

THRUST AREAS / MAJOR RESEARCH AREAS / MAJOR RESEARCH GROUPS

1. Area / Group Name: Centre for Emerging Diseases

Centre coordinator: Dr Sanjay Gupta

2. A brief write-up covering importance of area, its present status, activities completed at IIIT and activities going on and those proposed to be taken up in near future.

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' is supported by 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) and other viruses have amply highlighted the vulnerability of developing and developed nations. Research is being carried out on emerging/re-emerging pathogens specifically CHPV, endemic to India with 70% mortality among children and CHIKV with its annual large scale outbreaks in the country since 2006 when it infected ~1.6 million individuals. The on-going research objectives are to understand the molecular and cell biology of pathogen-host-vector interactions in these emerging viral diseases; study the pathogen specific remodeling processes of the host/vector cell; identify interactions which could be target for therapeutics and identify peptide based inhibitors. The emerging viruses research is funded by several research grants worth ~ 6.7 crore from Govt. of India funding agencies that include DBT, DST, ICMR and AICTE.

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 for early-stage rational drug discovery for a novel antimicrobial agent(s). X-ray crystal structure of a potential drug target from human pathogens responsible for infecting respiratory and/or gastrointestinal tract is being elucidated. The availability of the 3D – structural information of a drug target from many pathogenic organisms will enable the possibility of rational structure-based design and development of both a broad-spectrum and conversely, a pathogen-specific drug molecule.

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. India is the vast reservoir of living traditions of ethno medicine of which many are known to have role in cancer and cardiac protection. Besides the extensive use of these Ayurveda medicines, herbal remedies have not undergone rigorous scientific assessment at their molecular, biochemical and toxicological levels. Continuing research is necessary to identify the right biomolecules in appropriate doses which are non toxic, least interactive with other drugs and disease preventive in nature. Gene regulatory elements like MicroRNAs (miRNAs) and transcription factors are researched extensively to understand the gene regulation and may lead to novel therapeutics.

The bioinformatics group construct networks of complex systems, does data mining & pattern recognition, implement machine learning systems, and develop sophisticated tools and pipelines to solve problems relevant to disease biology.

3. **External fundings received, if any, amount, and details of funding agency, P.I.'s, duration etc.**

(Total projects; Rs. ~671.905 Lakhs)

The research efforts of the centre has successfully attracted research grants worth ~ 6.7 Crores from premier funding agencies of Govt. of India including Department of Biotechnology(DBT), Department of Science & Technology (DST), Indian Council for Medical Research (ICMR) and All India Council for Technical Education (AICTE).

1. Investigating microRNAs as the Next Generation Therapeutic Targets in Diabetic Cardiomyopathy. DST, Grant Value: Rs. 40 Lakhs, PT: Dr. Vibha Rani (2018-2021)
2. 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.**
3. **Identification of cellular targets of Chikungunya virus non structural proteins, Indian Council of Medical Research (ICMR), Duration: 2015-2018, Grant value: 34.1 Lakh, PI: Dr. Sanjay Gupta, Co-PI: Dr. Reema Gabrani/ Dr. Sanjeev K. Sharma (Project approved).**
4. Nanoparticles based amperometric biosensor for detection of thyroid dysfunctioning, Department of Science and Technology (DST), Govt. of India, Duration: **2014-2016, Grant value: 37.3 Lakh, PI: Dr. Sudha Srivastava, Co-PI: Dr. Vibha Gupta (Project approved).**
5. Development for reagents for simple immunochemical tests for the detection of Chikungunya infection, Department of Biotechnology (DBT), Govt. of India, Collaborative project among UDSC, IIIT and ICMR Virus Unit Kolkatta. IIIT, Duration: **2014-2017, Grant value: 18 Lakh, PI: Dr. Sanjay Gupta.**
6. 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.**
7. 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).**
8. Development of inhibitors to target glyoxylate and methylcitrate cycles essential for persistence of Mycobacterium tuberculosis. Indian Council of Medical Research (ICMR), IIIT, Duration: **2015-2018, Grant value: ~20 Lakh, PI: Dr. Chittaranjan Rout (JUIT, Wagnaghat); Co-PI: Dr. Vibha Gupta.**
9. 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.**
10. 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.**
11. 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.**
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. 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).
14. 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**.
15. 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).
16. 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**.
17. 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**.
18. 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-PI: **Dr. Nidhi Gupta**.
19. 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**.
20. 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).

