Centre for Emerging Diseases

Brief Overview

Newly emerged, re-emerged infectious and life style diseases constitute a global threat that puts every nation and every person at risk. 'Centre for Emerging Diseases' address questions of molecular pathogenesis of emerging viral and bacterial pathogens (host pathogen interactions, essential metabolic pathways of pathogens), structural biology, life style diseases such as cancer, cardiovascular diseases and the design of novel diagnostics and therapeutics. The research activities at the 'Centre for Emerging Diseases' has generated ~7.5 crore extramural research funding from various agencies of Govt. of India including Department of Biotechnology (DBT), Department of Science & Technology (DST), Indian Council of Medical Research (ICMR) and All India Council for Technical Education (AICTE).

Newly emerged and re-emerged diseases in the recent past caused by SARS, Chikungunya (CHIKV), Chandipura(CHPV) and other viruses have amply highlighted the vulnerability of developing and developed nations. Research efforts are on to understand the molecular and cell biology of pathogen-host-vector interactions in CHPV and CHIKV; study the pathogen specific remodeling processes of the host/vector cell; identify interactions which could be target for therapeutics and identify peptide based inhibitors.

In view of the rapid pace with which multidrug resistant strains of almost all group of pathogens are emerging, the need for new antibacterial compounds cannot be overemphasized. Research efforts have been initiated to generate X-ray crystal structure(s) of potential drug targets from human pathogens, for early-stage rational drug discovery for a novel antimicrobial agent(s).

Another major area of focus is to understand the mechanism and study the role of natural compounds in combating them cancer, metabolic, neurological disorders and cardiovascular diseases. Metabolic and neurological disorders are also being studied through mitochondrial defects. Besides the extensive use of these Ayurveda medicines, herbal remedies have not undergone rigorous scientific assessment at their molecular, biochemical and toxicological levels.. Different phytocompounds are being evaluated for multifactorial disease like Urolithiasis. Gene regulatory elements like miRNAs and transcription factors are researched extensively to understand the gene regulation and may lead to novel therapeutics.

Novel nanotherapeutic based interventions are being investigated through Drug loaded polymeric nanoparticles (chitosan, PLGA) to improve the delivery and bioavailability of anti epileptic drugs, anti Alzheimer's drugs, neuropathic pain and for some other CNS related drugs. Nanoemulsions encapsulating some natural antimicrobial compounds (catechins and flavanoids) are being explored for enhanced efficacy and bioavailability.

The increasing demand for early diagnosis of disease at curable stage, is the major driving force behind development of novel approaches for diagnostic tools. Controlled chemical synthesis of biocompatible nanoparticles is being exploited for development of biosensors with improved stability, sensitivity and response time. In addition to this, we are also striving towards developed of nanoparticles based vaccine.

Drosophila is a model organism for a wide array of genetic and evolutionary studies. NGS Technology has resulted in submission of whole genome sequence of Indian *Drosophila* species and *Zaprionus indianus (*agriculturally important pest species) in the 'Genome' Bank. Furthermore, bioinformatics group in the department is involved in constructing networks of complex systems, does data mining & pattern recognition, implement machine leaning systems, and in developing sophisticated tools and pipelines to solve problems relevant to disease biology.

Industry Project

2018

1. Biosensor development for infertility detection, **Ecozyme AB, Sweden**, 8000 SEK, **Technology Advisor/Consultant: Dr. Sudha Srivastava** (2018)

Extramurally Funded Research Projects

2018-19

2. Investigating microRNAs as the Next Generation Therapeutic Targets in Diabetic Cardiomyopathy. DST, Grant Value: Rs. 40 Lakhs, **PI: Dr. Vibha Rani** (2018-2021)

2007-17

3. Building integrated pipeline for cancer genome analysis: Role of mobile genetic elements in cancers, Department of Biotechnology (DBT), Govt. of India. Grant value: ~29.38 lakhs **PI: Kamal Rawal** (2017-2020), **Co-PI Sanjay Gupta.**
4. Identification of cellular targets of Chikungunya virus non structural proteins, Indian Council of Medical Research (ICMR), Duration: 2016-2019, Grant value: 34.1 Lakh, PI: Dr. Sanjay Gupta, **Co-PI: Dr. Reema Gabrani**.

5. Development of inhibitors to target glyoxylate and methylcitrate cycles essential for persistence of Mycobacterium tuberculosis. Indian Council of Medical Research

(ICMR), JIIT, Duration: 2015-2018, Grant value: ~32.1 Lakh, PI: **PI: Dr. Vibha Gupta.**

6. Development for reagents for simple immunochemical tests for the detection of Chikungunya infection, Department of Biotechnology (DBT), Govt. of India, Collaborative project among UDSC, JIIT and ICMR Virus Unit Kolkatta. JIIT, Duration: 2014-2017, Grant value: 18 Lakh, **PI: Dr. Sanjay Gupta**.

