

IISER PUNE - TEMPLE UNIVERSITY SUMMER PROGRAM 2018



RESEARCH PROJECTS IN BIOLOGY

May-July, 2018



ABOUT THE PROGRAM

Temple University and IISER Pune have signed a Memorandum of Understanding focusing on student and faculty exchange with emphasis on joint research programs. To strengthen this initiative, internships have been initiated for students from Temple University to work in research groups at IISER Pune.

This brochure includes information on the faculty and research projects that are open to accept students for Summer 2018 as part of this Program.

Applications: Interested students should directly contact the Project Investigator of interest. The initial inquiry should include a resume/CV, a transcript and a statement describing prior research experience, career goals and why the particular project is of interest.

Visa and Travel: Students will be responsible for obtaining **research visa** for participation in the summer research program. Students are responsible for travel arrangements. The most convenient would be to fly to Pune International Airport (PNQ) which has some international connections or fly to Mumbai (BOM) airport. IISER Pune is 3 hour drive from Mumbai airport .

Housing and Food: On-campus housing will be provided with access to several cafeteria. The estimated cost of housing and food: USD 300 per month.

For any questions related to visa, travel, housing and food, please contact Dr. Naresh Sharma (International Relations). Email: naresh.sharma@iiserpune.ac.in

General information: Inquiries about the program should be directed to arun@iiserpune.ac.in



ROLE OF EPIGENETIC REGULATION DURING DEVELOPMENT AND PATTERN FORMATION

Project Investigator: Sanjeev Galande

Preferred scientific requirements: Theory courses in any of the following: Cell Biology, Developmental Biology, Molecular Biology, Genetics. Practical experience in techniques related to any of the above topics would be helpful.

Research summary: Our group is interested in studying evolution of developmental signalling pathways, master regulatory transcription factors and epigenetic machinery which play critical roles in gene regulation during development and pattern formation. This is currently accomplished using two model systems.

1. Study of head regeneration in Hydra: Our emphasis is on regulation of Wnt signalling regulatory network in Hydra head organizer activity and associated epigenetic processes. Hydra is known for its tremendous regenerative capacity. Hydra exhibits morphallactic regeneration i.e. regaining missing body parts without involving cell proliferation. This property of hydra allows us to understand how developmental programs related to body pattern formation are evoked for successful regeneration. Here, we focus primarily on changes in the epigenetic machinery (writers, readers and erasers) responsible for early gene regulation upon injury. We are also focused on understanding the crosstalk between epigenetic modifiers and transcription factors during regeneration process.

2. Early embryonic development using Zebrafish: We are interested in understanding regulation of cell fate specification and cellular movements during early embryogenesis, especially focused on gastrulation. Our lab focuses on delineating the function of vertebrate lineage-specific chromatin organizers during this important stage of development. This is accomplished by employing genetics, imaging and genome-wide studies to identify novel epigenetic regulators and their functional characterization.

Representative Publications

1. Reddy PC, Ubhe S, Sirwani N, Lohokare R, and Galande S#. (2017) Rapid divergence of histones in Hydrozoa (Cnidaria) and evolution of a novel histone involved in DNA damage response in hydra. *Zoology (Jena)* 123:53-63.
2. Muralidharan B, Khatri Z, Maheshwari U, Gupta R, Roy B, Pradhan S, Karmodiya K, Padmanabhan H, Shetty A, Balaji C, Kolthur-Seetharam U, Macklis J, Galande S, and Tole S. (2017) Lhx2 interacts with the NuRD complex and regulates cortical neuron subtype determinants Fezf2 and Sox11. *J Neurosci.* 37:194-203.
3. Gottimukkala KP, Jangid R, Patta I, Sultana DA, Sharma A, Misra-Sen J, and Galande S#. (2016) Regulation of SATB1 during thymocyte development by TCR signaling. *Mol. Immunol.* 2016 Jul 22;77:34-43.
4. Keisuke S, Pradhan SJ, Barone V, Inglés-Prieto Á, Rogers KW, Müller P, Ruprecht V, Galande S, Janovjak H, and Heisenberg CP. (2016) A temporal pattern of Nodal signaling regulates cell fate specification. *Cell Reports.* 16:866-877.
5. Reddy PC, Unni MK, Gungi A, Agarwal P, and Galande S#. (2015) Evolution of Hox-like genes in Cnidaria: Study of Hydra Hox repertoire reveals tailor-made Hox-code for Cnidarians. *Mech Dev.* 138 Pt 2:87-96.

Contact Info: E-mail: sanjeev@iiserpune.ac.in, Tel: +91-20-2590-8060

Group Web Page: <http://www.iiserpune.ac.in/~sanjeev>



PLATELET ACTIVATING FACTOR (PAF) AND ITS ROLE IN BREAST CANCER

Project Investigator: Mayurika Lahiri

Preferred scientific requirements: Mammalian cell culture, PCR, Immunoblotting

Research summary: Apart from the various environmental factors which influence the induction and progression of cancers, bioactive molecules present in the tissue microenvironment as well as tumor milieu can contribute to the occurrence and progression of the disease. Phospholipid mediators such as lysophosphatidic acid, prostaglandins, platelet activating factor and platelet activating factor-like molecules are secreted by cells of the immune system and are present in the microenvironment. Under chronic inflammatory conditions the proportion of these molecules increases in the adjoining tissues. Given the contribution of chronic inflammation in various cancers, the possibility of these molecules behaving as potential factors for cancer initiation and progression has increased manifold.

