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Council of Scientific & Industrial Research
www.csir.res.in

CSIR - CDRI Newsletter

CSIR - Central Drug Research Institute, Lucknow
www.cdriindia.org

From the Director's Desk

Indeed, it gives me immense pleasure to share with you the current issue of CSIR-CDRI Newsletter. Following pages give glimpses of activities and achievements of CSIR-CDRI during the last six months. I am glad to state that the Institute is making strident progress in all fronts towards fulfilling its mandate. DCGI permission for phase I clinical trial of antidiabetic candidate drug CDR134F194 has been received and study is to be initiated shortly at our Mumbai Centre. Phase-I PK studies for the antimalarial candidate drug 97-78 has been initiated at PGI, Chandigarh. During last six months, many Institutes have joined us for collaborative research in the area of health and pharmaceutical research. In 2011, so far, we have already published >180 research papers in international journals including >91 publications having IF >3. Following our stringent policy for IPR, in the year 2011, so far, we have filed 15 patents in India and 4 patents abroad. Further 2 Indian patents and 3 foreign patents have been granted. This indicates our commitment towards the mandate as well as societal responsibility. Our scientists and research fellows once again proved their mettle by receiving prestigious awards including CRSI Medal and Young Scientist Award. I congratulate all of them.

It is very disheartening to report untimely demise of Dr. Vinod Bhakuni on July 15, 2011, who has made outstanding contributions in the area of protein chemistry. His work has fetched many awards including the prestigious Bhatnagar Prize and Fellowships of the three premier Indian Science Academies. His sudden demise is a great loss for the Institute.

One of our ambitious projects, OSDD Chemistry Outreach Program has been approved by DG, CSIR. Other project OSDD malaria has received in-principle approval from the competent authorities. CSIR-CDRI acts as nodal lab in both the projects. I anticipate participation of a large number of researchers in both the above projects and grand success. On 5 September 2011, the historic AcSIR Bill has been passed by the Lok Sabha that will now enable CSIR to award post-graduate and doctoral degrees to its students. It is just a good beginning. Still we have to go a long way to impress our society and leave a remarkable footprint for the coming generation.

I record my heartiest thanks and deepest gratitude to the entire staff of the Institute for their dedicated and wholehearted support in progressive functioning of the Institute and look forward for continued support.

With best wishes

T. K. Chakraborty

(Tushar Kanti Chakraborty)

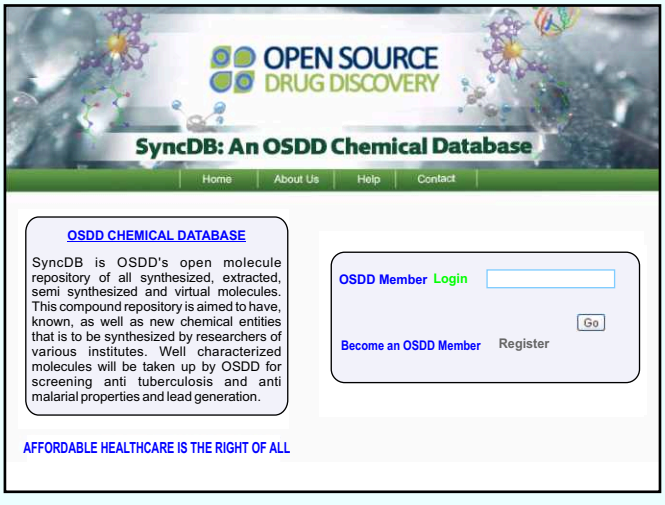
OSDD Chemistry Outreach Program

CSIR-CDRI Initiative

On the occasion of the International Year of Chemistry, CSIR has launched a Chemistry Outreach Program to create an Open Chemical Library mainly by the M.Sc. as well as Ph.D. students at universities/institutes across the length and breadth of the country to synthesize a large number of organic compounds which will be screened against various infectious diseases under the Open Source Drug Discovery (OSDD) program. The project aims to:

- Impart practical training to large number of M.Sc. students specializing in Organic Chemistry
- Involve various universities, IITs, IISERs and other academic institutes
- CSIR to set up OSDD OUTREACH CENTRES in some of its labs like CSIR-CDRI (Lucknow), CSIR-NEIST (Jorhat), CSIR-IICB (Kolkata), CSIR-NIIST (Trivandrum), CSIR-IICT (Hyderabad), CSIR-NCL (Pune), CSIR-IIIM (Jammu)
- Besides, University departments designated for carrying out these works to train other students from nearby colleges and universities who do not have any facility
- The compounds generated from the exercise to be submitted to the repository for screening and archiving.

