical Officer
Shyam Singh, M.Sc.
Sanjeev Meena, M.Sc.
Priyanka Trivedi, M.Sc.
Technical Assistant
Karthik R. M.Sc.
Senior Technician (2)
Hori Lal, B.Sc.

ETHNOBOTANY

Principal Scientist
K R Arya, M.Sc., Ph.D. *In-Charge (Retired on 31.01.2018)*
Senior Scientist
D K Mishra, M.Sc., Ph.D.
Scientist
Vineeta Tripathi, M.Sc., Ph.D.
Senior Technician (2)
J K Joshi, B.Sc.
Lab. Assistant
Makhan Lal
Gopi
Satya Narain *(Horticulture work)*
Lab Attendant (2)
N K Khanduri
R C Maurya
Lakhana Devi
Ashok Kumar *(Horticulture work)*

ENDOCRINOLOGY

Chief Scientist
Naibedya Chattopadhyay, M.Sc., Ph.D.
Senior Principal Scientist
Anila Dwivedi, M.Sc., Ph.D., *In-Charge*
Gopal Gupta, M.Sc., Ph.D.
Principal Scientist
FW Bansode, M.Sc., Ph.D.
Durga Prasad Mishra, M.Sc., Ph.D.
Senior Scientist
Divya Singh, M.Sc., Ph.D.
Ritu Trivedi, M.Sc., Ph.D.
Rajender Singh, M.Sc., Ph.D.
Monika Sachdev, M.Sc., Ph.D.
Scientist
Rajesh Kumar Jha, M.Sc., Ph.D.
Principal Technical Officer
JP Maikhuri, M.Sc., Ph.D.
Senior Technical Officer (3)
Mohini Chhabra, M.Sc., CLSc.
Balvir Singh, M.Sc.
Technical Officer
Konika Gupta, M.Sc.
Technical Assistant
Jaspreet Kaur, M.Sc.
Amar Deep Lakra, M.Sc
Senior Technician (2)
Geet Kumar Nagar, B.Sc.
Jr. Steno
H K Checkar
Lab. Assistant
VP Mishra (Retired on 31.07.2017)
R.G. Pandey
Mahesh Chandra Tewari
Lab Attendant (2)
Ram Karan
Nabbu Lal Kori

MEDICINAL AND PROCESS CHEMISTRY DIVISION

Chief Scientist
Arun K Sinha, M.Sc., Ph.D. FNASc, *Supervising Scientist-in-Charge, SAIF*
W Haq, M.Sc., Ph.D., *In-charge, Other Lab Services & Supervising Scientist-in-Charge, LES*
Kanchan Hajela, M.Sc., Ph.D. (Retired on 30.06.2017)
P M S Chauhan, M.Sc., Ph.D.
YS Prabhakar, M.Sc., Ph.D.
Senior Principal Scientist
V.L. Sharma, M.Sc., Ph.D.
Atul Kumar, M.Sc., Ph.D.
Sanjay Batra, M.Sc., Ph.D.
Principal Scientist
Atul Goel, M.Sc., Ph.D.
Gautam Panda, M.Sc., Ph.D.
T Narender, M.Sc., Ph.D.
K V Sashidhara, M.Sc., Ph.D.
Senior Scientist
Prem Prakash Yadav, M.Sc., Ph.D.
Maddi Shridhar Reddy, M.Sc., Ph.D. (Transferred to CSIR-IICT Hyderabad)
Kishor Mohanan , M.Sc.,Ph.D.
Pintu Kumar Mandal, M.Sc.,Ph.D.
Dipankar Koley, M.Sc., Ph.D.
Scientist
Ranveer Singh, M.Tech.
Namrata Rastogi, M.Sc. Ph.D.
Richa Pandey, M.Sc. Ph.D (Transferred from CSIR-IICT Hyderabad)
Ajay Kumar Srivastava, M.Sc. Ph.D (Transferred from CSIR-IICT Hyderabad)
Chandra Bhushan Tripathi, M.Sc. Ph.D
Malleswara Rao Kuram, M.Sc., Ph.D
Damodara Reddy N, MVSc. Ph.D
Principal Technical Officer
R K Asthana, M.Sc., Ph.D.
A K Mandwal, M.Sc., Ph.D.
Tara Rawat, B.Sc.
Senior Technical Officer (3)
Deepali Pandey, B.Sc.
Senior Technical Officer (2)
K S Anil Kumar, M.Sc., Ph.D., P.G.D.C.A.,
Senior Technical Officer (1)
Atma Prakash Dwivedi, M.Sc.
Ashok Kumar Sharma, B.Sc., D.Ch.E., A.M.I.E.
Tahseen Akhtar, M.Sc.
Surya Pratap Singh, M.Sc., Ph.D
Senior Technician (2)
Preeti Rastogi, M.Sc.
Ramjeet, B.Sc., PGDC
Radha Rani Gupta, B.Sc. (Retired on 30.09.2017)
Raju Arora, B.Sc.
V K Maurya, ITI
Anoop Kumar Srivastava, M.Sc
Shashi Rastogi, M.Sc.
Mithilesh Sharma, M.Sc.
Veena Mehrotra, M.Sc. (Expired on 20.01.2018)
Rajesh Kumar Verma
A K Pandey, B.Sc.
S C Tiwari, B.Sc.
Ram Lakhan
Senior Technician (1)
Manju, B.Sc
Technician (2)
H R Misra, M.Sc.
N P Misra, M.Sc.
Krishna Kumar, B.Sc.
Technician (1)
Rajesh Kumar Verma, B.Sc
Private Secretary
Avadhesh Kumar, B.A.
Lab. Assistant
J C Rajan
Satish Chandra Yadav, B.Sc.

MICROBIOLOGY

Senior Principal Scientist
P K Shukla, M.Sc., Ph.D. *In-Charge*
K K Srivastava, M.Sc., Ph.D.
Principal Scientist
B N Singh, M.Sc., Ph.D.

Senior Scientist
Arunava Dasgupta, M.Sc., Ph.D.
Sudhir Kumar Singh, M.Sc., M.Tech., Ph.D.
Y K Manju, M.Sc.,Ph.D
Sidharth Chopra, M.Sc., Ph.D.
Mukesh Pasupuleti, M.Sc, Ph.D
Trainee Scientist
Neha Topno, M.Sc.
Senior Technical Officer (3)
Agney Lal, B.Sc.
Senior Technical Officer (1)
Sandeep Kumar Sharma, M.Sc. Ph.D
Technical Assistant
Atul Krishna, B.Sc., DMLT
Umamageswaran V., M.Sc.
Senior Technician (2)
D K Tripathi, M.Sc.
OP Gupta
Lab. Assistant
A N Dixit, B.A.
Lab. Attendant (2)
Ravi Shankar Misra
Ram Prakash, B.A.
Shyam Sunder Yadav, B.A.

MOLECULAR & STRUCTURAL BIOLOGY

Senior Principal Scientist
Saman Habib, M.Sc., Ph.D., FASc
Ravishankar Ramachandran, M.Sc., Ph.D. *In-Charge*
Principal Scientist
Jimut Kanti Ghosh, M.Sc., Ph.D., FNASc
J Venkatesh Pratap, M.Sc., Ph.D.
Mohammad Imran Siddiqi, M.Sc., Ph.D.
Senior Scientist
Ashish Arora, M.Sc., Ph.D.
Mohammad Sohail Akhtar, M.Sc., Ph.D.
Amogh Anant Sahasrabuddhe, M.Sc., Ph.D.
Shakil Ahmed, M.Sc., Ph.D.
Scientist
Dibyendu Banerjee, M.Sc., Ph.D.
Tejender S Thakur, M.Sc., Ph.D.
Senior Technical Officer (3)
J P Srivastava, B.Sc., LL.B.
R K Srivastava, B.Sc.
Senior Technical Officer (1)
Ruchir Kant, M.Sc. Ph. D
Rima Ray Sarkar, M.Sc
Anupam Jain, M.Sc.
Technical Officer
Sarita Tripathi, M.Sc.
Senior Technician (2)
Ram Radhey Shyam

PARASITOLOGY

Senior Principal Scientist
Renu Tripathi, M.Sc., Ph.D,. FNASc. *In-Charge*
Principal Scientist
Kumkum Srivastava, M.Sc., Ph.D. (Retired on 31-10-2017)
Senior Scientist
Satish Mishra, M.Sc, Ph.D
Scientist
Mrigank Srivastava, M.Sc., Ph.D.
Susanta Kar, M.Sc., Ph.D.
Niti Kumar, M.Sc., Ph.D.
Bidyut Purkait, M.Sc., Ph.D
Technical Assistant
Ashan Manhas, B.Sc., M.L.T
Senior Technician (2)
K K Singh, M.Sc.
Lab. Attendant (2)
Prem Babu
Lab. Attendant (1)
Ram Das
Om Prakash

PHARMACEUTICS & PHARMACOKINETICS

Chief Scientist
A K Dwivedi, M.Sc., Ph.D. (Retired on 31.07.2017)
Senior Principal Scientist
Jawahar Lal, M.Pharm., Ph.D. *(Retired on 31.08.2017)*
Amit Misra, M.Pharm., Ph.D., *In-Charge*
Principal Scientist
Prabhat Ranjan Mishra, M.Pharm., Ph.D.
Senior Scientist
Manish Kumar Chourasia, M.Pharm., Ph.D.
Rabi Sankar Bhatta, M.Pharm., Ph.D.
Wahajuddin, M.S.(Pharma)., Ph.D
Scientist
Jiaur Rahaman Gayen, M.Pharm., Ph.D.
Private Secretary
Nandita Pandey, B.A.
Principal Technical Officer
S K Pandey, M.Sc. (Retired on 30.09.2017)
Technical Officer
V Saravanakumar, M.Sc., M.Phil., PGDCA, DIS
Technical Assistant
Deepak, M.Sc.,
Senior Technician (2)
S K Bhatnagar, B.Sc.
Narendra Kumar, B.Sc
Technician (2)
Akhilesh Kumar
Lab. Assistant
Shiv Lal
Lab. Attendant (2)
Ram Bhajan Shukla
Lab. Attendants (1)
Ram Sunder Lal, B.A.
Ram Kumar
Chandramani