7. Nanoparticles based amperometric biosensor for detection of thyroid dysfunctioning, Department of Science and Technology (DST), Govt. of India, Duration: 2014-2017, Grant value: 37.3 Lakh, **PI: Dr. Sudha Srivastava**, Co-PI: Dr. Vibha Gupta..

8. Studies on the phylogenomics and population genomics of indian Drosophila, Department of Science and Technology (DST), Govt. of India, Duration: 2014-2017, Grant value: 34.10 Lakh, **PI: Dr. Sujata Mohanty**

9. Purification of Chikungunya virus nsP3 Protein for peptide based inhibitor and structural studies, Department of Biotechnology (DBT), Govt. of India, Duration: **2013-2016**, Grant value: **68.6 Lakh**, **PI: Dr. Sanjay Gupta, Co-PI: Dr. Sanjeev K. Sharma/ Dr. Vibha Gupta/ Dr. Vijay K. Chaudhary**.

10. Structural Biology of CysE from pathogenic organisms – Potential for rational drug design, Department of Biotechnology (DBT), Govt. of India, Duration: **2013-2016**, Grant value: **40.5 Lakh**, **PI: Dr. Vibha Gupta Co-PI: Dr. Punit Kaur** (AIIMS).

11. Effect of curcumin on cardiac hypertrophy, Department of Biotechnology (DBT), Govt. of India, Duration: **2012-2015,** Grant value: **33.54 Lakh, PI: Dr. Vibha Rani**.

12. Development and evaluation of green tea catechins based intravaginal nanoemulsion gel for the treatment of urinary tract infections, Department of Biotechnology (DBT), Govt. of India, Duration: **2013-2016,** Grant value: **23.53 Lakh, PI: Dr. Shweta Dang, Co-PI: Dr. Reema Gabrani/ Dr. Javed Ali** (Jamia Hamdard, New Delhi).

13. Stage specific microRNA profiling from developing chick heart, Department of Biotechnology (DBT), Govt. of India, Duration: **2012-2016,** Grant value: **43. 11 Lakh, PI: Dr. Vibha Rani**.

14. Nanoparticle based Drug delivery system of some antiepileptic drugs for brain drug delivery through nasal route, Department of Biotechnology (DBT), Govt. of India, Duration: **2011-2014,** Grant value: **25.175 Lakh,PI:Dr. Shweta Dang, Co-PI: Ms. Manisha Singh/Dr. Javed Ali** (Hamdard University).

15. Viral-viral and viral-host protein interactions in chandipura virus mediated encephalitis, Department of Science and Technology (DST), Govt. of India,Duration: **2010-2013,** Grant value: **35.57 Lakh, PI**: **Dr. Sanjay Gupta, Co-PI: Dr. Reema Gabrani/Dr. Amita Gupta** (Delhi University).

16. Mapping viral host protein interactions of Chikungunya virus, All India Council for Technical Education, under "Research Promotion Scheme", Duration: **2009-2012,** Grant value: **15.45 Lakh, PI**: **Dr. Sanjay Gupta / Dr. Sanjeev K. Sharma**.

17. Designing a nanoparticles based glucose biosensors, All India Council for Technical Education (AICTE), under "Research Promotion Scheme", Duration: **2009-2012,** Grant value: **8.4 Lakh, PI: Dr. Sudha Srivastava, Co-I: Dr. Nidhi Gupta.**

18. Cardio protective properties of curcumin: Molecular interaction of cardiac transcription factors, Department of Science and Technology (DST), Govt. of India,Duration: **2009-2012,** Grant value: **19.99 Lakh, PI:Dr. Vibha Rani.**

19. Mapping of interactions among Chikungunya virus proteins, Department of Biotechnology (DBT), Govt. of India, Duration: **2008-2012**, Grant value: **24.87 Lakh**, **PI**: **Dr. Sanjay Gupta, Co-PI: Dr. Reema Gabrani /Dr. Vijay K. Chaudhary** (Delhi University).

20. Up gradation of comparative and functional genomics lab, All India Council for Technical Education, under "scheme for modernization and removal of obsolescence in technical education", Duration: **2008-2009**, Grant value: **7 Lakh, PI:Dr. Sanjeev K. Sharma, Co-PI: Dr. Sanjay Gupta**.