For further details on the program and registration visit http://crdd.osdd.net/syncdb/index.html



A Newsletter from
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(Council of Scientific and Industrial Research, New Delhi)
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CONTRIBUTIONS TO SCIENCE & TECHNOLOGY

Candidate Drugs under Advance Stages of Development

Diseases / Disorders	Candidate Drug	Efficacy	Clinical Status	Licensees & Collaborators
Liver Disorder	**Picroliv**	Hepatoprotective	Phase III clinical trial completed at CSMMU, Lucknow and Seth GS Medical College & KEM Hospital Mumbai	DIL, Mumbai
Dyslipidemia	**80-574 + Atorvastatin**	Antidyslipidemic	Extended phase III clinical trial	Cadila Pharmaceuticals Ltd., Ahmedabad
Malaria	**97-78**	Antimalarial	Phase-I single dose clinical study completed. Single dose pharmacokinetic study in healthy volunteers initiated	IPCA Labs., Mumbai
Diabetes	**CDR 134D123**	Antihyperglycemic	Phase-I single & multiple dose studies completed. A quality document as per Ayurvedic Pharmacopoeia of India specifications is being compiled for submission to CCRAS for expedited inclusion of *Xylocarpus granatum* in the Extra Ayurvedic Pharmacopeia to avail marketing permission from AYUSH	TVC Sky Shop Ltd., Mumbai
Diabetes & Dyslipidemia	**CDR 134F194**	Antihyperglycemic	DCG(I) permission to conduct phase 1 clinical trial received in May 2011 and preparation for the same has been initiated	TVC Sky Shop Ltd., Mumbai
Osteoporosis	**99-373**	Anti-osteoporotic	Plan and protocol of phase I clinical trial has been approved by DCG(I)	Negotiations in progress with MDRI
Malaria	**99-411**	Antimalarial	Pre-clinical data is under compilation for IND submission	IPCA Labs., Mumbai
Stroke	**Herbal Medicament**	Neuroprotective	Draft IND received from Themis Medicare is under review at CDRI for preparation of final IND document	Themis Medicare Ltd., Mumbai

Potential New Leads

Diseases / Disorders	Lead	Efficacy	Status	Licensees & Collaborators
Osteoporosis	**CDR1020F147** OsteoJuvenate	Optimum bone health	Completed requisite preclinical development; Process to obtain approval for clinical trial has been initiated	Natural Remedies Pvt., Ltd., Bangalore
Osteoporosis	**S-007-1500**	Fracture healing	Compound found safe in single dose toxicity study by oral route in rat and mice and by IM route in rat. One year stability study completed	Open for licensing
Osteoporosis	**CDR914K058**	Osteogenic	Efficacy established in animal models. Synthesis of compound in progress	Under negotiation
Thrombosis	**S-007-867**	Antithrombotic	Compound found safe in single dose toxicity study by oral route in rat and mice and by IM route in rat	Open for licensing
	S-002-333	Antithrombotic	Compound found safe in single dose toxicity study by oral route in rat	Open for licensing
Diabetes & Dyslipidemia	**CDR267F018**	Antidyslipidemic	28 day repeat dose toxicity study in Rh monkey: No significant toxic effect observed up to dose of 250 mg/kg po	Open for licensing
Contraception	**S-010-1255**	Spermicidal & Antitrichomonal	Potent spermicidal and anti-trichomonal (against both metronidazole susceptible and resistant strains) activity established with much higher safety index compared with Nonox-9	Open for licensing
Cancer	**S-009-131**	Anticancer	As per the studies in mice bearing cervical cancer (HeLa), activity is better than that of standard drug Adriamycin	Open for licensing
Tuberculosis	**S-006-830**	Anti-TB	MIC<3 µg/mL for Mtb H37Rv. Efficacy established *in vitro* & *ex vivo*. Large scale synthesis completed. QC analysis of pure compound in progress	Being developed under OSDD program

CONTRIBUTIONS TO SCIENCE & TECHNOLOGY

1. **A novel quercetin analog from a Indian medicinal plant with promising osteogenic action.** (Sharan K, Mishra JS, Swarnkar G, Siddiqui JA, Khan K, Kumari R, Rawat P, Maurya R, Sanyal S, Chattopadhyay N; **J Bone Miner Res.** 2011, Jun 2. doi: 10.100 2/jbmr.434; **IF: 7.056**)