PHARMACOLOGY

Principal Scientist
Manoj K Barthwal, M.Sc., Ph.D. *In-Charge*
Senior Scientist
Anil Gaikwad, MS (Pharma), Ph.D.
Prem N Yadav, M.Sc., Ph.D.
Kumaravelu Jagavelu, M.Sc., Ph.D.
Kashif Hanif, M.Sc., Ph.D.
Scientist
Shubha Shukla, M.Sc., Ph.D.
Baisakhi Moharana MVSc., Ph.D.
Principal Technical Officer
V S Nigam, B.Sc
Senior Technical Officer (3)
C P Pandey, M.Sc.
Senior Technical Officer (1)
Sheeba Saji Samuel, M.Sc.
Technical Officer
Sachi Bharti, M.Sc.
Smriti, M.Sc.
Pankaj Kumar Shukla, B.Sc., P.G.D.B.T.
Divya Mohan, M.Sc.
Deep Mala, M.Sc
Senior Stenographer
Varun Kumar Pathak, B.A
Senior Technician (2)
H C Verma, B.A.
Bharti Bhushan, B.Sc.
Ramesh Chandra, M.Sc.
Senior Technician (1)
Anil Kumar Verma, B.Sc.
Technician (2)
Surendra Singh, M.Sc., Ph.D
Lab. Attendent (2)
Hari Joshi
Lab. Attendent (1)
Pankaj Sengupta

TOXICOLOGY & EXPERIMENTAL MEDICINE

Chief Scientist
A Ghatak, M.B.B.S., M.D., MNAMS, FICP, MACCP, *In-Charge (Retired on 30.06.2017)*
Senior Principal Scientist
R K Singh, M.Sc., Ph.D., D.Sc. (*Retired on 30.11.2017)*
Sharad Sharma, M.B.B.S., M.D. *In-Charge*
S K Rath, M.Sc., Ph.D.
Principal Scientist
R K Tripathi, M.Sc., Ph.D.
Senior Scientist
Aamir Nazir, M.Sc., Ph.D.
Smrati Bhadauria, M.Sc., Ph.D.
Sarika Singh, M.Sc., Ph.D.
Madhav Nilkanth Magale, MVSc., Ph.D
Scientist
Vivek Vidyadhar Bhosale, M.B.B.S., M.D.
Principal Technical Officer
Mukesh Srivastava, M.Sc., Ph.D. (Biometry & Statistics)
P K Agnihotri, M.Sc., Ph.D.
Sadan Kumar, M.Sc
Technical Officer
Anurag Kumar Srivastava, B.Sc.
Shail Singh, M.Sc., Ph.D.
Anil Kumar Meena, M.Sc., B.Ed.
Navodayam Kalleti, M.Sc.
Technical Assistant
Sudhakar Yadav, M.Sc., M.L.T.
Senior Steno
Mohd Sufiyan
Senior Technician (2)
M P S Negi, B.Sc., PGDC (Biometry & Statistics)
Anupma, B.Sc.
Lab. Assistant
Shree Krishan
Umesh Kumar

Savitri Devi
Lab. Attendant (2)
Ram Kumar
Lab. Attendant (1)
Nand Pal Yadav

CLINICAL PHARMACOLOGY UNIT (CDRI), SETH G.S. MEDICAL COLLEGE, MUMBAI

Senior Technician (2)
P S Acharya, B.Com.
Vijal J Ashar, M.Sc.
Lab. Assistant
R B Pawar

ACADEMIC AFFAIRS UNIT
Principal Scientist
Anju Puri, M.Sc., Ph.D.
Senior Technician (2)
A K Pandey

BUSINESS DEVELOPMENT & INTELLECTUAL PROPERTY UNIT

Senior Scientist
Naseem Ahmed Siddiqui., B. Pharma, M.B.A.
Sripathi Rao Kulkarni, M.Sc., Ph.D., P.G. Dip. In Patent Law
Senior Technical Officer (3)
A S Kushwaha, B.Sc.
Technical Officer
Neelima Srivastava, M.C.A
Technician (2)
Preeti Agarwal, M.C.A.

COMPUTER CENTRE

Chief Scientist
A K Srivastava, B.E., *(Retired on 31-05-2017)*
Senior Principal Scientist
Kural, B.E., *Centre In-Charge*
Scientist
Santhosh Shukla, B.Tech.
Technical Officer
Ajay Kumar Maurya, M.C.A.
Technician (1)
Sumit Khichi

LABORATORY ANIMALS FACILITY

Chief Scientist
D S Upadhyay, M.V.Sc., Ph.D., *In-Charge*
Principal Scientist
S Raja Kumar, M.Sc
Senior Scientist
Dhananjoy Hansda, M.V.Sc.
Rituraj Konwar, M.V.Sc., Ph.D.
Jayant Sarkar, M.V.Sc., Ph.D.
Rajdeep Guha, M.V.Sc
Scientist
H K Bora, M.V.Sc
Shishir Kumar Gupta, MVSc., Ph.D
Principal Technical Officer (3)
Karunesh Rai, M.Sc.
Technical Officer
Shikha Mishra., M.Sc
Technical Assistant
Chandra Shekhar Yadav, M.Sc.
Senior Technician (2)
A K Dubey, B.A.
Ravinder Singh, M.Sc.,
Sanjeev Kumar Saxena, B.Sc.
Ravi Kumar Shukla
Narendra Kumar, B.A.
Pradeep Tirkey
Dinesh Kumar, B.A.
Technician (2)
Arun Sharma, B.Sc.
Senior Steno (H)
Raj Kumar, B.A.
Lab. Assistant
Dilip Kumar (Retired on 31-07-2017)
V B L Srivastava
S K Verma
Shiv Pal Singh
P B Thapa
O P Verma, B.A.
Mohd Saleem
Gopal Krishna (Retired on 30-06-2017)
Lab. Attendants (2)
Jameel Beg
Najbullah
Lab. Attendants (1)
Changa Lal

KNOWLEDGE RESOURCE CENTRE

Chief Scientist
S K Mallik, M.A., M.L.I.Sc., *In-Charge*
Principal Technical Officer
Sanjay Kumar, M.L.I.Sc
G C Gupta, B.Sc.
Senior Technical Officer (2)
Ramesh Chandra Gupta, M.L.I.Sc.
Senior Steno
Himanshu Upadhyay, B.A
Technical Officer
Pankaj Upreti, M.L.I.Sc

OTHER LAB SERVICES

Senior Principal Scientist
N K Agarwal, M.Sc.,
Senior Scientist
Manoj Kumar Rawat, M. Tech.
Senior Technical Officer (3)
R N Lal, M.Sc.
Senior Technical Officer (2)
Ram Karan Harijan, AMIE
Sanjay Kumar, Diploma
Technical Officer
Arbind Kumar, B.C.A, PGDCA
Senior Technician (2)
Ravi Kumar Mehra, B.A.
Kamal Singh, ITI
Laxmi Narain, ITI
K.M. Shukla, B.Sc.
Suresh S. Bhakuni
Technician (2)
R A Prajapati, M.A.
Technician (1)
Kul Bahadur Thapa, ITI (Electronics)
Lab. Assistant
Mohd Islam
Ramesh Chandra
Ved Prakash Misra

S & T MANAGEMENT UNIT

Chief Scientist
Vinay Tripathi, M.Sc., M.B.A., P.G. Dip., *Unit In-Charge*
Senior Principal Scientist
D N Upadhyay, M.Sc., Ph.D.
Principal Scientist
Prem Prakash, M.Pharm.
Senior Scientist
Anand P Kulkarni, M.Sc., Ph.D. (*Director Secretariat)*
Junior Scientist
Sanjeev Yadav, M.Sc., Ph.D., PG Dip. Bioinformatics
Senior Technical Officer (3)
Ravindranath S Londhe, GD Art (Comm.), Art Teachers Dip.
Sr. Technical Officer (1)
Savita Tripathi, M.Sc., B.Ed.
Technical Officer
Farha khan, M.C.A
Technical Assistant
M Muruganantham, B.Sc., M.B.A
Senior Technician (2)
Chandrika Singh, B.Sc., LL.B.
Technician (2)
Susheel Kumar, B.Sc
Lab. Assistant
Kishori Kumari (Retired on 31.01.2018)
Lab. Attendant (1)
Pradeep Kumar Srivastava, B.Sc.