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. 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)
3. 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).

4. "Rational Structure-based development of potent inhibitors targeting mycobacterial cysteine biosynthetic pathway: 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
5. Analysis of Chikungunya virus nsP3 protein micro/macro interactors, DST - (Women Scientist Scheme- A) Rs. 20 lacs, PI: Ipsita Nandi (PhD) Mentor: Dr. Sanjay Gupta (2018-2021)
6. Identification of peptide/protein binders of Chikungunya, DST - Inspire Fellowship, Rs. 410,000, Garima Agarwal, Mentor: Dr. Sanjay Gupta (2015-2020)
7. Structure, Function and Inhibition of Isocitrate Lyases of Mycobacterium tuberculosis, DST - Inspire Fellowship, Ms Monika Rs. 3,80,000/year, Mentor: Dr. Vibha Gupta, 2015-2020

4. **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 Facilities					
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

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

Publications: (International):

2018

- Chhabra A, Rani V*. Gel-Based Gelatin Zymography to Examine Matrix Metalloproteinase Activity in Cell Culture. *Methods Mol Biol.* 2018; 1731:83-96. Doi: 10.1007/978-1-4939-7595-2_9.
- Jain, V. Rani*. (2017) Anti-hypotensive Drug Induced Cardiotoxicity: An in vitro Study. *In Vitro Cellular & Developmental Biology – Animal.* 2018 Feb;54(2):92-98.
- Sharma, S. Zapatero-Rodríguez, J. Saxena, R., Kennedy, R O' and **Srivastava, S.** Ultrasensitive direct impedimetric immunosensor for detection of serum HER2 **Biosensors and Bioelectronics** vol 106, pp 78-85, 2018. <https://doi.org/10.1016/j.bios.2018.01.056> [Impact factor: 7.78, Indexed in Scopus]
- G. Sharma, S. Dang, S. Gupta, and **R. Gabrani**, “Antibacterial Activity, Cytotoxicity and Mechanism of Action of Bacteriocin from *Bacillus subtilis* GAS101”. **Med Princ Pract**, 2018 Jan 31. doi: 10.1159/000487306. [Epub ahead of print] [Impact factor: 1.2]
- K. Singal and **S. Mohanty** “Comparative genomics reveals the presence of putative Toxin-Antitoxin system in *Wolbachia* genomes” *Molecular Genetics and Genomics*, vol. 293(2):pp.525-540, April, 2018. [**Indexed in Scopus, Impact factor: 2. 979**]
- ishtha Saxena, Nancy taneja, Prakriti Shome, **Shalini Mani**. Mitochondrial donation: A boon or curse for the treatment of incurable mitochondrial diseases. *J Hum Reprod Sci*, 2018;11:3-9. 2018.
- Nancy Taneja, **Shalini Mani**. Vitamin D status influences mitochondrial metabolic activity and hyperglycaemic condition of skeletal muscle cells. *Journal of Pharmacy Research*, vol 12, Issue 2 , pp 221-226, 2018

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- Gupta,M., Prasad,Y., Sharma,S.K., **Jain,C.K.**, Identification of Phosphoribosyl-AMP cyclohydrolase, as drug target and its inhibitors in *Brucella melitensis* bv. 1 16M using metabolic pathway analysis, *Journal of Biomolecular Structure and Dynamics*, 2017 Feb;35(2):287-299. [Indexed in SCOPUS, Impact factor: **2.30**].