A 6-C-β-D-glucopyranosyl-(2S,3S)-(+)-3',4',5,7-tetrahydroxyflavanol (GTDF), a novel flavonol-C-glucoside isolated from the extracts of *Ulmus wallichiana* had a non-estrogenic bone sparing effects on OVx rats. The effects of GTDF on osteoblast function and its mode of action and *in vivo* osteogenic effect was studied. GTDF stimulated osteoblast proliferation, survival and differentiation, but had no effect on osteoclastic or adipocytic differentiation. In cultured osteoblasts, GTDF transactivated aryl hydrocarbon receptor (AhR). Activation of AhR mediated the stimulatory effect of GTDF on osteoblast proliferation and differentiation. Furthermore, GTDF stimulated cAMP production, which mediated osteogenic gene expression. Together, data suggest that GTDF stimulates osteoblast growth and differentiation via AhR and promotes modeling-directed bone accrual, accelerates bone healing after injury and exerts anabolic effects on osteopenic rats by likely direct stimulatory effect on osteoprogenitors. Based on these preclinical data, clinical evaluation of GTDF as potential bone anabolic agent is warranted.

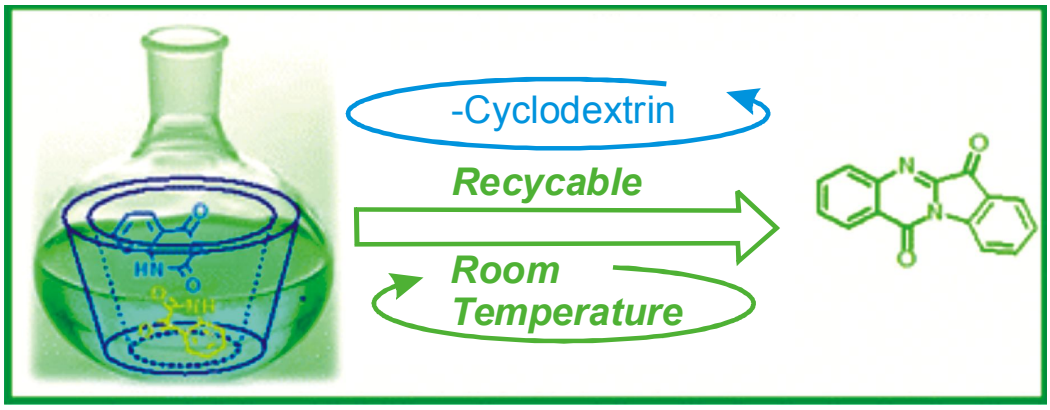
2. **A synthetic S6 segment derived from KvAP channel self-assembles, permeabilizes lipid vesicles and exhibits ion channel activity in bilayer lipid membrane.** (Verma R, Malik C, Azmi S, Srivastava S, Ghosh S, Ghosh JK. **J Biol Chem.**, 2011; 286(28): 2482 8-41, **IF: 5.328**)

KvAP is a voltage-gated tetrameric K(+) channel with six transmembrane (S1-S6) segments in each monomer from the archaeon *Aeropyrum pernix*. The objective of the present investigation was to understand the plausible role of the S6 segment, which has been proposed to form the inner lining of the pore, in the membrane assembly and functional properties of KvAP channel. For this purpose, a 22-residue peptide, corresponding to the S6 transmembrane segment of KvAP (amino acids 218-239), and a scrambled peptide (S6-SCR) with rearrangement of only hydrophobic amino acids but without changing its composition were synthesized and characterized structurally and functionally. Although both peptides bound to the negatively charged phosphatidylcholine/phosphatidylglycerol model membrane with comparable affinity, significant differences were observed between these peptides in their localization, self-assembly and aggregation properties onto this membrane. S6-SCR also exhibited reduced helical structures in SDS micelles and phosphatidylcholine/ phosphatidylglycerol lipid vesicles as compared with the S6 peptide. Furthermore, the S6 peptide showed significant membrane-permeabilizing capability as evidenced by the release of calcein from the calcein-entrapped lipid vesicles, whereas S6-SCR showed much weaker efficacy. Interestingly, although the S6 peptide showed ion channel activity in the bilayer lipid membrane, despite having the same amino acid composition, S6-SCR was significantly inactive. The results demonstrated sequence-specific structural and functional properties of the S6 wild type peptide. The selected S6 segment is

probably an important structural element that could play an important role in the membrane interaction, membrane assembly, and functional property of the KvAP channel.