SOPHISTICATED ANALYTICAL INSTRUMENT FACILITY

Senior Principal Scientist
Brijesh Kumar, M.Sc., Ph.D., *Mass Unit In-charge, and Overall Facility In-charge*
Principal Scientist
Ravi Sankar Ampapathi, M.Sc., Ph.D., *NMR Unit In-charge*
Senior Scientist
Sanjeev Kumar Shukla, M.Sc., Ph.D.
Sanjeev Kanojiya, M.Sc., Ph.D.
Kalyan Mitra, M.Sc., Ph.D. *Electron Microscopy Unit In-charge,*
Principal Technical Officer
H M Gauniyal, M.Sc. Ph.D
Rakesh Khanna, B.Sc., A.I.C (Retired on 28.02.2017)
A K Sinha, M.Sc. (Retired on 30.11.2017)
Senior Technical Officer (3)
Pramod Kumar, M.Sc.
Sunil Kumar, B.Sc.
R K Purshottam, B.Sc.
Senior Technical Officer (2)
Kavita Singh, M.Sc. Ph.D.
Technical Officer
Binod Kumar Saw, M.Sc.
Garima Pant, M.Sc.
Amit Kumar, M.Sc., M.Tech
Technical Assistant
Tofan Kumar Rout, M.Sc. Ph.D.
Pooja Soni, Diploma
S Mehazabeen, B.Sc.
Senior Technician (2)
Ashok Pandey, B.Sc.

Sandeep Sengupta, B.Sc.
Radhey Krishna, B.Sc., L.T., C.Lib.Sc.
Akhilesh Kumar Srivastava, B.Sc.
Madhuli Srivastava, B.A.
S A Singh, B.Sc., PGDCA
D N Vishwakarma
Madhu Chaturvedi, Diploma
Sr. Steno
Surendra Kumar, B.Com
Lab Assistant
Janki Saran Singh (Retired on 31.01.2018)

ENGINEERING SERVICES DIVISION

Senior Superintending Engineer
Parvez Mahmood, B.Sc.,Engineering(Civil),
In-Charge
Kamal Jain, B.E., (Electrical)
Assistant Executive Engineer
Mohit Kumar Shukla, A.M.I.C.E (Civil)
Jai Prakash, Diploma
Sidho Hembrom, Diploma
D K Vishwakarma, Diploma
Brahma Singh, Diploma
Assistant Engineer
Ajay Kumar, Diploma
Junior Engineer
Madhukar Saroj, Diploma
Asstt. (G) Grade I
B.K. Shukla, B.Com
Senior Technician (2)
B P Sunwar, Diploma
Radhey Lal, ITI
VK Mishra, Diploma
A K Sonkar, ITI (Retired on 31.03.2017)
K K Kaul, ITI (Retired on 30.09.2017)
Mahindra Singh, ITI (Retired on 30.09.2017)
Basudev Pradhan , ITI
M S Verma, BA, ITI
Harish Kumar, ITI
Vijay Kumar, ITI
Swapan Karmi, ITI
Ramesh Kunwar, ITI
Arun Kumar Srivastava, ITI
Senior Technician (1)
G C Roy, ITI (Retired on 31.08.2017)
Lab. Assistants
Rama (Retired on 31.01.2017)
Ramanuj (Retired on 31.12.2017)
Popinder Singh
S K Bhattacharya
S K Yadav
Bishan Singh
A K Misra
Om Prakash
Shankar Roy
Z U Beg
Ramesh Chandra
Lab Attendant (2)
Sandeep Roy
Dhirendra Misra
Mohd. Irfan
Raju Vishwakarma
Ram Autar
Hari Om Garg
Satyajeet Roy
Ram Samujh
Bindeswari Prasad
Lab. Attendant (1)
Darshan Lal
Vishwanath Nigam
Suresh Kumar
Ram Bilas (Retired on 30.11.2017)
Gaya Prasad
Ram Asrey
Group D
Om Prakesh
Hanuman
Radhey Shyam
Hari Prasad
Maiku Lal-II

COA OFFICE

Controller of Administration
CP Arunan, BA
Asstt. (G) Grade I
Kamla Kandpal, M.A
Lab. Assistants
Sohan Lal (Retired on 31.10.2017)
MTS
Sourav Sarkar

DIRECTOR'S OFFICE

Private Secretary
Sumit Srivastava, B.Com.
Sunita Chopra, B.A.
Senior Technician (2) (Driver)
Shakeel Ahmad Khan
KK Kashyap
Lab. Attendant (2)
Nand Kishore
Trainee
Rajesh

ESTABLISHMENT I

Section Officer (G)
Krishna Raj Singh, B.Sc, MSW
Asstt. (G) Grade I
Jagdish Prasad, B.Sc., MPA
Vibhash Kumar, B.A (Hons), CIC
Riti Choudhary, B.A
Saju P Nair
Reena Bisaria, B.A
Ajay Kumar, BA.(H), LL.B,
Senior Steno
Deepak Dhawan, BA
Asstt. (G) Grade III
Sushree Anjali Singh, BA
Deepak Kumar Gupta, M.Com
Group-C
Manju Yadav

ESTABLISHMENT II

Section Officer (G)
Ishwar Nath Jha
Asstt. (G) Grade I
Vivek Bajpai, M.A
Rashmi Srivastava, B.A, B.Ed
Dilip Kumar Sen, B.Com
Javed Sayed Khan, B.A.
Gangadin Yadav, B.A
Neena Raizada, B.A
Aparna Bajpai, B.A
Senior Steno
Vinod Kumar Yadav, B.A
Asstt. (G) Grade III
Rishi Kant, M.Sc
Kumar Saurabh, B.Com
Multi Tasking Staff
Ram Kumar, B.Com

GENERAL SECTION

Section Officer (G)
Anil Kumar, B.Sc.
Asstt. (G) Grade I
Kailash Chandra
Rajendra Prasad, B.A
Ajay Shukla, M.Com
Rani
Mohd. Irfan
Senior Steno (ACP)
Seema Srivastava, M.A
Asstt. (G) Grade III
Anoop Thakur, B.Tech
Drivers
Prem Chand
Daya Shankar Singh
Multi Tasking Staff
Kalpanath Sharma
Mohd. Saleem

RECORDS

Asstt. (G) Grade I
Birendra Singh, B.A

BILL SECTION

Section Officer (G)
Nitu Kumari, B.Sc., M.A
Asstt. (G) Grade I
H K Johar, B.A
Valsala G Nair (Retired on 31.05.2017)
Dilip Kumar (Cash), B.A, LLB
Senior Steno
Renuka Mushran, BA
Asstt. (G) Grade I
Nida Parveen, B.Com
Vinay Kumar Singh, BCA
Indra Prakash Singh, BA
Lab. Attendant (2)
Vinod Kumar Sharma, BA
Trainee
Faizi

VIGILANCE

Section Officer
Anil Kumar, B.Sc.
Asstt. (G) Grade III
Jaya Singh, B.Sc
Senior Steno
Vineet Pandey, BA
Lab Assistant
Ramesh Chandra

HINDI SECTION

Senior Hindi Officer
VN Tiwari, MA, Ph.D (Retired on 31.10.2017)
Neelam Srivastava, M.A., B.Ed., L.L.B

Senior Steno (Hindi)
Anil Kumar, B.Com

SECURITY

Security Officer
Anil Kumar Upadhyay, M.A.

FINANCE & ACCOUNTS

Controller of Finance & Accounts
A K Dwivedi, B.Sc, M.A
Finance & Accounts Officer
I B Dixit, M.Sc, M.B.A
Bhaskar Kumar Ravi, MBA
Section Officer (F&A)
R P Tripathi, M.Com, LL.B
Kailash Singh, (Retired on 31.01.2017)
Private Secretary
V.P. Singh, B.A
Asstt. (F&A) Grade I
Mahesh Babu, B.A
S L Gupta, B.A
Sasidharan Radha
U K Tewari, B.Sc
Rekha Tripathi, B.H.Sc.
Ajay Kumar, B.A
Asstt. (F&A) Grade II
D K Khare, M.Com
Mahender Kumar, B.Com
Sanjay Kumar, B.A
Tahseen Tilat, B.A
S A Siddiqui, B.A
Chandrashekhar
Asstt. (F&A) Grade III
Abhishek Kumar
Sushree Mamta Chaurasi
Lab. Attendants (2)
Vikramaditya
Angad Prasad
Multi Tasking Staff
Mohd. Firoz, B.A

STORES & PURCHASE

Stores & Purchase Officer
MP Singh
Section Officer
Amit Kumar
Asstt. (S&P) Grade I
P S Chauhan, B.Sc
Arun Wadhera
A K Misra, B.A
H B Neolia, M.A
R C Dwivedi, B.Com
Md. Rijwan, B.Tech, MPA
Mahesh Kumar
Asstt. (S&P) Grade II
M C Verma, B.Com
Srikant Mishra, B.A
Kanchan Bala, B.A
Asstt. (S&P) Grade III
Vandana Parwani, B.A
G P Tripathi
Anil Kumar
Chakrasen Singh
Senior Steno (H)
Jitendra Patel, M.A.
Senior Technician(2)
Ram Pal Rawat, B.Sc., LLB
Nuzhat Kamal, B.Sc.
Lab. Assistant
Rama Shukla *(Retired on 31.07.2017)*
Kamlesh
Lab Attendant
Hardwari
MTS
Sudhir Kumar Yadav

CSIR DISPENSARY

Medical Officer Group III (7)
Asha Negi, M.B.B.S., M.D. *(Retired on 30.06.2017)*
Medical Officer Group III (5)
N K Srivastava, M.B.B.S. MD., *In charge*
Medical Officer Group III (4)
Shalini Gupta, M.B.B.S. MD
Kunal Gupta, M.B.B.S.MD
Senior Technician (2)
Nandita Dhar, Diploma in Nursing *(retired on 31.08.2017)*
Shailendra Mohan, M.Sc., DIP
Technician (2)
Shraddha, M.A., Diploma in Nursing
Shabana, B.A., Diploma in Pharmacy
Technician (1)
Shimpi Gupta, Diploma in Pharmacy
Sahajada Jalal, Diploma in Pharmacy
Lab. Assistant
S K Paswan
Lab Attendant (2)
Lalji Prasad
Lab Attendant (1)
Shubhendra Kumar