- Atinderpal Kaur, Sonal Gupta, Amit Tyagi, Rakesh Kumar Sharma, Javed Ali, Reema Gabrani, Shweta Dang, Development of Nanoemulsion Based Gel Loaded with Phytoconstituents for the Treatment of Urinary Tract Infection and in Vivo Biodistribution Studies, *Adv Pharm Bull*, 2017, 7(4), 611-619 doi: 10.15171/apb.2017.073 (IF=0.61)
- Kaur, Atinderpal; Saxena, Yashaswee; Bansal, Rakhi; Gupta, Sonal; Tyagi, Amit; Sharma, Rakesh Kumar; Ali, Javed; Panda, Amulya Kumar; Gabrani, Reema; Dang, Shweta; Intravaginal Delivery of Polyphenon 60 and Curcumin Nanoemulsion Gel, *AAPS PharmSciTech*, DOI: 10.1208/s12249-016-0652-6, Jan 2017 (Impact factor 1.7)
- Saxena R. and **Srivastava S.**, "Nanoparticles Empowered Microelectrode for Fast and Sensitive Detection of Thyroid Stimulating Hormone" **Sensor Letters** vol 15, pp 375-379, (2017) [Indexed in SCOPUS, Impact factor: 0.56]
- Jain A, Rani V*. Mode of treatment governs curcumin response on doxorubicin-induced toxicity in cardiomyoblasts. *Mol Cell Biochem*. 2017 Sep 19. Doi: 10.1007/s11010-017-3195-6.
- S. Saxena, A. Jain, V Rani*, MicroRNAs mediated MMP regulation: Current diagnostic and therapeutic strategies for metabolic syndrome, *Current Gene Therapy*, 2017 Jul 7. Doi: 10.2174/1566523217666170707100026.
- Chhabra A, Rani V*. Cell In Situ Zymography: Imaging Enzyme-Substrate Interactions. *Methods Mol Biol*. 2017; 1626:133-143. Doi: 10.1007/978-1-4939-7111-4_12.
- Twinkle Wah, Sahil Dargan, Sumedha Jaitly and Vibha Rani*, miRNA Regulation of Telomerase: A novel Therapeutic Approach for Cancer. *Open Journal of Proteomics*, 2017, Jan.
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- G. Sharma, K. Raturi, S. Dang, S. Gupta, and R. Gabrani, "Inhibitory effect of cinnamaldehyde alone and in combination with thymol, eugenol and thymoquinone against *Staphylococcus epidermidis*". **J Herbal Med**, vol. 9, pp 68-73, Sep. 2017. doi.org/10.1016/j.hermed.2016.11.001 [[Indexed in SCOPUS, Impact: 1.3]
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- Abhishek Negi, Shahrukh Husain, Priyadarshini, "A Review on Role of miRNA in Kidney Diseases". *Journal of Global Pharma Technology*. 2017; 05(9):28-36.
- **S. Mohanty** and R. Khanna " Genome wide comparative analysis of four Indian *Drosophila* species." *Molecular Genetics and Genomics*, vol. 292(6):pp.1197-1208, Dec 2017. **[Indexed in SCOPUS, Impact factor: 2. 979]**
- R. Khanna, S. Mittal and **S. Mohanty** " Development of Computer Algorithm for editing of NGS Metagenome Data" *J of Comp. Biology*, Sep; vol.24 (9):pp. 882-894, 2017. **[Indexed in SCOPUS, Impact factor: 1. 032]**
- K. Singal, R. Khanna and **S. Mohanty** "Is *Drosophila*-microbe association species-specific or region specific? A study undertaken involving six Indian *Drosophila* species" *World J of Microbiology and Biotechnology*, vol.33(6):103, Jun, 2017. **[Indexed in SCOPUS, Impact factor: 1. 658]**
- R. Khanna and **S. Mohanty** " Whole genome sequence resource of Indian *Zaprionus indianus*." *Molecular Ecology Resources*, May; Vol 17(3)pp.,557–564, 2017 **[Indexed in SCOPUS, Impact factor: 7.332]**
- Nancy Taneja, Rajesh Khadgawat, **Shalini Mani**. Vitamin D receptor gene polymorphisms and haplotype analysis in Type 2 Diabetes Mellitus patients from North India. *Asian Journal of Pharmaceutical and clinical research*. 10 (1), 248-252, 2017.
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WGS SUBMITTED TO GENOME BANK: 09

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6. DETAILS OF COLLABORATIONS, IF ANY.

S. No.	Name of the collaborator	Organization
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1.	Prof. Vijay K. Chaudhary	Professor and Head, Department of Biochemistry, University of Delhi South Campus (UDSC)
2.	Prof. Sudhanshu Vрати	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	Scientist E, National Institute of Malaria 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.

(v) Research area, brief on Research activities, abstract of research work

Sanjay Gupta, Ph.D.

Research area : Viral diseases and Functional Genomics

Brief on Research activities:

Newly emerged and re-emerged diseases in the recent past caused by SARS, Chikungunya (CHIKV), Chandipura (CHPV), Bird flu and other viruses have amply highlighted the vulnerability of developing and developed nations.. Research is being carried out on emerging/re-emerging pathogens specifically CHPV, endemic to India with 70% mortality among children and CHIKV with its annual large scale outbreaks in the country since 2006 when it infected ~1.6 million individuals. The on-going research objectives are to understand the molecular and cell biology of pathogen-host-vector interactions in these diseases; study the pathogen specific remodeling processes of the host/vector cell; identify interactions which could be target for therapeutics and identify peptide based inhibitors.