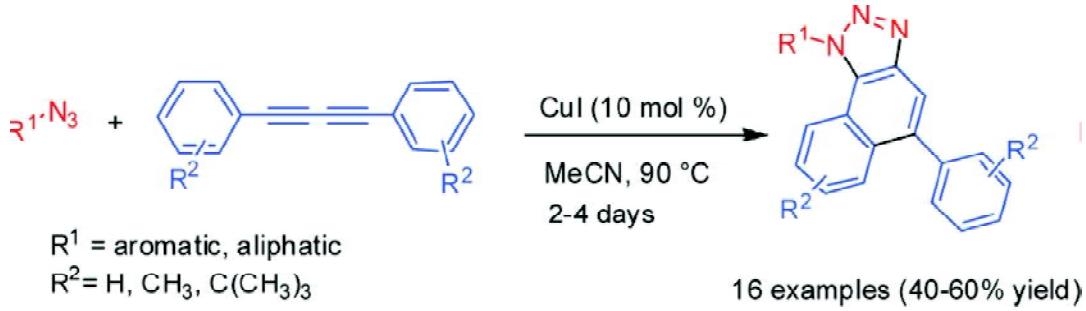
3. **β-Cyclodextrin catalysed synthesis of tryptanthrin in water.** (Kumar A, Tripathi VD and Kumar P; **Green Chemistry** 2011, 13 (1): 51-54; **IF: 5.472**)

An efficient and green method has been developed for the synthesis of tryptanthrin employing β-cyclodextrin as a catalyst in aqueous media at room temperature from isatoic anhydride and isatin. The reactions were performed under mild conditions to afford biologically active natural product tryptanthrin in excellent yields.



4. **Unprecedented Cu-catalyzed coupling of internal 1,3-diynes with azides: One-pot tandem cyclizations involving 1,3-dipolar cycloaddition and carbocyclization furnishing naphthotriazoles.** (Mandadapu AK, Sharma SK, Gupta S, Krishna DG, Kundu B; **Organic Letters** 2011; 13(12) 3162- 5; **IF: 5.250**)

A one-pot protocol for the synthesis of triazole-annulated polyheterocycles via metal-catalyzed coupling of internal 1,4-disubstituted 1,3-diynes and organic azides has been described. The mechanistic rationale for the reaction suggests tandem cyclizations involving copper-catalyzed cycloaddition and 6-endo carbocyclization reactions. The cascade cyclization leads to an increase in molecular complexity to furnish naphtho[1,2-d]triazoles in satisfactory yields. The generality of the method has been demonstrated by using a series of aromatic/aliphatic azides and symmetrical internal 1, 3-diynes.



BUSINESS DEVELOPMENT ACTIVITIES

The Institute continued 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:

Details	Client/Collaborator	Date of Signing the Agreement
Sponsored Project Agreement		
To investigate the toxicological profile of MA 305 formulation using single dose 14 days toxicity studies in mice by oral route	Maharishi Ayurveda Products Pvt. Ltd., Noida.	26-06-2011
Memorandum of Agreement		
Effect of Sulphadoxine – Pyrimethamine co-administration on pharmacokinetics of α/β – Arteether, an antimalarial agent in healthy male volunteers	Chhatrapati Shahuji Maharaj Medical University, Lucknow.	19-04-2011
To record the neurobehavioral parameters in the pretreated animals.	Allahabad University, Allahabad	11-07-2011
Isolation and characterization of antidiabetic secondary metabolites from two selected medicinal plants	Chhatrapati Shahuji Maharaj Medical University, Lucknow	02-08-2011
Material Transfer Agreement		
Antisera recognizing N-6 methyladenine	New England BioLabs, Inc 240 Country Ipswich MA 01938-2723	10-06-2011
AR423 strain	National University Corporation Kumamoto University, Japan	05-07-2011
Green fluorescent protein (GFP) - *Leishmania donovani* Dd8 strain	Hong Kong Polytechnic University, Hong Kong	09-08-2011
Confidential Disclosure Agreement		
Phyto extract from plant - 4744, showing osteoprotective activity by non-estrogenic osteogenic mode	Arjuna Natural Extracts Limited, Kochi, Kerala	10-05-2011
Lead molecule-93/478, showing promising anti ischemic, cardioprotective and antihypertensive activity	Laila Pharmaceuticals Pvt. Ltd., Tamil Nadu	25-7-2011

New Projects Undertaken

Grant in Aid Projects

1 Electronic structure theory based investigation of conformational behavior and secondary structures of substituted β-proline based peptides conformational studies and biological evaluation

This is a joint collaborative project, involving researchers from CSIR-CDRI, Lucknow and IIIT, Hyderabad. As an important/attractive strategy to develop new anti-platelet molecules, the project intend to build peptides using novel β-prolines and investigate their structures by theoretical methods using different *ab initio* and where necessary QM/MM methods; The structures will also be experimentally investigated and some of the peptides will be evaluated for inhibition of collagen mediated platelet activation.