CANTEEN

Manager Gr. II (ACP)
J P Satti, B.A
Asstt. Manager & Store Keeper (ACP)
R S Tewari
Count Clerk (ACP)
Ram Jiyawan Tewari
Y K Singh, B.A
Cook (ACP)
Man Bahadur *(Expired on 18.12.2017)*
Asstt. Halwai
Uma Shanker Tewari
Bearer
Ganga Ram
Rajendra
Sukhdev Prasad
Wash Boys
Ram Moorat
Dinesh Pal Singh

Notes

ट्रॉमा का दर्द कम करेगी सीडीआरआई की नई दवा

सीडीआरआई के 66वें स्थापना दिवस पर डायरेक्टर ने दी जानकारी, कहा- इस दवा से हड्डियां भी तेजी से जुड़ेंगी

अमर उजाला ब्यूरो

लखनऊ।

सीडीआरआई के स्थापना दिवस कार्यक्रम में मौजूद विशेषज्ञ।

सड़क दुर्घटना के बाद ट्रॉमा का दर्द कम करने के लिए सेंट्रल ड्रग रिसर्च इंस्टीट्यूट (सीडीआरआई) एक दवा को विकसित कर रहा है। यह दवा फ्रैक्चर के बाद हड्डियों को जुड़ने की गति को तेज करेगी। हैदराबाद की कंपनी के साथ संयुक्त रूप से इस दवा को बायोडिग्रेडेबल इम्प्लांट का हिस्सा भी बनाने पर काम शुरू किया गया है। ऐसा होने पर इम्प्लांट को निकालने के लिए जहां दोबारा ऑपरेशन नहीं करना होगा। वहीं इंप्लांट के शरीर में घुलने के बाद उसमें शामिल दवा इस फ्रैक्चर को तेजी से हील करना शुरू कर देगी। यह जानकारी सीडीआरआई के 66वें स्थापना दिवस पर जानकीपुरम विस्तार कैंपस में शुक्रवार को आयोजित कार्यक्रम में निदेशक डॉ. मधु दीक्षित ने दी। उन्होंने बताया कि इस सिंथेटिक ड्रग एस-008-399 को लैब में तैयार किया गया है। अब हैदराबाद की फार्मा कंपनी आर्थो रिजेनिक्स प्राइवेट

दवा के उपयोग पर सफल रहने के बाद मरीजों के दर्द को करने में मदद कर पाएंगे। एनिमल मॉडल पर इसके परिणाम अच्छे रहे हैं। अब ट्रायल का अगला चरण फार्मा कंपनी के साथ सीडीआरआई ने शुरू कर दिया है।

डॉ. दीक्षित ने बताया कि ट्रॉमा की वजह

मौत हो जाती है। इनमें से अधिकांश की मौत हड्डियों के फ्रैक्चर्स होने के बाद होने वाले बुरे परिणामों की वजह से होती है। सीडीआरआई जिस दवा पर काम कर रहा है। उससे इस तरह की मौतों की दर को नियंत्रित किया जा सकेगा। हमने सीडीआरआई में उपयोगी दवाओं के

ग्रुप भी बनाया है। यह ग्रुप संस्थान में होने वाले शोध की सभी अपडेट को केंद्रीयक त कर विशेषज्ञों की मदद से उनको उपयोगी दवा के रूप में विकसित करेगा। इसी ग्रुप का आइडिया था कि ड्रग एस-008-399 को पहले फार्मा कंपनी को लाइसेंस दिया जाए। इसके जरूरत के

90 करोड़ रुपये से न्यू कैंपस में एनिमल फेसिलिटी

सीडीआरआई अब इस 40 साल पुराने एनिमल हाउस को न्यू कैंपस में आधुनिक बनाकर शिफ्ट करेगा। इसके लिए संस्थान ने 90 करोड़ रुपये का एक प्रोजेक्ट केंद्र को भेजा है। एनिमल हाउस न्यू कैंपस में लैब एनिमल फेसिलिटी के नाम से बनेगा।

पंजाब ने सवाईकल कैंसर की वैक्सीन को बनाया अनिवार्य

लखनऊ। हर सातवें मिनट में देश में एक महिला की मौत सर्वाइकल कैंसर से हो जाती है। देश में सबसे पहले पंजाब ने सर्वाइकल कैंसर की वैक्सीन को स्वास्थ्य कार्यक्रम में शामिल किया है। हर नौ से 13 साल की लड़की को यह वैक्सीन वहां लगाई जाएगी। यह जानकारी विश्व स्वास्थ्य संगठन की वैक्सीन सेफ्टी पर ग्लोबल एडवाजयरी कमेटी की सदस्य और ट्रांसनेशनल हेल्थ साइंस टेक्नोलॉजी इंस्टीट्यूट की कार्यकारी निदेशक प्रो. गगनदीप कांग ने दी। प्रो. कांग ने बताया कि अब गोवा और कर्नाटक राज्य भी इस दिशा में कदम बढ़ा रहे हैं।

जाना पड़ेगा • मां की मौत, तीन अबोध बच्चियां... मामा ने कहा- लावारिस में डाल दो • जानिए, मंदिर में 5 करोड़ के जेवर

गर्भ निरोधक 'सहेली' से कैंसर का भी इलाज

सीडीआरआई ने शुरू किया क्लीनिकल ट्रायल, पीएम मोदी आज करेंगे लोकार्पण

अमर उजाला ब्यूरो

लखनऊ।

सीडीआरआई के इसी नवीन परिसर का लोकार्पण करेंगे प्रधानमंत्री नरेंद्र मोदी।

देश की दिग्गज वैज्ञानिक संस्था सेंट्रल ड्रग रिसर्च इंस्टीट्यूट (सीडीआरआई) की करीब 30 साल पहले बनाई गर्भनिरोधक दवा सहेली (सेंटक्रोमेन) अब अपने कैंसर निरोधी गुणों के लिए चर्चा में है। अभी तक बिना साइड इफेक्ट के गर्भ निरोधक का काम कर रही सहेली में एंटी कैंसर गुण मिलने के बाद इसका क्लीनिकल ट्रायल देश के प्रमुख चिकित्सा संस्थान में शुरू कर दिया गया है। प्रधानमंत्री नरेंद्र मोदी के सीडीआरआई के न्यू कैंपस जानकीपुरम विस्तार के लोकार्पण कार्यक्रम के समय इस नई सफलता को भी साझा किया जाएगा।

सोमवार को सीएसआईआर की 37 सालों में इकलौती महिला निदेशक डॉ. मधु दीक्षित ने बताया कि सेंटक्रोमेन को सहेली के नाम से बनाया गया। भारत सहित कई देशों में यह अपनी बिना साइड इफेक्ट के प्रभावी रूप से काम करने के लिए प्रसिद्ध हुई। हाल ही में इस दवा में सवाईकाल और ब्रेस्ट कैंसर से बचाव के लिए गुण मिले। इस सूचना को उन्होंने सीडीआरआई के साथ भी साझा किया। इसके बाद हमने आगे की खोज शुरू की। अब इस एंटी कैंसर गुण के साथ सेंटक्रोमेन ड्रग का क्लीनिकल ट्रायल शुरू कर दिया गया है। टाटा कैंसर इंस्टीट्यूट को इसके लिए चुना गया। हमें उम्मीद है कि जल्दी फार्मा इंडस्ट्री को एक बिना नुकसान पहुंचाने वाली कैंसर थेरेपी सेंटक्रोमेन के गुणों के साथ मिल जाएगी। सेंटक्रोमेन के एंटी कैंसर गुणों के साथ लोकार्पण कार्यक्रम में सीडीआरआई की कई दूसरी दवाओं की जानकारी भी साझा की जाएगी।

डॉ. मधु दीक्षित

सीडीआरआई आने वाले मोदी तीसरे प्रधानमंत्री

डॉ. मधु दीक्षित ने बताया कि सीडीआरआई की 1951 में स्थापना पहले प्रधानमंत्री जवाहर लाल नेहरू ने की। इसके बाद पूर्व प्रधानमंत्री राजीव गांधी भी एक बार सीडीआरआई के ओल्ड कैंपस छतर मंजिल आए। 25 साल बाद अब कोई प्रधानमंत्री सीडीआरआई में आ रहे हैं।

सीडीआरआई को चाहिए बजट

डॉ. मधु दीक्षित ने बताया कि शोध के लिए बजट की कमी है। लेकिन, प्रधानमंत्री से उनकी विजिट के समय कोई मांग नहीं रखी जाएगी। इसके लिए सीएसआईआर के माध्यम से बाद में अनुरोध किया जाएगा।

प्रधानमंत्री का सीडीआरआई में कार्यक्रम >> आगमन - 5:15 बजे शाम >> लोकार्पण कार्यक्रम, प्रवर्तनी उद्घाटन - 5:30 बजे >> लैब में विजिट : 5:40 बजे >> एयरपोर्ट के लिए रवाना : 6 बजे शाम