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 have been initiated for early-stage rational drug discovery for a novel antimicrobial agent(s). Determination of X-ray crystal structure of a potential drug target from human pathogens responsible for infecting respiratory and/or gastrointestinal tract is on-going. The availability of the 3D – structural information of a drug target from many pathogenic organisms will enable the possibility of rational structure-based design and development of both a broad-spectrum and conversely, a pathogen-specific drug molecule.

Sudha Srivastava, Ph.D.

Research area : Diagnostic devices – Nanotechnology; Biosensors

Brief on Research activities:

The increasing demand for early diagnosis, sensitive and easy detection of the most threatening disease at curable state is the major driving force behind development of novel approaches for disease diagnostic tool. 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.

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, hematopoiesis 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.

Reema Gabrani, Ph.D.

Research area : Protein Engineering

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 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. Presently, the whole genome sequence of 12 different Drosophila species is publicly available in the databases, providing baseline to understand how genomes have evolved. 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. Since Drosophila has shown ways in understanding genetic and biology of many organisms including human, studying the evolution of insecticide resistant, behaviour genes and cold adapted genes, effect of mutagenesis and understanding aging process is the focus of present research work which may well be utilized in other organisms of agriculture (insect pest) and health concern.

Shweta Dang, M. Pharm, Ph.D.

Research area : Novel Drug Delivery systems

Brief on Research activities:

Polymeric Nanoparticles (chitosan, PLGA) containing encapsulated, dispersed, absorbed drugs are being investigated to improve the delivery and bioavailability of some anti epileptic drugs, anti alzheimer's drugs and for some other CNS related disorders. Nanoemulsions encapsulating some natural antimicrobial compounds (catechins and flavanoids) are being investigated for enhanced efficacy and bioavailability. These nano carriers 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 and decreasing toxicity by using biocompatible and biodegradable nanomaterials.

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 *Aspergillus 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 neuroprotective potentials of medicinal plant compounds from selected medicinal plants.

Kamal Rawal, Ph.D.

Research area : Bioinformatics, Network Sciences, Clinical Research

Brief on Research activities:

For the past 10 years, we have been working to develop computational systems, databases and machine learning programs for retrotransposons insertions particularly in the area of diseases. To begin with, we were the first group to find the distribution of LINEs and SINEs in an *Entamoeba histolytica* genome (human pathogen of a disease called amebiasis). During the course of our research, we built suite of software tools including machine learning systems based upon support vector machines. These systems were applied to over 50 genomes to identify set of statistically important signals flanking the insertion sites in the various genomes. We also discovered widespread presence of MGEs in intronic regions of several hundred human genes and found typical patterns at the sites of their insertions. These patterns were absent in case of disruption of MGEs in genes implicated in diseases such as Duchene Myotrophy disease and several types of cancers (Rawal and Ramaswamy 2011, NAR).

In a recent work in our lab (Jaisri et al 2016, Plos One), we developed a new approach of combining data from heterogeneous databases including literature, structure and microarrays to construct disease networks and attempt to explain therapeutics of a drug molecule in context of networks. The system also shows new approach to identify drug targets using diseases based pathways.

Shalini Mani, Ph.D.

Research area : Medical Biotechnology

Brief on Research activities:

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.

Research is also being conducted to explore the possible mechanism behind the association between vitamin D deficiency and pathogenesis of type 2 diabetes.

Priyadarshini, Ph.D.

Research area : Medical Biotechnology

Brief on Research activities:

Kidney stone formation is a complex process involving multiple factors. It invariably comprises a combination of inorganic crystals and organic macromolecules consisting principally of proteins, lipids and glycominaglycans. It has been assumed that inhibitors of urolithiasis have protective effect while stimulator helps in stone formation. The inhibition is generally understood to arise mainly from the non-dialyzable molecules of urine, particularly acidic glycoproteins and glycosaminoglycans. Some inhibitor as well as stimulator molecules have been identified, including Tamm–Horsfall protein, uropontin, calgranulin, bikunin, and prothrombin F1 fragment. Interaction of biomolecules present in kidney stone is being investigated so as to solve the mystery of stone formation.

13. 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.