PI: Dr. TK Chakraborty, Director, CSIR-CDRI and Dr. RS Ampapathi, Senior Scientist, SAIF

Funding Agency: DST

Approved budget: ₹ 21.02 lakh (CSIR-CDRI Component only)

2 Impact of adipokine and chemokine gene polymorphism and its protein expression in metabolic syndrome

This is a joint collaborative project involving researchers from CSMMU, Lucknow, CSIR-CDRI, Lucknow and ESI Hospital, Lucknow. In this study, using candidate-based approach, adipokine and chemokine gene polymorphisms and their circulating levels will be analyzed in a case-control set-up. This project is expected to identify genetic marker(s) for assessment of susceptibility of metabolic syndrome. This will not only help in prediction of disease risk but also possibly assist in formulating specifically-targeted personalized medicine in future.

PI: Dr. Ashim Ghatak, Chief Scientist, Clinical & Experimental Division and Dr. Rituraj Konwar, Scientist, Endocrionology

Funding Agency: ICMR

Approved budget: ₹ 5.47 lakh (I yr grant, CSIR-CDRI component only)

3 Nucleosomal histone proteins of *Leishmania donovani*: Molecular and immunobiochemical characterization for its potential as vaccine target against visceral leishmaniasis

The proposed study intends to study immunological and molecular characterization of nucleosomal histone proteins of *Leshmania donovani*, analysis of their stage specific expressions and their prophylactic potential against experimental VL.

PI: Dr. Anuradha Dube, Chief Scientist, Parasitology

Funding Agency: ICMR

Approved budget: ₹ 16.39 lakh (I yr grant only)

4 Production of microbial heparinases to produce low molecular weight heparins used as antithrombotic agents

The proposed study intends to produce/ optimize novel potential heparinases by new microorganisms. Project involves screening for isolation of heparinase producing microbes, optimization, purification, characterization and evaluation of antithrombotic activity. Expected outcome of the investigations has enough potential for technology development and commercialization.

PI: Dr. CKM Tripathi, Senior Principal Scientist, Fermentation Technology

Funding Agency: UPCST

Approved budget: ₹ 5.36 lakh

5 Crystallographic and biochemical studies on feast/famine regulatory proteins from mycobacteria

The project aims to use a combination of crystallographic, genetic, biochemical and computational techniques to understand molecular mechanisms of feast/famine regulatory proteins from mycobacteria. These proteins bind to small molecules like amino acids to effect functional modulations. The project aims to solve the crystal structures of above proteins with/without appropriate ligands, examine interactions with specific DNA sequences. The group will also try to identify novel small molecules through virtual screening which can be used as a functional probe and evaluate these proteins as novel therapeutic targets.

PI: Dr. Ravishankar R, Principal Scientist, Molecular & Structural Biology

Funding Agency: DBT

Approved budget: ₹ 9.00 lakh

6 Preclinical development of DSE-37 [S,S"-{disulfanediylbi (pyrrolidinopropane-2,1-diyl}-bis-(piperidinothiocarbamate)] as a vaginal contraceptive

Recently, CSIR-CDRI discovered a novel series of non-detergent spermicidal compounds, the disulfide esters (DSE) of carbothioic acid which displayed extremely potent spermicidal action by killing 100% human sperm at just 4% of concentration required by Nonoxynol-9 and also extremely selective spermicidal activity. Under this project, it is proposed to establish the *in vitro* (human sperm) and *in vivo* (in rabbit model) contraceptive efficacy of the above compound using a suitable formulation with DSE as the active ingredient.

PI: Dr. Gopal Gupta, Principal Scientist, Endocrinology

Funding Agency: ICMR

Approved budget: ₹ 8.936 lakh

7 Antimalarial principles from plants belonging to the genues Veronia endemic to western ghats

This is a joint collaborative project involving researchers from CSIR-CDRI, Lucknow and CSIR-NCL, Pune. The project aims for isolation and characterization of bioactive principles from the plants belonging to genus veronica, screening for antimalarial activity and structural modification of active compounds for further optimization. Attempts will be made to study the mechanism of action of active principle.