सीडीआरआई में शोध कर रहे 22 कश्मीरियों की जांच

प्रधानमंत्री नरेंद्र मोदी के सीडीआरआई में कार्यक्रम के मद्देनजर वहां के अधिकारियों, कर्मचारियों व शोधकर्ताओं के बारे में खुफिया तंत्र द्वारा छानबीन की गई। कश्मीर के मूल निवासी 22 शोधकर्ताओं के मूलनिवास के थाने से उनके चरित्र के सत्यापन के साथ ब्योरा एकत्र किया गया। परिवार के बारे में भी जानकारी एकत्र करके उच्चाधिकारियों को उपलब्ध कराई। एसएसपी दीपक कुमार ने बताया कि प्रधानमंत्री की सुरक्षा के मद्देनजर हर बिंदु पर छानबीन की गई है।

7 राज्य • 1 केंद्रशासित प्रदेश • 19 संस्करण | उत्तर प्रदेश | उत्तराखंड | हिमाचल | जम्मू-कश्मीर | दिल्ली | हरियाणा | पंजाब | चंडीगढ़

अमर उजाला

लखनऊ

बुधवार, 1 मार्च 2017

amarujala.com

दिव्यांगों की बेहतरी के लिए हों वैज्ञानिक शोध

दिव्यांग सशक्तीकरण थीम पर अंतरराष्ट्रीय विज्ञान दिवस पर शहर में कई जगह आयोजन, लगी प्रदर्शनी

अमर उजाला ब्यूरो

लखनऊ।

वैज्ञानिक शोध दिव्यांगों के सशक्तीकरण और उनको मुख्यधारा से जोड़ने के लिए होना चाहिए। ऐसी तकनीक एवं सहायक उपकरणों का विकास हो, जिससे दिव्यांगों की जिंदगी बेहतर हो सके। ये बातें मंगलवार को डॉ. शकुंतला मिश्रा पुनर्वास विश्वविद्यालय में विज्ञान दिवस पर डीन एकेडमिक्स प्रो. एपी तिवारी ने कहीं। इस बार अंतरराष्ट्रीय विज्ञान दिवस विशेष बच्चों को समर्पित रहा। उन्होंने कहा कि वैज्ञानिक शोध और नई तकनीक का लक्ष्य सभी का कल्याण होना चाहिए। इस दौरान साइंस एवं टेक्नोलॉजी के डीन प्रो. सीके दीक्षित, सांख्यिकी एवं गणित विभाग के सहायक प्रो. डॉ. प्रवीण कुमार मित्र, रसायन विभाग के प्रो. डॉ. विनय कुमार सिंह और विज्ञान संकाय के शोधार्थी कपिल पांडेय, रोशनी यादव व प्रदीप कुमार ने दिव्यांगों के हित में वैज्ञानिक शोध की बात कही।

वहीं, सीमैप में ओपन डे रहा। दोपहर में गवर्नर हाउस की धन्वंतरि वाटिका के प्रभारी वैद्य डॉ. शिवशंकर त्रिपाठी ने लोगों को आयुर्वेद की महत्ता समझाई। सीडीआरआई में दिव्यांग बच्चों के लिए खेलकूद और चित्रकला प्रतियोगिता का आयोजन किया गया। इसमें दृष्टि सामाजिक संस्थान के बच्चों ने अपनी रचनाशीलता के जरिये आसपास मौजूद विज्ञान के उपयोग पर पेंटिंग बनाईं। निदेशक डॉ. मधु दीक्षित ने विजेता बच्चों को पुरस्कार भी दिए। भारतीय सर्वेक्षण विभाग, भू स्थानिक आंकड़ा केंद्र, मानचित्र भवन में नक्शों की प्रदर्शनी और मैप सेल का काउंटर लगाया गया, जहां गायत्री बाल विद्या मंदिर के बच्चों ने पहले भू-सर्वे के नक्शे प्लेन टैबलिंग, जीपीएस, डाटा रिसीवर, टोटल स्टेशन, डिजिटल लेवल की जानकारी ली। एलयू के भूगर्भ विज्ञान विभाग में बच्चों को म्यूजियम दिखाया गया। कार्यक्रम का उद्घाटन एलयू वीसी प्रो. एसपी सिंह ने किया। विद्यालिका ज्ञानदीप इंटर कॉलेज, गोमती नगर

विज्ञान दिवस पर मंगलवार को सीडीआरआई में आयोजित कार्यक्रम के दौरान सांस्कृतिक प्रस्तुति देते विशेष बच्चे।

धन्वंतरि वाटिका का अवलोकन करते स्कूली बच्चे।

स्वतंत्र सोच ही नवाचारों की जननी

लखनऊ। इंटीग्रल विश्वविद्यालय में राष्ट्रीय विज्ञान दिवस पर भारतीय कृषि अनुसंधान परिषद के निदेशक डॉ. कुलदीप कुमार लाल ने कहा कि स्वतंत्र सोच ही नवाचारों की जननी होती है। उन्होंने कहा कि हमारे देश के लिए ये सकारात्मक बात है कि अब हम विकासशील लोगों को विशेष रूप से अलग व्यक्ति कहने लगे हैं। समारोह की अध्यक्षता कर रहे कुलपति प्रो. एस डब्ल्यू अख्तर ने कहा कि जो कुछ विज्ञान ने आज हासिल किया है वो सब आज से 50 साल पहले असंभावित लगता था। उन्होंने इंसान और समाज के विकास के लिए विज्ञान और प्रौद्योगिकीय नवाचारों की भूमिका पर बल दिया। इस अवसर पर प्रो वाइस चांसलर प्रो. जावेद मुसर्रत, रजिस्ट्रार, प्रो. इरफान अली खान, डीन विज्ञान, प्रो अब्दुल रहमान आदि उपस्थित थे। मिशि की ओर से बुधवार को लालबाग पुर मंजिल के पास निःशुल्क स्वास्थ्य जांच शिविर का आयोजन किया गया है।

'थियोफायलिन' गला रही हड्डियां

» अस्थमा के इलाज में दी जाती है 'थियोफायलिन' दवा

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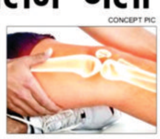
LUCKNOW (28 July): अस्थमा को नियंत्रित करने वाली दवा 'थियोफायलिन' लोगों की हड्डियों को कमजोर कर रही है. सीएसआईआर सेंट्रल ड्रग रिसर्च इंस्टीट्यूट (सीडीआरआई) के वैज्ञानिकों की ओर से की गई रिसर्च में यह एलार्मिंग जानकारी सामने आई है. रिसर्च में पता चला है कि थियोफायलिन हड्डी बनाने वाली कोशिकाओं को नष्ट करके हड्डियों में ऑस्टियोपोरोसिस को बढ़ाता है. साइंटिस्ट्स के अनुसार लगभग 4 पर्सेंट आबादी अस्थमा की चपेट में और इन मरीजों को ये दवा सामान्यत: दी जाती है.

सीडीआरआई वैज्ञानिकों के अनुसार औद्योगिकीकरण और वायु प्रदूषण में हुई तीव्र बढ़ोत्तरी के कारण लंबी सांस संबंधी बीमारियों (सीओपीडी) जिनमें अस्थमा प्रमुख है, के मामलों में कई गुना बढ़ोत्तरी हो रही है. वैज्ञानिकों के अनुसार थियोफायलिन एक मिथाइलजेंथीन दवा है जो ब्रांकोडायलेटर (फेफड़ों को फैलाने) का काम करती है. इसमें एंटी एन्फ्लेमेट्री गुण होते हैं और सांस लेने वाली परेशानी के लक्षणों को कम करती



CONCEPT PIC

है. थियोफायलिन को भारत में सीओपीडी के उपचार के लिए फिक्स्ड डोज कांबिनेशन के रूप में बेची जाने वाली लगभग 50 दवाओं में एक एडिटिव के रूप में भी प्रयोग की जाती है. थियोफायलिन युक्त दवाएं जिनमें डेरीफायलिन सामान्यत: यूज की जाने वाली दवा है.

हीलिंग में भी देरी

शोध में सामने आया है कि थियोफायलिन दवा हड्डी का निर्माण करने वाली कोशिकाओं (आस्टियोब्लास्ट) को मारने का कार्य करती है. साथ ही हड्डी को नष्ट करने वाली कोशिकाओं (आस्टियोक्लास्ट) को और अधिक सक्रिय कर देती है. जिससे हड्डियां खोखली होती हैं. इसके अलावा रिसर्च में यह भी पता चला कि इस दवा के कारण फ्रैक्चर की हीलिंग में विलंब हुआ.

इस टीम ने किया शोध

सीडीआरआई के डॉ. नैबेद्य चट्टोपाध्याय के नेतृत्व में रिसर्च... ने यह शोध किया, जिनमें डॉ. विष्णु लाल शर्मा, डॉ. साध्यसाची ... डॉ. अरुण त्रिवेदी, डॉ. जिया उर गाईन, डॉ. मोहम्मद वहाजु... डॉ. स्मृति भदौरिया सहित रिसर्च स्टूडेंट्स, सुभाशिस पाल, ... खान, श्याम सुंदर पाल मीना, मोनिका मितल, कोनिका पोरवा... श्रीवास्तव, इशा तनेजा, जाकिर हुसैन और धनराजु मंडलपु श...

विटामिन डी की भी होती है कमी

डॉ. नैबेद्य ने बताया कि यह दवा विटामिन डी की कमी का कार... है. शरीर में कैल्शियम और फॉस्फेट का संतुलन बनाए र... हार्मोन को भी बदल देती है. थियोफायलिन विटामिन डी का ... उत्पादन करने वाले एंजाइम को भी रोकता है जिससे विटामि... स्तर गिरावट आती है. विटामिन डी एक हार्मोन है जो संक्रमण ... के लिए स्वस्थ प्रतिरक्षा प्रणाली का रखरखाव करता है औ... कार्डियो वैस्कुलर व मेटाबोलिक स्वास्थ्य के लिए आवश्यक...