PAF acting through PAF-R (Platelet activating factor receptor, a G protein-coupled receptor) has been demonstrated to play important roles in various cancers. Apart from the well-known roles of PAF in inflammation, platelet aggregation various groups have demonstrated the contributing role of PAF in cancer progression. Our recent study, demonstrated the ability of PAF to enhance migration in MDA-MB 231 cells (invasive breast cancer cells) through the JNK and/or PI3K signaling pathways.

The possibility of PAF inducing transformation in breast epithelial cells has not yet been explored. We observed that in non-transformed breast epithelial cells, PAF induced formation of abnormal acinar structures when cells were grown as 3D cultures under constant stimulation of PAF. Apart from the increase in the number of cells in the acini, indicative of proliferation or evasion of apoptosis, the acinar structures also showed presence of protrusion-like structures indicative of EMT-like phenotype. Taken together, we demonstrated the ability of PAF to induce transformation of non-transformed breast epithelial cells. These results appeal for further investigations to delineate the pathway and identify novel targets to design novel therapeutics.

Representative Publications

1. Anandi, L., Chakravarty*, V. Ashiq KA*, Bodakuntla S and Lahiri, M. (2017) DNA-PK plays a central role in transformation of breast epithelial cells following alkylation damage. *Journal of Cell Sciences* 130 (21): 3749-3763; doi: 10.1242/jcs.203034.

* equal contribution

Cover Image: <http://jcs.biologists.org/content/130/21.cover-expansion>

First Person: <http://jcs.biologists.org/content/130/21/3605>

2. Anandi, L., Chakravarty, V. and Lahiri, M. (2016) Investigating two Hallmarks of Cancer - Genome Instability and Tumor Promoting Inflammation. *Indian Society of Cell Biology Newsletter* 35 (2):ISSN: 2349:8307.

3. Anandi, VL. and Lahiri, M. (2016) Platelet Activating Factor leads to initiation and promotion of breast cancer. *Cancer Cell and Microenvironment* 3 (3): e1370.doi:<http://dx.doi.org/10.14800/ccm/1370> [Invited review].

4. Anandi, VL., Ashiq, KA*, Nitheesh, K*. and Lahiri, M. (2016) Platelet Activating Factor promotes motility in breast cancer cells and disrupts non-transformed breast acinar structures. *Oncology Reports* 35 (1): 179-88. doi: 10.3892/or.2015.4387

* equal contribution

5. Bodakuntla, S., Anandi VL., Sural, S., Trivedi, P and Lahiri, M. (2014) N-nitroso-N-ethylurea activates DNA damage surveillance pathways and induces transformation in mammalian cells. *BMC Cancer* 14 (1): 287. doi:10.1186/1471-2407-14-287.

Contact Info: E-mail: mayurika.lahiri@iiserpune.ac.in, Tel: +91-20-2590- 8056

Group Web Page: <http://www.iiserpune.ac.in/~mayurika.lahiri>



UNDERSTANDING CROSS-KINGDOM REGULATION OF PHYTOPHTHORA GENES BY POTATO SMALL RNAS

Project Investigator: Anjan K. Banerjee

Preferred scientific requirements: Fundamental knowledge of molecular biology and some basics of Bioinformatics

Research summary: Research on cross-kingdom RNA interference (RNAi) mechanisms have provided novel and fascinating insights regarding plant-pathogen interactions. The oomycete pathogen *Phytophthora infestans* – that causes late blight disease of potato – can hijack RNA silencing machinery of host plants to increase susceptibility. In this project, we will examine if small RNAs of host plants can affect the mRNAs of *P. infestans*. We will use techniques such as cloning, confocal microscopy, infection assays and transformation of both *P. infestans* and potato to understand the function of the gene of interest. The work is expected to provide insights regarding RNAi-based resistance strategies employed by potato plants to circumvent infection.

Representative Publications

B. Natarajan, H. Kalsi, P. Godbole, N. Malankar, A. Thiagarayaselvam, S. Siddappa, H.V. Thulasiram, S.K. Chakrabarti and A.K. Banerjee, MiRNA160 is associated with local defense and systemic acquired resistance of potato against *Phytophthora infestans* infection, Under review (2017).

Contact Info: E-mail: akb@iiserpune.ac.in, Tel: +91-20-2590-8057

Group Web Page: <http://www.iiserpune.ac.in/~akb/>



IISER Pune is spread over a 100-acre area in Pashan, an educational and research hub of Pune, with several premier academic organizations in the vicinity.

Pune is connected by Air to all major cities across the country. The airport at Lohegaon doubles as an air force base. Pune is also well connected by trains and is accessible from Mumbai by road, which is a 3-hour drive. The Mumbai international airport has a regular taxi service to Pune. Regular bus service runs between the two cities as well.

Pune hosts a series of annual music festivals ranging from Indian Classical to Jazz and is home to renowned artists, musicians, and theatre groups that stage plays in Marathi and English. With the west coast just a couple of hours of drive away from Pune, several richly bio-diverse ecological hot spots are within reachable distances to Pune as are some of the spectacular beaches in this part of the country.



INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (IISER) PUNE

Dr. Homi Bhabha Road, Pashan, Pune-411008, India

Phone: +91-20-25908001; Fax: +91-20-20251566

Website: www.iiserpune.ac.in