PI: Dr. Kumkum Srivastava, Principal Scientist, Parasitology

Funding Agency: DST

Approved budget: ₹ 6.26 lakh (CSIR-CDRI component only)

8 Delivery system for the management of septic shock: Rational approach towards lipopolysaccharide (LPS), neutralization and detoxification

A sepsis is a spectrum of clinical conditions caused by the immune response of a patient to infection that is characterized by systemic inflammation and coagulation. The strategy is to develop target oriented delivery systems with certain degree of cationicity and hydrophobicity that could interact with LPS (either hydrophobic or electrostatic) to alleviate macrophage stimulation and circumvent further toxic cascading events.

PI: Dr. PR Mishra, Senior Scientist, Pharmaceutics

Funding Agency: ICMR

Approved budget: ₹ 15.0 lakh

9 Isolation, identification, characterization and bioactivity assay of antidiabetic drug leads from few selected medicinal plants of north east India: Voyage for cure of diabetes

This is a joint collaborative project involving researchers from CSIR-CDRI, Lucknow and Assam University, Silchar. The project aims to develop a hypoglycaemic product of patentable quality with full understanding of their molecular mechanism of action utilising traditional medicinal plants of North-East India.

PI: Dr. AN Gaikwad, Scientist, Drug Target Discovery & Development
Funding Agency: DBT
Approved budget: ₹ 22.25 lakh (CSIR-CDRI component only)

Industry Sponsored Project

10 To investigate the toxicological profile of MA 305 formulation using single dose 14 days toxicity studies in mice by oral route

Under this sponsored project, CSIR-CDRI has undertaken a study to measure the toxicological profile of 'MA 305 formulation' through single dose 14 day toxicity studies in mice by oral route as per the protocol approved by the Maharishi Ayurveda Products Private Ltd., Noida.

PI: Dr. Sharad Sharma, Principal Scientist, Toxicology
Funding Agency: M/s Maharishi Ayurveda Products Pvt. Ltd., Noida
Approved budget: ₹ 3.00 lakh

New Models/Facilities in Animal House

SHR Rat (Specific Hypertensive Rat): Disease specific animal model for use for CVS, antihypertensive and congestive heart failure studies

Animal Genetic Monitoring Lab

C57BL/6 Mice: Background strain for transgenesis. Used in cardiovascular and audiogenic seizure studies

Animal Health Monitoring Lab

OPEN SOURCE DRUG DISCOVERY FOR MALARIA

(CSIR-CDRI as Coordinating Laboratory)

Council of Scientific & Industrial Research (CSIR), India

Research Institutes (India)

Research Partners (other countries)

University & College researchers/students (India)

Companies/CROs

International Agencies

The project aims to:

- Identify pathways and novel targets using bioinformatics and systems approaches.
- Identify chemical entities of interest and use open source for wide participation in chemical synthesis of compounds, lead optimization and cross validation of data.
- Set-up and validate *in vitro* and *in vivo* screening systems, evaluate drug kinetics and drug-drug interaction.
- Search for anti-malarial compounds from plants under traditional use.
- Drug development (toxicity profiling, pharmacokinetics, evaluation in monkeys (*P. cynomolgi*), take candidate drugs through Phase I and early efficacy studies).

For further details, please visit http://malaria.osdd.net

Some Important Publications

(April - September 2011)