21. Inferring the origin, population structure and demographic history of *Drosophila malerkotliana* with population genomic approach, Department of Science and Technology (DST), Govt. of India, Duration: **2007-2010**, Grant value: **7.44 Lakh, PI:Dr. Sujata Mohanty.**

Fellowship Project

1. Development PLGA nanoparticles loaded with donepezil and memantine for Brain Drug Delivery through nasal route in Alzheimer's disease, BIOCARE-DBT, PI: Ms Atinderpal kaur (PhD student), **Mentor: Dr Shweta Dang, 2017-2020, Rs 26 lakhs**
2. "Rational Structure-based development of potent inhibitors targeting mycobacetrial cysteine biosyntheticpathway: in silico and experimental drug design against M. tuberculosis CysE. DST Fellow, Rs. 15,95,000, PI Sunita Gupta (PhD), **Mentor: Dr. Vibha Gupta**, 2015-2020
3. Identification of peptide/protein binders of Chikungunya, DST - Inspire Fellowship, Rs. 16,60,000, Garima Agarwal, **Mentor: Dr. Sanjay Gupta** (2015-2020)
4. Structure, Function and Inhibition of Isocitrate Lyases of Mycobacterium tuberculosis, DST - Inspire Fellowship, Ms Monika Rs.11.64 Lakh, **Mentor: Dr. Vibha Gupta**, 2015-2020
5. Fabrication of Nanotechnology based Point of Care device for Diagnosis of Thyroid Dysfunctioning, DST - Inspire Fellowship, Mr. Rahul Saxena Rs. 11.68 lakh , **Mentor: Dr. Sudha Srivastava**, 2015-2020
6. Nanoparticle based vaccine development against Hepatitis E Virus, DST - Inspire Fellowship, Ms. Dibya rani Rs. 11.92 lakh, **Mentor: Dr. Sudha Srivastava**, 2015-2020
7. Differential expression pattern of miRNAs in rice root during Cr(VI) stress. DST: Grant value: Rs. 33 Lakh, **Mentor: Vibha Rani**) Scientist: Sonali Dubey (2015-2018).
8. Deciphering the host interactions of Chandipura virus matrix protein (Ph.D. Student: Sreejith Rajasekharan) **(ICMR)**, **Grant Value: Rs 3.0 lakhs**, **Supervisor : Sanjay Gupta** (2014 – 2015)

Major resources available in area

(a) **Physical**

Equipments from EXTRA MURAL FUNDING (Exclusive for Centre for emerging diseases)					
S. No.	**Name of Equipment**	**No. of equipment**	**Cost (Rs.in lac)**	**Make / supplier**	**Date of Purchase**
1	AKTA PURE Purification system	1	31.20	GE Healthcare	Feb-14
2	Deep freezer (-20C)	3	1.86	Vestfrost	Nov-08, Mar-10, Mar-14
3	Dissolution Test Apparatus	1	1.50	Veego	May-12
4	Fluorescence Microscope	2	8.29, 6.43	Olympus	Dec-09, 2016
5	Gel dryer + small instruments	1	1.37	Macflow	Nov-09
6	HPLC (Isocratic)	1	6.63	Waters	Jun-12
7	Real time PCR with PC	1	15.51	Thermo Scientific	Oct-12
8	Spectrophotometer (UV-Vis and nanodrop)	3	13.40	JH Bio, Eppendorf, Shimadzu	Dec-08, Nov-09, Apr-12
9	Thermal cycler (PCR)	**3**	**6.76, 2.5**	**Eppendorf**	4/1/2007, Jan 13, 2018
10	Ultra centrifuge	1	14.87	Beckman	Nov-09
11	Ultrasonicator	1	7.17	Hielscher	Dec-13
12	UV cross linker	1	1.11	Merck	Jan/14
13	Electrochemical Work Station + hand held galvanostat/potentiostat	1	10.548	CH Instruments	Mar 15
14	ELISA Reader	1	2.98	Thermo Scientific	2015
15	Work Station	1	2.3	DELL	2015
16	Refrigerated Centrifuge	1	2.1	Genetix	2014
17	Orbital shaker	1	1.97	Remi	2014
TOTAL (in Lakhs)			**138.498**		

Shared Facilties

1	Centrifuge	7 (4 for CFED)	11.18	Eppendorf, Remi, G-Biosciences, Thermo Scientific, Genetix	Nov-08, Nov-09, Aug-12, Sep-10, Oct-12, Mar-14, Apr-14
2	Digital shaker Incubator	3 (2 for CFED)	8.58	New Brunswick, Remi	Nov-09, May-12, Mar-14
3	Laminar flow	3 (2 for cfed)	2.86	Atlantis, ISIC	Nov-08, Jan-11, Mar-14
4	Micropipettes	10 sets (5 sets for cfed)	5.00	Eppendorf, YVR LifeSci., Thermo Scientific, Discovery Chem.	Nov-08, Oct-09, Nov-09, Sep-10, Feb-12, Oct-12, Mar-14
5	Electrophoresis system (Vertical & Horizontal)	5 (4 sets for cfed)	5.25	BioRad, Genei, Mac Flow, G-Biosciences	Nov-08, Sep-10, Mar-14
6	PCR (thermal cycler 96 well simpli amp) model a24812ref	2	1.83	Thermo Scientific	2017
7	Thermo multi scan FC(ELISA reader)	1	3.15	Thermo Scientific	2017

Details of publications, patents and Process / Equipment / Software Developed

Patent Granted:

Sudha Srivastava and Shikha Sharma (2010) "Novel process to enhance thermal stability of enzyme nanoparticles" Indian Patent Application No. 2782/DEL/2010

Patent Filed:

Sudha Srivastava and Rahul Saxena (2018) "An Improved Electrode for Electrochemical Device" Indian Patent Application No 201811012008.

