Usha Nagarajan

Assistant Professor

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Area of Expertise

Developmental Biology
Cancer Biology
Genetics

Research Interest

As most of these signaling activities, their regulatory mechanisms are well conserved and as more than 75% of human diseases find a match in Drosophila genome, fruit flies serve as a popular model to understand many of these basic molecular and cellular processes operating among other species. Our laboratory has undertaken genetic screening to address and understand the following processes:

Intracellular Trafficking and Tumorigenesis

To maintain homeostasis, cell communicates with the extracellular matrix and intracellular components involving several signalling components. During this process, several cell surface components like signalling receptors and membrane proteins are constantly transported by intracellular trafficking components either inside the cell either to perform specified function or for degradation (endocytosis) and recycled back to the cell surface (exocytosis). To this end, intracellular trafficking components interact with several post-translational regulatory (ubiquitination, phosphorylating and dephosphorylating) machineries to modulate several signaling activities including Notch, Hedgehog, Wnt/Wg, Hippo signaling. Loss of an Intracellular trafficking component severely deregulates signaling activities leading to tumorigenesis and tumor formation. Our lab has undertaken a genetic screening to identify several components that mediate this process. We are interested to investigate how these intracellular components interact with posttranslational regulatory machineries to promote tumors and invasiveness.

Organ size and tumorigenesis

In multicellular organisms, organ size and tissue architecture are maintained by highly coordinated activities of various signaling pathways like Notch, Hedgehog, Wnt/Wg, Hippo signaling. Deregulation of these activities leads to various developmental defects and diseases. Our genetic screening has discovered novel components of post-translational machineries to be involved in maintaining organ size and regulating growth factors. We have undertaken molecular and genetic approaches to dissect the role of these components in maintaining organ size.

Research Funding:

Completed PROJECT - Project File No: YSS/2014/00089
Funding agency: Department of Science and Technology (DST)-SERB, India**.**
Title: Genetic Screening to identify and characterize novel factors implicated in ligand-independent Notch signaling pathway
Grant Size: 26 Lakhs INR **Duration:** 3 years (November 2015-November 2018)

Ongoing PROJECT - Project File No: CRG/2018/003725
Funding agency: Department of Science and Technology (DST)-SERB, India**.**
Title: Genetic and Molecular characterization of novel Shrub-interacting factors implicated in Intracellular signaling pathways using Drosophila melanogaster
Grant Size: 52 Lakhs INR **Duration:** 3 years (February 2019-February 2022)

Previous Positions:

Assistant Professor (Research)	Lab 210 (Fly Lab), ASK-II School of Chemistry and Biotechnology (SCBT), SASTRA Deemed University, Thanjavur, Tamilnadu, India 613401.	June 2014- February 2020
Postdoctoral Research Associate	Dr Marios Georgiou School of Life Sciences, Queens Medical Center, University of Nottingham, Nottingham, UK NG5 2UH (Qualified for **Marie Curie CASCADE Fellowship** but did not avail as it was not funded to University of Nottingham).	April 2015- April 2016
Postdoctoral Research Fellow	Dr. Thomas Vaccari, IFOM-IEO campus, Via Adamello, 16, Milano, 20139, Italy.	February 2013- February 2014
Postdoctoral Research Fellow	Dr. Matt Gibson, Stowers Institute for Medical Research, Kansas City, MO, 64110, USA	2009-2012
Postdoctoral Research Fellow	Dr Rakesh Mishra and Dr Jyotsna Dhawan, Center for Cellular and Molecular Biology(CCMB), Hyderabad, India.	2008-2009
Academic Details		
Ph.D., (Life Sciences) Developmental Biology	Dr. L.S. Shashidhara Center for Cellular and Molecular Biology (CCMB), Hyderabad, India.	2002-2009
M.Sc., (Biotechnology)	Tamilnadu Agricultural University (TNAU), Coimbatore, Tamilnadu, India.	2000-2002 95.3%
B.Sc., (Agriculture)	Anbil Dharmalingam Agricultural College and Research Institute (ADAC&RI), Tiruchirapalli, Tamilnadu, India.	1994-1998 92%
Higher Secondary School	Lions Matriculation and Higher Secondary School, Tirupattur, Tamilnadu, India	1991-1993 92%