एसजीपीजीआई के साथ होगी रिसर्च

डॉ. नैबेद्य ने बताया कि इस प्रीक्लीनिकल रिसर्च के आ... एसजीपीजीआई में एक क्लीनिकल रिसर्च शुरू की जाएगी. ... की डायरेक्टर डॉ. मधु दीक्षित के अनुसार रिसर्च का उद्दे... लोग और डॉक्टर्स जागरुक हो और मरीजों में आस्टियोप... के खतरे के मैनेजमेंट किया जा सके. साथ ही विटामिन डी ... मात्रा का भी देने का ध्यान रखा जा सके.

http://inextepaper.jagran.com/1299343/INEXT-LUCKNOW/29-07-17#page/3/2

Indian envoy to Ethiopia visits CSIR, CDRI

PIONEER NEWS SERVICE ■ LUCKNOW

Keeping in line with Prime Minister Narendra Modi's emphasis on stronger and long-term cooperation between African countries and India for mutual benefits the efforts of the director general, CSIR, for implementing twining programmes, the Ambassador of India to Ethiopia, Anurag Srivastava, visited the CSIR-Central Drug Research Institute on Monday. The main objective of his visit was to focus on the future prospects of bilateral collaboration between the two countries in terms of scientific and industrial research, particularly in the pharmaceutical research sector.

The ambassador to Ethiopia, Anurag Srivastava, told the panel of scientists that it had a good biodiversity and many traditional medicinal plants should be tested scientifically. He further said that in Ethiopia more than 35 public universities were running and more than 200 Indian faculties were contributing in the improvement of science and technical education there. "CSIR-CDRI can play an important role in the development of the pharmaceutical research sector in Ethiopia," he said. Referring to the MoU signed last month between CSIR and the Metal Industries Development Institute (MIDI), Ethiopia, he said there were enormous possibilities for bilateral collaboration in drug discovery and the development field too. Further he visited different laboratories and the major facilities of the Institute and had discussions with the scientists concerned in the laboratories there. Director Madhu Dikshit welcomed the guests. Senior principal scientist Saman Habib presented an outline of the activities and achievements of the Institute and also briefed about the ongoing international research programmes at the CSIR-CDRI such as the CSIR-TWAS Fellowship, the RTF-DCS Fellowship, the CV Raman International Fellowship and the JRD Tata Fellowship for the developing countries. A panel of research area coordinators and senior scientists had a discussion on various possibilities of research collaborations.

Dikshit said that CSIR-CDRI, Lucknow, could contribute in Human Resource Development for the pharmaceutical research in Ethiopia through its bilateral fellowship, skill development and specialised training programmes. "The Institute can play a major role in setting up a Centre for Excellence at Ethiopia through its expertise in drug research. In line with the CDRI's mission to provide affordable healthcare for all the Institute can also contribute in the exploration of Ethiopian flora and fauna and screening of their materials for medicinal uses in the collaborative research mode and can also contribute in the betterment of the pharmaceutical sector and drug development and research programmes of Ethiopia," she said.

आइसीएमआर-एनआइटीएम के बीच अनुबंध

सस्ती एवं सुलभ औषधियों की खोज की मुहिम

सीएसआईआर-केंद्रीय औषधि अनुसंधान संस्थान, लखनऊ एवं आईसीएमआर-नेशनल इंस्टीट्यूट ऑफ ट्रेडीशनल मैडिसिन, बेलगावी हाल ही एक सहमति पत्र पर हस्ताक्षर किए। सहमति पत्र के अनुसार दोनों संस्थान, संयुक्त रूप से भारतीय पारंपरिक औषधियों एवं हर्बल दवाओं के वैज्ञानिक सत्यापन एवं नैदानिक परीक्षण (क्लीनिकल ट्रायल्स) कर सकेंगे, जिससे आयुष (आयुर्वेद, योग एवं प्राकृतिक चिकित्सा, यूनानी, सिद्ध और होम्योपैथी) चिकित्सा पद्धति के दिशा निर्देशानुसार मरीजों के लिए नई औषधियाँ उपलब्ध करने में सहायता मिलेगी।

...शेष पृष्ठ 15 पर

सेमिनार सीडीआरआइ में कार्यक्रम का आयोजन, दुनिया में दस में से तीन लोग हैं इस रोग से पीड़ित

कई गंभीर बीमारियों की वजह है हाइपरटेंशन

जागरण संवाददाता, लखनऊ : उच्च रक्तचाप या हाइपरटेंशन शरीर में अनेक गंभीर बीमारियों जैसे हृदयघात, स्ट्रोक, किडनी, आंख संबंधी बीमारियों के खतरे को बढ़ा देता है। दुनिया में दस में से तीन लोग हाइपरटेंशन से पीड़ित हैं। पूरी दुनिया में लगभग 1.56 बिलियन लोग हाइपरटेंशन से ग्रसित हैं। उनमें से 50 फीसद लोगों को तो इसकी जानकारी भी नहीं है। यही नहीं,

से मनाया जा रहा है।

एनबीआरआइ के प्रधान वैज्ञानिक डॉ.

तनाव से छुटकारा पाने के लिए शिविर का आयोजन

वर्ल्ड हाईपरटेंशन डे को लेकर बुधवार को बाबू बनारसी दास कॉलेज ऑफ डेंटल साइंस में जागरुकता शिविर का आयोजन किया गया। डिपार्टमेंट ऑफ जनरल मेडिसिन एं डपब्लिक हेल्थ की ओर से आयोजित कैंप में तनाव से दूर रहने के नुस्खे बताए गए। इस अवसर पर संस्थान के कुलपति प्रो एके मित्तल ने

वोर ब्लड प्रेशर' पर एक रक्तचाप जांच शिविर का आयोजन संस्थान की मेडिकल ऑफिसर डॉ.शलिनी गुप्ता के निर्देशन में किया गया जिसमें 400 से अधिक लोगों ने अपना ब्लडप्रेशर चेक करवाया जिसमें अनेक वैज्ञानिक प्रशासनिक, तकनीकी स्टाफ, शोध छात्र एवं सहयोगी स्टाफ शामिल थे। अंत में डॉ.काशीफ हा... ने सभी को धन्यवाद दिया।

WORLD HEALTH DAY

CDRI bid to motivate students

PIONEER NEWS SERVICE ■ LUCKNOW

In continuation of CSIR-CDRI's mission to promote experimentation and innovativeness in education and bring confidence to the society about the relevance of the Institute in terms of social impact under the CSIR-800 programme, a motivation programme was organised at CSIR-CDRI on the occasion of World Health Day for the students of B Pharma along with their faculties from the Shambhunath Institute of Pharmacy, Jhalwa, Allahabad, on April 7, 2017.

Its major objective was to ... students ... in science ... ent knowl... overy and ... e motiva... r Sanjeev ... bout the ... SIR-CDRI ... f celebrat... Day. He ... depression ... st of caus... the World ... n (WHO) ... heme of ... ssion: let's ... the latest ... HO, more ... eople are ... ression, an ... an 18 per ... and 2015. ... or people ... ders, cou... tigma pre... essing the ... ed to live ... lives. ... dents and ... exhibit of

achievements of CSIR-CDRI and various labs. In the Pharmaceutics Division, Dr Amit Mishra interacted with the students and talked about the basics and advance research in the field of pharmaceutics. Dr Wahazuddin, discussed the various research aspects of Pharmacokinetics and Metabolism. In the Pharmacology Division Dr Anil Gaikwad interacted with the students and faculties and briefed them about the recent advances in drug discovery and development and motivated the former for pursuing a career in science.

Dr RK Singh talked about the importance of toxicological studies in drug development. Students and faculties have taken a glance of hands-on working for drug development in various labs personally and interacted with the research students too.

ब्रेस्ट कैंसर से भी बचाएंगी 'सहेली' और 'छाया'

रूमा सिन्हा • लखनऊ

ब्रेस्ट कैंसर महिलाओं में होने वाला सबसे कॉमन कैंसर है। केंद्रीय औषधि अनुसंधान संस्थान (सीडीआरआइ) द्वारा विकसित गर्भ निरोधक दवा सेंटक्रोमॉन जो महिलाओं के बीच सहेली और छाया के नाम से लोकप्रिय है अब ब्रेस्ट कैंसर से भी दो-दो हाथ करेंगी।

तीसरे व चौथे चरण के ब्रेस्ट कैंसर में इस दवा को काफी प्रभावी पाया गया है, जिससे सीडीआरआइ के हौसले बुलंद हैं। दवा के विपणन के लिए ड्रग कंट्रोलर से अनुमति मांगी गई है। अनुमति मिलते ही सेंटक्रोमान को मार्केट कर दिया

उपलब्धि

- केंद्रीय औषधि अनुसंधान संस्थान ने विकसित की है गर्भ निरोधक दवा
- दवा के वितरण के लिए ड्रग कंट्रोलर से मांगी गई है अनुमति

जाएगा। सीडीआरआइ की निदेशक डॉ.मधु दीक्षित बताती हैं कि वैज्ञानिकों ने सेंटक्रोमान में एंटी कैंसर एजेंट की पहचान की थी। इसके लिए कुछ मरीजों पर ट्रायल भी किए गए थे जिसमें कैंसर के तीसरे व चौथे चरण के मरीजों में इसे काफी प्रभावी पाया गया था।

संबंधित खबर » 7

'PM's visit to CDRI a morale booster for scientists'

PIONEER NEWS SERVICE ■ LUCKNOW

He listened more than he spoke at the Central Drug Research Institute and his parting words to the CDRI scientists were "All the best." A ripple of excitement ran through the majestic campus of the CDRI as Prime Minister Narendra Modi arrived at 5.25 pm on his first-ever visit to any CDRI of the country straight after his arrival in the state capital.