Publications: (International):

2019

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- Saxena S, Mathur P, Shukla V, **Rani V***. "Differential Expression of Novel MicroRNA from Developing Fetal Heart of Gallus gallus domesticus implies a Role in Cardiac Development" Molecular and Cellular Biochemistry, 2019, Sep 7. doi: 10.1007/s11010-019-03618-4
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- R. Sharma, R. Raghav, P. Kumari, P Rishi, S Sharma, **S. Srivastava** and I. Verma "Exploiting chitosan and gold nanoparticles for antimycobacterial activity of *in silico* identified antimicrobial motif of human neutrophil peptide-1" **Scientific Reports**, 9:7866, (2019) [Impact factor: 4.01, Indexed in Scopus].
- R. Saxena , O. Y. Alothman , **S. Srivastava**, "Gold Nanoparticle Based Electrochemical Immunosensor for Detection of T3 Hormone" **Journal of Nanoelectronics and Optoelectronics** (Accepted) (2019) [Impact factor: 1.069, Indexed in Scopus]
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- I. Nandi, A. Gupta, VK. Chaudhary, V. Gupta, **R. Gabrani*,** S. Gupta*, "Expression, purification and functional characterization of recombinant Hyper Variable Region (HVR) of Chikungunya virus nsP3 protein" *3Biotech***,** vol. 9, pp. 235, June 2019. [IF: 1.8] * Corresponding author

- UL. Raj, M. Gautam, S. Dang, **R. Gabrani,** "Antibacterial and antibiofilm activities of trans-cinnamaldehyde nanoemulsion against *Escherichia coli*" *Asian J Pharm Clin Res***,** vol. 12, pp. 301-304, Feb. 2019.
- G. Agarwal, S. Gupta, **R. Gabrani,** A. Gupta, VK. Chaudhary, V. Gupta "Virtual screening of inhibitors against Envelope glycoprotein of Chikungunya Virus: a drug repositioning approach" *Bioinformation,* vol. 15(6), pp. 439-447, June 2019
- R. Ghildiyal, S. Gupta, **R. Gabrani,** G. Joshi, A. Gupta, VK. Chaudhary, V. Gupta, "Chikungunya polymerase: a potential target for inhibitors—in silico study" *Virus Disease* (2019). https://doi.org/10.1007/s13337-019-00547-0
- K. Nigam, A. Kaur, A. Tyagi, M. Nematullah, F. Khan, **R. Gabrani**, S. Dang, **"**Nose-to-brain delivery of lamotrigine-loaded PLGA nanoparticles" *Drug Deliv Transl Res***,** 2019 Mar 18. doi: 10.1007/s13346-019-00622-5. [Epub ahead of print] [IF: 3.111]
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- Manavi Jain, Paramveer Yadav and **Priyadarshini.** Proteomics Study in Urolithiasis. Current Proteomics. DOI : 10.2174/1570164616666190722161823 [Indexed in SCOPUS Impact Factor: 0.768]
- **Priyadarshini,** Devesh Raizada, Pragya Kumar, Tanya Singh, Trisha Pruthi, Abhishek Negi, Lokesh Nigam and Naidu Subbarao. Exploring the modulatory effect of albumin on calcium phosphate crystallization. Current Science, Vol. 117, No. 6, 25 September 2019 [Indexed in SCOPUS Impact Factor: 0.756]
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- M. Antil, J. Sharma, Y. Brissonnet, M. Choudhary, S. Gouin and **V. Gupta,** "Structure Function insights into elusive *Mycobacterium tuberculosis* protein Rv1916". **International Journal of Biological macromolecules. In press Available:https://doi.org/10.1016/j.ijbiomac.2019.09.038** [Impact factor: 4.784]
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- "Full-length cloned sequence of the non-structural protein 4 (nsP4)gene of Chikungunya virus, isolate IND-06-Guj, of 2006 outbreak." Genbank Accession No. JF272476, 2011.
- "Full-length cloned sequence of the capsid protein gene of Chikungunya virus, isolate IND-06-Guj, of 2006 outbreak." Genbank Accession No. JF272477, 2011.
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- "Full-length cloned sequence of the Envelope protein 2 (E2) gene of Chikungunya virus, isolate IND-06-Guj, of 2006 outbreak." Genbank Accession No. JF272479, 2011.
- "Full-length cloned sequence of the Envelope protein 1 (E1) gene of Chikungunya virus, isolate IND-06-Guj, of 2006 outbreak." Genbank Accession No. JF272480, 2011.
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DETAILS OF COLLABORATIONS