SN	Authors	Title	Journal	Impact Factor
1.	Srivastava J S	Cost is always an ethical issue in developing countries	**British Medical Journal** (Rapid Communication) 2011;342:doi:10.1136/bmj.d2813	**13.471**
2.	Saxena R & Dwivedi A	ErbB family receptor inhibitors as therapeutic agents in breast cancer: Current status and future clinical perspective	**Medicinal Research Reviews** 25 Oct 2010	**10.228**
3.	Rajender S, Avery K & Agarwal A	Epigenetics, spermatogenesis and male infertility	**Mutat Res.- Rev Mutation** 727(3):62-71	**8.741**
4.	Sharan K, Mishra JS, Swarnkar G, Siddiqui JA, Khan K, Kumari R, Rawat P, Maurya R, Sanyal S & Chattopadhyay N	A novel quercetin analog from a medicinal plant promotes peak bone mass achievement, bone healing after injury and exerts anabolic effect on osteoporotic bone: The role of aryl hydrocarbon receptor as a mediator of osteogenic action.	**J Bone Miner Res** 2011; doi: 10.1002/jbmr.434.	**7.056**
5.	Tiwari RL, Singh V, Singh A & Barthwal MK	IL-1R-Associated kinase-1 mediates protein kinase C{delta}-induced IL-1{beta} production in monocytes.	**J Immunol.** 2011; 187(5): 2632-45	**5.745**
6.	Atul Kumar & Siddharth Sharma	A grinding-induced catalyst- and solvent-free synthesis of highly functionalized 1,4-dihydro- pyridines via a domino multicomponent reaction	**Green Chemistry** 2011, 13, 2017	**5.472**
7.	Atul Kumar, Garima Gupta & Suman Srivastava	Functional ionic liquid mediated synthesis (FILMS) of dihydro thiophenes and tacrine derivatives	**Green Chemistry** 2011; DOI: 10.1039/c1gc15410a	**5.472**
8.	Verma R, Malik C, Azmi S, Srivastava S, Ghosh S & Ghosh JK.	A synthetic S6 segment derived from KvAP channel self-assembles, permeabilizes lipid vesicles, and exhibits ion channel activity in bilayer lipid membrane	**J Biol Chem.** 2011; 286(28): 24828-41	**5.328**
9.	Nand Lal, Lalit Kumar, Amit Sarswat, Santosh Jangir & Vishnu Lal Sharma.	Synthesis of S-(2-thioxo-1,3-dithiolan-4-yl) methyl-dialkylcarba mothioate and S-thiiran-2-ylmethyl-dialkylcarbamothioate via Inter molecular O-S rearrangement in water	**Organic Letters** 2011; 13 (9), 2330-2333.	**5.250**
10.	Mandadapu AK, Sharma SK, Gupta S, Krishna DG & Kundu B.	Unprecedented Cu-catalyzed coupling of internal 1,3-diynes with azides: One-pot tandem cyclizations involving 1,3-dipolar cycloaddition and carbocyclization furnishing naphthotriazoles	**Organic Letters** 2011; 13(12), 3162-5	**5.250**

SN	Authors	Title	Journal	Impact Factor
11.	Sarswat A, Kumar R, Kumar L, Lal N, Sharma S, Prabhakar YS, Pandey SK, Lal J, Verma V, Jain A, Maikhuri JP, Dalela D, Kirti, Gupta G & Sharma VL	Arylpiperazines for management of benign prostatic hyperplasia design, synthesis, quantitative structure-activity relationships and pharmacokinetic studies	**Journal of Medicinal Chemistry** 2011; 54 (1): 302-311	**5.207**
12.	Awanit Kumara, Rizwan Ahmeda, PK Singh & PK Shukla	Identification of virulence factors and diagnostic markers using immunosecretome of *Aspergillus fumigatus*	**Journal of Proteomics** 2011; 74(7):1104-12	**5.074**
13.	Pandey BK, Srivastava S, Singh M & Ghosh JK	Inducing toxicity by introducing a leucine-zipper-like motif in frog antimicrobial peptide, magainin 2	**Biochem J.** 2011; 436(3): 609-20.	**5.016**
14.	Singh PK, Srivastava A, Singh P, Singh D, Dalela D, Goel M, Gupta S, Negi MPS, Bhatt M & Rath S	Clinical utility of survivin gene expression in patients with transitional-cell carcinoma of the urinary bladder	**Eur J Cancer** 2011; (Conference proceedings) supplements 9: 4	**4.944**
15.	Singh PK, Srivastava A, Singh P, Singh D, Dalela D, Goel M, Gupta S, Negi MPS, Bhatt M & Rath S	Diagnostic and prognostic potential of Ck20 gene expression in patients with transitional-cell carcinoma of the urinary bladder	**Eur J Cancer** 2011; (Conference proceedings) Supplements 9: 14	**4.944**
16.	Swarnkar G, Sharan K, Siddiqui JA, Mishra JS, Khan K, Khan MP, Gupta V, Rawat P, Maurya R, Dwivedi AK, Sanyal S & Chattopadhyay N	Identification of a rare naringenin analog from a medicinal plant having potent bone anabolic effect by acting as an osteoblast oestrogen mimic.	**Br J Pharmacol** 2011; doi:10.1111/ j. 1476-5381.2011. 01637.x.	**4.925**
17.	Jackson KE, Habib S, Frugier M, Hoen R, Khan S, Pham J, de Pouplana LR, Royo M, Santos MAS, Sharma A & Ralph SA	Protein translation in Plasmodium parasites	**Trends in Parasitology** 2011; doi:10.1016/ j.pt.2011.05.005	**4.906**
18.	Dwivedi SK, Singh N, Kumari R, Mishra JS, Tripathi S, Banerjee P, Shah P, Kukshal V, Tyagi AM, Gaikwad AN, Chaturvedi RK, Mishra DP, Trivedi AK, Sanyal S, Chattopadhyay N, Ramachandran R, Siddiqi MI, Bandyopadhyay A, Arora A, Lundåsen T, Anakk SP, Moore DD & Sanyal S	Bile acid receptor agonist GW4064 regulates PPAR{gamma} coactivator-1{alpha} expression through estrogen receptor-related receptor {alpha}.	**Mol. Endocrinol**. 2011; 25(6): 922-32	**4.889**
19.	Rajender S, Francis A, Pooja S, Krupakar N, Surekha D, Reddy G, Rao DR, Rao L, Ramachandra S, Vishnupriya S, Ramalingam K, Satyamoorthy K, & Thangaraj K	CAG repeat length polymorphism in the androgen receptor gene and breast cancer risk: Data on Indian women and survey from the world	**Breast Cancer Res Treat.** 2011; 127(3):751-60	**4.859**
20.	Tyagi AM, Srivastava K, Kureel J, Kumar A, Raghuvanshi A, Yadav D, Maurya R, Goel A & Singh D	Premature T cell senescence in Ovx mice is inhibited by repletion of estrogen and medicarpin: A possible mechanism for alleviating bone loss.	**Osteoporos Int.** 2011 May 12. [Epub ahead of print]	**4.859**
21.	Pal P, Kanaujiya JK, Lochab S, Tripathi SB, Bhatt ML, Singh PK, Sanyal S & Trivedi AK	2-D gel electrophoresis-based proteomic analysis reveals that Ormeloxifene induces G0-G1 growth arrest and ERK-mediated apoptosis in chronic myeloid leukemia cells K562.	**Proteomics** 2011; 11(8), 1517-1529,	**4.815**