For the research scientists and faculty, it was a major boost since the Prime Minister is also the president of the CSIR (Council for Scientific and Industrial Research). Director Madhu Dikshit said the Prime Minister was amply satisfied with the visit after viewing its achievements. The Prime Minister visited the eight stalls which highlighted the various achievements of the CDRI during the past and was briefed

Prime Minister Narendra Modi and Chief Minister Yogi Adityanath at the new campus of CDRI

Pioneer, Dikshit said: "The Prime Minister was given the details of CDRI's achievements in the past and present ... how to assess their effect which we explained through experiments and the clinical trials which we carried out," she added. ... sent at the exhibition st... that they were happy that ... hard work they had pu... make the visit successf...

Concern over rise in depression cases

Lucknow (PNS): Cases of depression have seen an unprecedented uptick over the last decade in Lucknow. Over 12 per cent of the total population in the state capital is in the grip of depression and the mental disorder is more common among women than among men.

This was stated by head of the Geriatric Mental Health department of King George's Medical University (KGMU) Dr SC Tiwari while delivering a lecture organised by Indian Medical Association (Lucknow) at IMA Bhawan on Friday. The programme was organised on the occasion of 'World Health Day' and themed on depression.

"Over five crore people suffer from depression. The need of the hour is to pay attention to the cure of this disease before it becomes an epidemic. A huge population in the state capital is in the grip of depression. The problem is more pronounced in women and higher number of women are being diagnosed with it. A large group of patients could not get treatment either due to social stigma or lack of awareness. The cure for this problem is possible and a patient can live a normal life after treatment," Prof Tiwari said.

"People in 15-35 year age group are more severely affected with the problem of depression. It negatively impacts their productivity and physical health in the longer run," he stressed.

Analysing the rise in number of suicides, consultant psychiatrist Dr Mohd Aleem Siddiqui said: "The Central government has recently passed Mental Health Bill under which suicide has been kept out of the category of crime. Suicide is the last stage of depression and with timely treatment, a patient could be saved from going to such an extreme. It is important to listen carefully to patients having suicidal thoughts and through planned counselling sessions along with anti-depressants, a patient's willingness to live could be raised."

Besides, renowned psychiatrist Dr Sashwat Saxena suggested symptoms to identify if a person suffers with depression. "Though we all get dissatisfied and unhappy with life, depression is deeper, more intense and prolonged than such dark phases. It leads to sharp decline in one's willingness to live and interest in day-to-day activities," he said.

CDRI holds health check-up camp

Lucknow (PNS): CSIR-CDRI in association with department of Public Health Dentistry, KGMU, organised an awareness programme and oral health check-up camp during World No Tobacco Day celebrations on Wednesday and raised the public awareness about the adverse effect of Tobacco consumption.

Chief scientist Asim Ghatak welcomed the guests and briefed about the objectives of celebrating the day. He said it was not only the government who could step in for tobacco control, people could also contribute on an individual level to making a sustainable tobacco-free world.

Madhu Dikshit

"People can commit to never take tobacco products and can also motivate others for quitting it for saving themselves from mouth cancer, hypertension, heart attack and stroke," he said.

During celebrations in the morning, Dr SK Sonkar from KGMU delivered a lecture on "Tobacco and health issues" and mentioned various shocking facts about tobacco use. He said 21 per cent people over 15 years used tobacco worldwide and tobacco killed one out of 10 adults each year. In India 43 per cent of rural and 28 per cent of urban males are consuming tobacco and tobacco products, He added.

Further, Dr Gaurav Mishra from department of Public Health Dentistry, KGMU, discussed about preventive measures for tobacco control. He said: "Tobacco spending also drains resources from households that could have been spent on other basic needs, such as food, educatio... shelter."

In her presidential r... CDRI director Madhu D... thanked both the speak... their eye-opening talk... also thanked Dr G... Mishra for organisin... healthcare camp at CDR... also expressed her co... over the increasing u... tobacco among youths.

About 200 participa... their check-up done dur... camp. A follow-up stu... also conducted on p... pants who had taken p... last year's camp.

Dr Vivek Bhosale ... posed a vote of thanks fo... speakers and resident d... and the team of the orga... committee for makin... awareness programme ... cessful.

शुक्रवार, 17 फरवरी 2017 21

हिन्दुस्तान

सीडीआरआई का पोस्टर सर्वश्रेष्ठ घोषित

पोस्टर प्रदर्शनी

लखनऊ | निज संवाददाता

बाबा साहेब भीमराव अम्बेडकर केन्द्रीय विश्वविद्यालय में 'कैंसर रोकथाम शोध में नवीनता' विषय पर चल रही चल रही तीन दिवसीय अन्तरराष्ट्रीय संगोष्ठी का पोस्टर प्रदर्शनी के साथ समापन हो गया।

समापन विश्वविद्यालय के कुलपति प्रो. आरसी सोबती ने किया। प्रदर्शनी में सीडीआरआई के एसआरएफ हरीश कुमार के पोस्टर को सर्वश्रेष्ठ घोषित किया गया। विश्वविद्यालय के प्रवक्ता प्रो. गोविन्द पांडे ने बताया कि पोस्टर प्रदर्शनी में देश-विदेश से आए शोध छात्र-छात्राओं ने अपने पोस्टर प्रदर्शित किए। कुल 103 पोस्टर लगाए गए थे। इसमें से तीन मेधावियों के पोस्टर को पुरस्कार के लिए चुना गया। उन्हें समापन समारोह के कुलपति प्रो. आरसी सोबती ने पुरस्कार देकर सम्मानित किया। इसमें सीडीआरआई के एसआरएफ हरीश कुमार सर्वश्रेष्ठ रहे। दूसरे स्थान पर बाबा साहेब भीमराव अम्बेडकर केन्द्रीय विश्वविद्यालय के शोध छात्र आलोक कुमार और तीसरे स्थान पर लखनऊ विश्वविद्यालय के एसआरएफ मनीष कुमार गुप्ता रहे। तीन दिन तक चलने वाली संगोष्ठी में मुम्बई के टाटा मेमोरियल हास्पिटल की निदेशक डॉ. शुभदा वी चिपलुन्कर, जापान के डाक्टर जोजी किटायामा, अमेरिका के डाक्टर पॉल सहित देश विदेश से अन्य डाक्टरों और विशेषज्ञों ने अपने अनुभव साझा किए कि किस प्रकार से कैंसर के लक्षण को पहचाना जा सकता है।

पोस्टर प्रतियोगिता में प्रथम पुरस्कार प्राप्त करते सीडीआरआई के हरीश कुमार

Issue 22, 2017

From the journal:
Green Chemistry

Metal-free synthesis of polysubstituted pyrroles using surfactants in aqueous medium

Amrendra Kumar,[a] Ramanand[a] and Narender Tadigoppula*[a]

Author affiliations

Abstract

An efficient and metal-free method has been developed for the synthesis of substituted pyrrole derivatives *via* intermolecular cycloaddition of substituted

Journal of Medicinal Chemistry — Article — pubs.acs.org/jmc

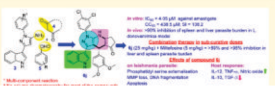
Antileishmanial Activity of Pyrazolopyridine Derivatives and Their Potential as an Adjunct Therapy with Miltefosine

Deviredy Anand, Pawan Kumar Yadav, Om P. S. Patel, Naveen Parmar, Rahul K. Maurya, Preeti Vishwakarma, Kanumuri S. R. Raju, Isha Taneja, M. Wahajuddin, Susanta Kar, and Prem P. Yadav

Medicinal and Process Chemistry Division, Parasitology Division, Pharmacokinetics and Metabolism Division, CSIR-Central Drug Research Institute, BS-10/1, Sector 10, Jankipuram Extension, Sitapur Road, Lucknow 226031, India
Academy of Scientific and Innovative Research, Anusandhan Bhawan, New Delhi 110025, India

Supporting Information

ABSTRACT: A series of pyrazolo(dihydro)pyridines was synthesized and evaluated for antileishmanial efficacy against experimental visceral leishmaniasis (VL). Among all compounds, 6d and 6j exhibited better activity than miltefosine against intracellular amastigotes. Compound 6j (50 mg/kg/day) was further studied against *Leishmania donovani*/BALB/c



Springer Link

Molecular Neurobiology
pp 1–17 | Cite as

Angiotensin Receptor Blockade by Inhibiting Glial Activation Promotes Hippocampal Neurogenesis Via Activation of Wnt/β-Catenin Signaling in Hypertension

Authors — Authors and affiliations

Shahnawaz Ali Bhat, Ruby Goel, Shubha Shukla, Rakesh Shukla, Kashif Hanif

Article
First Online: 07 September 2017

Abstract

Hypertension is ... stroke and Alzh... ...th gliosis and impaired neurogenesis. Further, renin angiotensin system (RAS) is

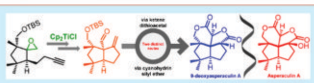
Organic Letters — Letter — pubs.acs.org/OrgLett

Radical Approach to the Chiral Quaternary Center in Asperaculin A: Synthesis of 9-Deoxyasperaculin A

Dipendu Das and Tushar Kanti Chakraborty

CSIR-Central Drug Research Institute, Sector 10, Jankipuram Extension, Sitapur Road, Lucknow 226031, India
Department of Organic Chemistry, Indian Institute of Science, Bangalore 560012, India

Supporting Information



ABSTRACT: Diastereoselective approaches toward the synthesis of a marine-derived sesquiterpenoid fungal metabolite, asperaculin A, are delineated, combining step economy and simplicity. Two distinct lactonization sequences from a common intermediate led to the first synthesis of 9-deoxyasperaculin A, a novel dioxa[5.5.5.6]fenestrane, in 14 steps (16% overall yield) and 16 steps (18% overall yield), respectively. [2,3]-Wittig–Still rearrangement and Ti(III)-mediated epoxide opening–cyclization were employed as some of the key steps for the stereoselective generation of the vicinal all-carbon quaternary centers of the target molecule.