S. No.	Name of the collaborator	Organization
1.	Prof. Vijay K. Chaudhary	Professor and Head, Department of Biochemistry, University of Delhi South Campus (UDSC)

2.	Prof. Sudhanshu Vrati	Dean, Translational Health Science & Technology Institute, (THSTI)
3.	Dr. Dinesh Gupta	Research Scientist, International Centre for Genetic Engineering and Biotechnology (ICGEB)
4.	Dr. Amita Gupta	Associate Professor, Department of Microbiology, Univ. of Delhi, South Campus
5.	Dr. Manish Sharma	Research Scientist, Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi
6.	Dr Shyamal K Goswami	Professor, School of Life Sciences, JNU
7.	Dr. Punit Kaur	Professor and Head, Department of Biophysics, All India Institute of Medical Sciences, Delhi
8.	Prof Malcolm Schug	Associate Professor and Director of Undergraduate Studies, Univ. of North Carolina, Greensboro
9.	Dr. Aparup Das	Director, National Institute of Tribal Health and Research, ICMR, New Delhi
10.	Prof. K. K. Biswas/ Yamuna Prasad	Department of Computer Science and Engineering, IIT Delhi
11.	Dr. Gulshan Wadhwa	Joint Director, Dept. of Biotechnology, Govt. of India
12.	Dr. R.T. Narendhirakannan	Assistant Professor (SG), Department of Biotechnology, School of Biotechnology and Health Sciences, Karunya University, Coimbatore
13.	Dr. UmeshC. S. Yadav	Associate Professor and Coordinator, School of Life Sciences, Central University of Gujarat
14.	Dr Javed Ali	Senior Assistant Professor, Department of Pharmaceutics, Jamia Hamdard, New Delhi.
15.	Prof. Dr. John Baines	Professor, Max Plank Institute for Evolutionary Biology, Germany
16.	Dr. S. P. Singh	Associate Prof., **Dept. of Biochemistry**, **Banaras Hindu University**

		(BHU), Varanasi
17.	Dr Amit Tyagi	Scientist D, INMAS, DELHI
18.	O'Kennedy R	Biomedical Diagnostics Institute (BDI), Dublin City University, Dublin 9, Ireland; School of Biotechnology, Dublin City University, Dublin 9, Ireland.

Research Activities

Sudha Srivastava, Ph.D.

Research area: Diagnostic devices – Nanotechnology; Biosensors

Brief on Research activities:

The increasing demand for early diagnosis of disease at curable state, is the major driving force behind development of novel approaches for diagnostic tools. Nanoparticles are exploited for development of biosensors with improved stability, sensitivity and response time. A nanoparticle based glucose biosensor has been developed and investigations are ongoing for thyroid biosensor as well as immunosensor for cancer diagnosis as point of care device development. Our group has developed expertise in controlled chemical synthesis of biocompatible nanoparticles of metallic, non-metallic materials as well as biomolecules. In addition to this, we are also striving towards developed of nanoparticles based vaccine.

Reema Gabrani, Ph.D.
Research area: Medical Biotechnology

Brief on Research activities:

Current research interests include exploring the anti-microbial and anti-proliferative aspects of plant active compounds & antimicrobial peptides and their nano-encapsulated forms to understand the scientific basis of their activity which could lead to the development of unique drugs. Also part of studies on protein based interactions of Chandipura and Chikungunya virus with viral and host factors to understand the pathogenesis and disease progression. Notably such work can lead to the generation of novel therapeutic strategies.

Sujata Mohanty, Ph.D.

Research area: Molecular Genetics and Genomics

Brief on Research activities:

Drosophila has clearly evolved as a model organism for a wide array of genetic and evolutionary studies. With recent development in genomic applications in biomedical and agricultural research, initial information also has come from studies with Drosophila model. The comparative genomics of many sequenced genomes was quite surprising; many of the genes identified in *D. melanogaster* were found to be conserved across other organisms including human. India is rich in biological diversity with many flora and fauna present in many eco-climatic zones. Inferring genetic inter-relationship among closely related species is not only important for academic point of view but also to understand how species diversity has been accompanied by small changes at the nucleotide level. We specifically focus on sequencing whole genomes of Indian *Drosophila* species through NGS Technology on Illumina platform, which is a part of our current on-going "*Drosophila* Genomics" project and submitted to 'Genome' Bank of NCBI for the first time from India. The genome of *Zaprionus indianus,* an agriculturally important pest species was also analyzed and submitted in 'Genome' Bank. The genome-wide analysis among these genomes evidenced the role of ecological factors influencing the genome variations. The addition of several genomes from different ecological sources will be further instrumental in studying variations and adaptations of genes of medical importance. Our research also focuses on studying the genomics of *Wolbachia*, an obligate endosymbiont of *Drosophila* host and theirassociation. Understanding this endosymbiont genome in different eco-geographical conditions has become imperative for the recent use of Wolbachia in medical entomology as a vector-control agent.