PATENTS

(April 2011-September 2011)

Patents Granted Abroad

1.	US Patent No.	7959954	Date of Grant	14-07-2011
	Title	A process for the isolation of an antidiabetic and antihyperlipidimic fraction from the fruits of *Xylocarpus granatum*, a mangrove plant.		
	Inventors	Vijai Lakshmi, Ajet Saxena, Rajesh Kumar, Raghwendra Pal, Satyawan Singh, Arvind Kumar Srivastava, Preeti Tiwari, Deepak Raina, Anil Kumar Rastogi, Sudhir Srivastava, Mahendra Nath Srivastava, Ramesh Chandra, Anju Puri & Ram Raghubir		
	Supporting Staff	Hriday Ram Mishra, Suresh Chandra, Naveen Prakash Misra, Mukesh Srivastava , Tika Ram & R.R.Gupta		
2.	South African Patent No.	2010/04272	Date of Grant	30-03-2011
	Title	An Improved process for preparation of trans-3,4-Diarylchroman		
	Inventor	Devi Prasad Sahu		
	Supporting Staff	Atma Prakash Dwivedi		

Patents Granted in India

1.	Patent No.	247797	Date of Grant	20-05-2011
	Title	Oxy substituted flavones as antihyperglycemic and antidyslipidemic agents		
	Inventors	Ram Pratap, Mavurapu Satyanarayan, Chandishwar Nath, Ram Raghubir, Anju Puri, Ramesh Chander, Priti Tiwari, Brajendra Kumar Tripathi & Arvind Kumar Srivastava		

Patents Filed Abroad

1.	Chinese Patent App. No.	200980152325.9	Filing Date	23-06-2011
	Title	Substituted benzfurochromenes and related compounds for the prevention and treatment of bone related disorders		
	Inventors	Atul Goel, Amit Kumar, Sumit Chaurasia, Divya Singh, Abnish Kumar Gautam, Rashmi Pandey, Ritu Trivedi, Man Mohan Singh, Naibedya Chattopadhyay, Lakshmi Manickavasagam, Girish Kumar Jain & Anil Kumar Dwivedi		
	Supporting Staff	Abdul Malik & Avinash Kumar		
2.	Korean Patent App. No.	10-2011-7012523	Filing Date	31-05-2011
	Title	Substituted benzfurochromenes and related compounds for the prevention and treatment of bone related disorders		
	Inventors	Atul Goel, Amit Kumar, Sumit Chaurasia, Divya Singh, Abnish Kumar Gautam, Rashmi Pandey, Ritu Trivedi, Man Mohan Singh, Naibedya Chattopadhyay, Lakshmi Manickavasagam, Girish Kumar Jain & Anil Kumar Dwivedi		
	Supporting Staff	Abdul Malik & Avinash Kumar		