Green Chemistry

COMMUNICATION

Metal-free synthesis of polysubstituted pyrroles using surfactants in aqueous medium†

Amrendra Kumar, Ramanand and Narender Tadigoppula*

Cite this: Green Chem., 2017, 19, 5385
Received 22nd June 2017, Accepted 17th October 2017
DOI: 10.1039/c7gc01874f

An efficient and metal-free method has been developed for the synthesis of polysubstituted pyrrole derivatives via intermolecular cycloaddition of substituted 1-phenyl-2-(phenylamino)-ethan-1-one/1-phenyl-2-(phenylamino)-propan-1-ones/2-((4-methoxyphenyl)amino)-1-(thiophen-2-yl)ethan-1-one/1-(furan-2-yl)-2-((4-methoxyphenyl)amino)ethan-1-one/1-(benzofuran-3-yl)-2-((4-methoxyphenyl)amino)ethan-1-one and dialkyl acetylene dicarboxylate/ethylbutyno-

tumor activities. Pyrrole-containing compounds also have many applications as chemosensors, for laser manufacture, and image diagnosis. The pyrrole derivatives in general are synthesized by using the methods reported by Knorr, Pall-Knorr, and Hantzsch, transition-metal catalysed cyclizations, cycloaddition methods, isocyanide-based reactions, rearrangement reac-

Taylor & Francis Online

Journal
Analytical Letters
Volume 50, 2017 - Issue 1

BIOANALYTICAL

Determination of Pentacyclic Triterpenes from *Betula utilis* by High-Performance Liquid Chromatography and High-Resolution Magic Angle Spinning Nuclear Magnetic Resonance Spectroscopy

Anil Bhatia, Baleshwar Meena, Sanjeev K. Shukla, Om P. Sidhu, Dalip K. Upreti, Anuradha Mishra, ...show all

Issue 22, 2017

From the journal:
Green Chemistry

Metal-free synthesis of polysubstituted pyrroles using surfactants in aqueous medium

Amrendra Kumar,[a] Ramanand[a] and Narender Tadigoppula*[a]

Clinical Cancer Research

Therapeutics

Abstract 51: The eukaryotic translation initiation factor 4H regulates proliferation, migration, and invasion in cancer cells

Manohar Singh, Rachana Trivedi, and Durga Prasad Mishra

DOI: 10.1158/1557-3265.HEMMAL17-51 Published December 2017

December 2017
Volume 23, Issue 24
Supplement

Abstracts: Second AACR Conference on Hematologic Malignancies: Translating Discoveries to Novel Therapies; May 6-9, 2017; Boston, MA

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Critical Reviews™ in Therapeutic Drug Carrier Systems
DOI: 10.1615/CritRevTherDrugCarrierSyst.2017017912
pages 63-96
Volume 34, 2017
ISSN Print: 0743-4863
ISSN Online: 2162-660X

Lessons Learned from Gemcitabine: Impact of Therapeutic Carrier Systems and Gemcitabine's Drug Conjugates on Cancer Therapy

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ABSTRACT
Currently, drug delivery systems have a high impact in cancer therapy and are receiving more attention... Compared with current cancer therapies, gemcitabine (2', 2'-difluoro-2'-deoxycytidine) ... chemotherapeutic agent against pancreatic, colon, bladder, breast, ovarian, non-small-cell lung, and ...

सी एसआईआर सीडीआरआई CSIR CDRI

nature neuroscience

Brief Communication

Developmentally defined forebrain circuits regulate appetitive and aversive olfactory learning

Nagendran Muthusamy, Xuying Zhang, Caroline A Johnson, Prem N Yadav & H Troy Ghashghaei

Nature Neuroscience 20, 20–23 (2017)
doi:10.1038/nn.4452
Received: 23 June 2016
Accepted: 01 November 2016

PLOS

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Deletion of the rodent malaria ortholog for falcipain-1 highlights differences between hepatic and blood stage merozoites

Christine S. Hopp, Brandy L. Bennett, Satish Mishra, Christine Lehmann, Kirsten K. Hanson, Jing-wen Lin, Kimberly Rousseau, Filomena A. Carvalho, Wouter A. van der Linden, Nuno C. Santos, Matthew Bogyo, Shahid M. Khan, Volker Heussler, Photini Sinnis

Published: September 18, 2017 • https://doi.org/10.1371/journal.ppat.1006586

Issue 80, 2017

From the journal:
Chemical Communications

A stereoselective thiocyanate conjugate addition to electron deficient alkynes and concomitant cyclization to N,S-heterocycles

Vikas Dwivedi,[a] Manda Rajesh,[a] Ravi Kumar,[ab] Ruchir Kant[c] and Maddi Sridhar Reddy*[abc]

Author affiliations

ChemComm

COMMUNICATION

A stereoselective thiocyanate conjugate addition to electron deficient alkynes and concomitant cyclization to N,S-heterocycles†

Vikas Dwivedi, Manda Rajesh, Ravi Kumar, Ruchir Kant and Maddi Sridhar Reddy

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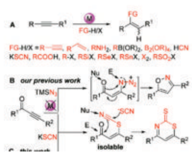
DOI: 10.1039/c7cc06088a

A regio- and stereoselective thiocyanate addition to ynones is achieved using KSCN in AcOH at 70 °C. The reaction is extendable to ynals, ynesulfones, ynoic acids and ynoates. Adducts from ynones were readily transformed into thiazine-2-thione derivatives under slightly modified reaction conditions. In contrast, thiocyanated adducts from ynamides underwent an in situ decyanative amide cyclization towards isothiazolones. None of these events needed any transition metal or catalyst, attaining a high synthetic value.

Hydrofunctionalization of alkynes is a remarkable strategy to access a variety of highly substituted/functionalized olefins with very high regio- and stereoselective selectivities. This has uncovered the ways to solve several long lasting problems in the selective synthesis of olefins through conventional methods. The strategy is highly reliable because the starting materials



ACS Publications

Organic Letters

Letter

Decarbethoxylative Arylation Employing Arynes: A Metal-Free Pathway to Arylfluoroamides

Ekta Gupta, Ruchir Kant, and Kishor Mohanan
Medicinal & Process Chemistry Division and Molecular and Structural Biology Division, CSIR-Central Drug Research Institute, BS-10/1, Sector 10, Jankipuram extension, Sitapur Road, P.O. Box 173, Lucknow 226031, India
Academy of Scientific and Innovative Research, New Delhi 110001, India

Analytical Letters

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Determination of Pentacyclic Triterpenes from Betula utilis by High-Performance Liquid Chromatography and High-Resolution Magic Angle Spinning Nuclear Magnetic Resonance Spectroscopy

Anil Bhatia, Baleshwar Meena, Sanjeev K. Shukla, Om P. Sidhu, Dalip K. Upreti, Anuradha Mishra, Raja Roy & Chandra Shekhar Nautiyal

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ELSEVIER

Acta Biomaterialia
Volume 57, 15 July 2017, Pages 170-186

Full length article

Selective phenylalanine to proline substitution for improved antimicrobial and anticancer activities of peptides designed on phenylalanine heptad repeat

Amit Kumar Tripathi[a], Tripti Kumari[a], Anshika Tandon[a], Mohd. Sayeed[a], Tayyaba Afshan[a], Manoj Kathuria[c], P.K. Shukla[b], Kalyan Mitra[c], Jimut Kanti Ghosh[a]

https://doi.org/10.1016/j.actbio.2017.05.007

nature nanotechnology

Article

A synthetic intrabody-based selective and generic inhibitor of GPCR endocytosis

Eshan Ghosh, Ashish Srivastava, Mithu Baidya, Punita Kumari, Hemlata Dwivedi, Kumari Nidhi, Ravi Ranjan, Shalini Dogra, Akiko Koide, Prem N. Yadav, Sachdev S. Sidhu, Shohei Koide & Arun K. Shukla

Nature Nanotechnology 12, 1190–1198 (2017)
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Received: 27 January 2017
Accepted: 13 August 2017
Published online: 02 October 2017

PubMed

Physical interaction of estrogen receptor with MnSOD: implication in mitochondrial O2.- upregulation and mTORC2 potentiation in estrogen-responsive breast cancer cells.

Abstract
Augmented reactive oxygen species levels consequential to functional alteration of key mitochondrial attributes contribute to carcinogenesis, either directly via oxidative DNA damage infliction or indirectly via activation of oncogenic signaling cascades. We previously reported activation of a key oncogenic signaling cascade via mammalian target of rapamycin (mTOR) signaling complex-2 (mTORC2) owing to estrogen receptor (ER-α)-dependent augmentation of $O_2^{\cdot-}$ within the mitochondria of 17-β-estradiol (E2)-stimulated breast cancer cells. ... In addition, we also observed diminished interaction of MnSOD with sirtuin-3, the key mitochondrial deacetylase in the presence of ER-α ...