Vibha Rani, Ph.D.

Research area: Medical Biotechnology

Brief on Research activities:

Heart development is a highly conserved process across all vertebrate organisms. MicroRNAs (miRNAs), the non-coding RNAs are researched extensively due to their newly found role as regulators of gene expression in developmental processes. Emerging evidences suggest that specific spatio-temporal miRNA expression is required for proper embryonic developmental processes such as cardiogenesis, myogenesis, hematopoisis and neurogenesis. These small RNAs are the critical regulator of differential gene expression. When, how and where they are expressed during the various stages of heart development is the objective of ongoing research that will increase understanding of gene regulation during vertebrate heart development and diseases.

Shweta Dang, M. Pharm, Ph.D.

Research area: Novel Drug Delivery systems

Brief on Research activities:

Drug loaded polymeric nanoparticles (chitosan, PLGA) are being investigated to improve the delivery and bioavailability of anti epileptic drugs, anti Alzheimer's drugs, neuropathic pain and for some other CNS related drugs. Nanoemulsions encapsulating some natural antimicrobial compounds (catechins and flavanoids) are being investigated for enhanced efficacy and bioavailability. These nano carriers based formulations help improve the stability of hydrophobic drugs, rendering them suitable for administration, improving biodistribution and pharmacokinetics, resulting in improved efficacy, reduction in adverse effects because of less peripheral circulation.

Vibha Gupta, Ph.D.

Research area: Structural Biology

Brief on Research activities:

In view of the rapid pace with which multidrug resistant strains of almost all group of pathogens are emerging, the need for new antibacterial compounds cannot be overemphasized. Research efforts of the Structural Biology group are focused towards deciphering the structure-function of novel drug targets from human pathogens responsible for infecting respiratory and/or gastrointestinal tract and understanding how the target contributes to the virulence processes of the pathogen. Research techniques employed to unravel the molecular structure and functional mechanism of a target protein of interest are recombinant DNA technology, protein purification, X-ray crystallography, biochemistry, binding affinity studies, bioinformatics tools including molecular dynamic simulations. Our Current focus is on following potential drug targets:

1. CysE / Serine acetyltransferase - The enzyme is known to be essential for survival of persistent *M. tuberculosis, E. histolytica, H. Influenzae*, etc. and are absent in *Homo sapiens*. Therefore, this pathway is worth exploring for developing new antimicrobial compounds. We have performed the structural and kinetic analysis of two previously uncharacterized CysE from pathogenic bacteria. *Klebsiella pneumonia* (Kpn) and *Shigella flexneri* (Sfl). Crystal Structure of KpnCysE has been determined up to 3 Å. Detailed studies have revealed better substrate affinity and stability of the former enzyme compared to the later. A promising natural product inhibitor that inhibits KpnCysE, SflCysE and *E. coli* CysE better than physiological feedback inhibitor cysteine, has been identified and may form a basis for drug discovery and therapeutic development.

2. Isocitrate lyases involved in Glyoxylate and methylcitrate cycles: These have proven essentiality for persistence of *Mycobacterium tuberculosis* in its host and play an important role in metabolism of even and odd chain fatty acids via β-oxidation. Therefore, utilization of these fatty acids as carbon source allows *M. tuberculosis* to survive under nutrient deprived conditions in the host cell and hence helps in its persistence. We have characterized ICL2 of *M. tuberculosis* and identified a natural product inhibitors of both ICLs through *in silico* screening.

Chakresh Jain, M.Sc., MCA, ALCCS (eqvt. M. Tech-CS), Ph.D.
Research area : Bioinformatics

Brief on Research activities:

Research group focuses on the development of pathogenic microbial network specially *Bacillus anthracis ames* and *Aspergilus fumigates Af293* and identification of potential drug target using computational methods such as machine learning and phylogenetic profiling and tools. Work is being carried out for new algorithms and pipelines for computational si/miRNA designing, novel antimicrobial peptide identification and database creation on microbial pathogens. Further *in-silico* target-ligand interactions and simulation studies are also conducted for the investigation of neuaroprotective potentials of medicinal plant compounds from selected medicinal plants.

Shalini Mani, Ph.D.

Research area: Medical Biotechnology

Brief on Research activities:

Major research is focused upon the role of cellular bioenergetics in human health and diseases. Mitochondria, being a powerhouse of the cellular system are a most important organelle. Hence, any perturbation in mitochondrial metabolism may affect several organs and hence cause several diseases/disorders. In the last few decades only, mitochondrial defects are found to be associated with a large number of metabolic and neurological disorders. Based on it, the current research interest is to explore the mechanism of pathogenic role of mitochondria in common metabolic/lifestyle diseases like cancer and diabetes.

Priyadarshini, Ph.D.

Research area: Medical Biotechnology

Brief on Research activities:

My research focuses on understanding the molecular mechanism of urolithiasis. Since urolithiasis is a multifactorial disease, investigating the factors underlying the cause and curative management of this disease is the general goal of my research. Various biomolecules and reactive oxygen species is important factors which influence mechanism of kidney stone formation. The research work involved the identification and characterization of a novel protein inhibitor against calcium oxalate crystal growth. Different phytocompounds have antiurolithiatic properties, we are trying to combine these phytocompuonds to prepare an effective anti-urolithiatic formulation.

Manisha Singh, M. P. T (Neurology), CNDT, PhD (Ongoing)

Research area: Novel Drug Delivery systems

Brief on Research activities:

The main difficulty to treat CNS disorders is to deliver the drug at site as, the complex anatomy of the brain and "blood brain barrier" put a restriction to most of the molecule to cross and reach inside the brain. Nasal route is chosen for drug delivery as it can cross the olfactory pathway by one or a combination of pathways. We aim to develop a drug delivery system which shows site specificity in case of Central Nervous System Disorders (CNS Disorders) like Alzheimer's disease, Epilepsy, Psychosomatic disorders etc., which can reduce the dose, adverse effects and can enhance rate and extent of drug transport. Polymeric nanoparticles by different methods (ionic gelation, Coacervation etc.) were explored to encapsulate various plant based medicinal (Gingko biloba, Catechin hydrate, etc.) and drugs (Gabapentin, Escitalopram, hydrochlorothiazide) compounds. Further, their characterizations and in vitro toxicity and safety evaluation are been done on cellines (NB41A3, RPMI2650, Vero etc). These nanoformulation help in increasing the efficacy, bioavailability and stability of these compound and make them more therapeutically potential.

DEPARTMENT OF BIOTECHNOLOGY
LIST OF DOCTORAL STUDENTS

S. No.	Enrollment No.	Name	Research Topic	Supervisor(s)	Ph.D. Awarded
			PhD Awarded		
1	8401003	Shikha Shamra	Development of nanoparticle based glucose biosensor	Prof Sudha Srivastava	2012
2	6401007	Aditi Shrivastav	Investigating dererminants of sweetness in sweet molecules	Prof. Sudha Srivastava	2013
3	6401002	Kapila Kumar	Intraviral Protein Interactions of Chandipura virus	Prof. Sanjay Gupta Dr. Reema Gabrani	2013
4	10401003	Sonal Gupta	Nano carrier based intra vaginal drug delivery system	Dr. Shweta Dang; Dr. Reema Gabrani	2015
5	10401005	Jyoti Rana	Molecular Interactions of Chikungunya	Prof. Sanjay Gupta	2015
6	10401006	Sreejith R.	Viral host Protein interactions in Chandipura virus pathogenesis	Prof. Sanjay Gupta	2015
7	8401005	Namrata Dudha	Mapping interactions of Chikungunya virus structural proteins	Prof. Sanjay Gupta; Dr. ReemaGabrani	2015
8	11401104	Nidhi Bajpai	Implementation of clinical data management of vaccines with respect to data management activates in an indian pharmaceutical company	Prof. Sanjeev K. Sharma; Dr. Shweta Dang	2015
9	10401004	Neha Atale	Effect of *Syzygiumcumini* in glucose induced cardiac inflammation	Dr. Vibha Rani; Dr. Sujata Mohanty	2016
10	12401105	Deepak Sharma	Investigation of nanoparticle approach for improved brain delivery of antiepileptic drugs through nasal route	Dr. Shweta Dang; Prof. S. K. Sharma; ProfJaved Ali	2016

11	11401107	Ragini Raghav	Development of a nanoparticle based immunosensor for cancer antigen ca-125	Prof Sudha Srivastava	2016
12	9401006	Jaisri J.	Constructing comprehensive map of molecules implicated in obesity using computational approaches	Dr. Kamal Rawal	2017
13	12401101	Garima Sharma	Purification, characterization and antibacterial studies of bacteriocin from dairy forms isolates	Dr. Reema Gabrani; Prof. Sanjay Gupta	2017
14	13401105	Yashika Rustagi	Profiling and characterization of microRNAs from 10th day of chick embryonic heart	Dr. Vibha Rani	2018
15	13401101	Nancy Taneja	Study of mitochondrial defects and VDR polymorphisms in Type-2 diabetes	Dr.Shalini Mani; Dr.Priyadarshini	2013
16	14401008	Aditi Jain	Effect of curcumin on drug induced cardiotoxicity	Dr.Vibha Rani	2014
17	14401010	Radhika Khanna	Novel sequences generation and comparative analysis of Indian Drosophila and Zaprionus species	Dr. Sujata Mohanty	2014
18	14401011	Samiya Khan	Development of a biocatalyst for refining diesel	Prof. Sanjay Gupta; Prof. Pammi Gauba	2014
			Ongoing PhDs		
S. No.		**Name**	**Research Topic**	**Supervisor(s)**	**Year of Registration**
1	14401012	DeepaliVerma	Biochemical and structural studies of CysE from pathogenic bacteria causing respiratory and gastrointestinal infections	Dr. Vibha Gupta	2014
2	14401013	Garima Agarwal (Inspire Fellow)	Identification of peptide/protein binders of chikungunya virus	Dr. Reema Gabrani	2014

3	15401001	Dibya Rani (Inspire Fellow)	Nanoparticle based vaccine against Hepatitis E virus	Dr. Sudha Srivastava Dr. B. Nayak	2015
4	15401005	Sharad Saxena (CSIR-SRF)	Characterization of MMP7 as potential therapeutic target in cardiac stress	Dr. Vibha Rani	2015
5	15401007	Monika (Inspire Fellow)	Development of inhibitors to target isocitratelyases of *M. Tuberculosis*	Dr. Vibha Gupta	2015
6	15401008	Rahul (Inspire Fellow)	Fabrication of nanotechnology based point of care device for diagnosis of thyroid dysfunctioning	Prof. Sudha Srivastava	2015
7	15401009	Sunita Gupta (Women Scientist)	Inhibitor discovery for mycobacterial biosynthetic pathway to cysteine	Dr. Vibha Gupta	2015
8	16401001	Kuldeep Nigam (CSIR-SRF)	Nano-carrier based approach for neuropathic pain management	Dr. Shweta Dang	2016
9	16401006	Atinderpal Kaur (BioCARe-Women Scientist)	Development of drug loaded nanoemulsion based formulations	Dr. Shweta Dang	2016
10	16401004	KopalSinghal (CSIR-SRF)	Comparative genomics of Wolbachiaendosymbiont from Indian drosophila species	Dr. Sujata Mohanty	2016
11	17401001	ChetnaFaujdar	Management of urolithiasis	Dr. Priyadarshini	2017
12	17401004	MeghaGautam	Anti-Cancer therapy	Dr. Reema Gabrani	2017
13	17401005	Preeti Thakur	Water pollution and its remediation	Prof. Pammi Gauba	2017
14	17401006	RituGhildiyal (CSIR-SRF)	Cellular interactors of non-structural proteins of Chikungunya virus	Dr. Reema Gabrani	2017
15	17401009	GeetaSwargiary	Anticancerous herbs as mitocans	Dr. Shalini Mani	2017
16	18401013	Priyanka Mathur	Investigating microRNAs as the Next Generation	Dr Vibha Rani	2018

			Therapeutic Targets in Diabetic cardiomyopathy		
17	18401016	SakshiTyagi	Vitamin D as anticancerous agent	Dr. Shalini Mani	2018
18	18401007	Gemini Patel	Drosophila innate immunity	Dr. Sujata Mohanty	2018
19	18401002	Pankaj Kr. Tripathi	Computational method for potential gene identification	Dr. Chakresh K Jain	2018
20	18401004	Yogender Thakur	Mobile genetic elements in cancer	Dr. Chakresh K Jain	2018
21	18401009	AbhayGautamBankar	Key gene identification in lung cancer therapeutics	Dr. Chakresh K Jain	2018
22	18401017	Shilpa Gundagatti	Biosensor development for malaria	Prof. Sudha Srivastava	2018
23	18401010	VandanaTandasi	Stability studies of blood grouping reagents: Anti-A and Anti-B	Prof. Sudha Srivastava	2018
24	18401015	Shikha Mishra	Diabetic nephropathy	Dr. Priyadarshini	2018
25	18401001	Shivani Sharma	Biological pathways and diseases	Dr. Priyadarshini	2018
26	18401005	Kumkum Sharma	Cardio-protective effect of aged garlic extract	Dr. Vibha Rani	2018
27	19401001	Pallavi Kumari	To be decided	Dr.Shweta Dang	2019
28	19401002	Surbhi Sharma	To be decided	Dr.Shweta Dang	2019
29	19401003	Renu Bhadana	To be decided	Dr.Vibha RAni	2019
30	19401004	Namita Sharma	To be decided	Prof.Sudha Srivastava	2019
31	19401006	Vijeta Prakash	To be decided	Dr. Reema Gabrani	2019
32	19401008	Divyanshi Jain	To be decided	Dr.Sujata Mohanty	2019
33	19401013	Shivani Singhal	To be decided	Dr.Vibha Rani	2019
34	19401014	Satyender Singh Yadav	To be decided	Dr.Susinjin Bhattacharya	2019