Courses Taught:

- B Tech - (Biology for Engineers, Developmental Biology)
- M Tech - (Cell and Molecular Biology, Developmental Genetics)
- M.Sc.- (Advanced Biochemistry, Immunology, Principles of Genetics Cell and Molecular Biology, Genetic Engineering,)

Awards/Medals:

Ph.D.:

- Dr. Ed Lewis Best Poster award during the poster presentation at EMBO International Workshop on "Upstream and Downstream of Hox Genes" at CCMB, Hyderabad, India, 14th-17th December 2005.
- The Best Poster Award at the 9th Japanese Drosophila Research Conference (JDRC9), YAMAHA Resort TSUMAGOI, Japan, 6th-8th July, 2009.

Undergraduation:

- The Western Electronic and Scientific works Gold Medal for the Highest OGPA.
- Meenakshi Ammal Gold Medal for the highest marks in Agricultural Botany.
- Senthilvel Medal for the second highest marks obtained in Soil Science & Agricultural Chemistry.
- Ibrahim Mohamed Doka Mohamed and Kenana Sugar Company Limited Gold Medal for the Best B.Sc (Ag) Student.

Symposium Participation:

- Participated in EMBO International Workshop on "Cell Interaction in Development and Disease" held at CCMB, Hyderabad, India, 16th- 18th December 2004.
- Participated in the symposium on "Development, Epigenetics and Plasticity" and the Annual Conference of the Indian society of Developmental Biologists-2004 held at JNCASR, Bangalore, India, 21st -23rd December 2004.
- Participated in 30th Mahabaleswar Seminar and teaching workshop on "Evolution of Developmental Mechanisms" held at Mahabaleswar, India, 21st -26th January 2005.
- Participated in International symposium on "Cellular Signaling during Development" and the Annual Conference of the Indian society of Developmental Biologists-2006, at Agarkar Research Institute, Pune, India, 23rd-25th November 2006.

Poster Presentation:

- At 47th Annual *Drosophila* Research Conference, Hilton Americas-Houston, Houston, Texas, USA, 29th March - 2nd April 2006, (Abstract No.70012).
- At EMBO International Workshop on "Upstream and Downstream of Hox Genes" at CCMB, Hyderabad, India, 14th-17th December 2005.
- At International symposium on "Insect Genetics and Genomics", held at Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad, India, 9th -11th January 2006.
- At EMBO International Workshop on "Developmental Mechanisms and Disease Models held at IIT, Kanpur, India, 16th-20th December 2006.
- At the 9th Japanese Drosophila Research Conference (JDRC9), YAMAHA Resort TSUMAGOI, Japan, 6th-8th July, 2009.
- At the Young Investigator Research Day (YIRD) held at Stowers Institute for Medical Research, Kansas City, MO, USA 14th-15th May 2012.
- At the ABCD congress held at Ravenna, Italy, 12-14th September 2013.
- At EMBO International Workshop on "Upstream and Downstream of Hox Genes" at CCMB, Hyderabad, India, 14th-17th December 2014.

Oral Presentation:

- At the International symposium on "Developmental Dynamics" and the Annual Conference of the Indian society of Developmental Biologists-2005 at Department of Zoology, University of Kalyani, India, 23rd –25th November, 2005.
- At the 9th Japanese Drosophila Research Conference, YAMAHA Resort TSUMAGOI, Japan, 6th-8th July, 2009.

Fellowship:

Postdoctoral Studies

- 2015-2016- Qualified for Marie Curie CASCADE Fellowship in collaboration with University of Nottingham

Ph.D.:

- CSIR-UGC NET JRF qualified during June 2002 **(Second Rank in All-India Shyam-Prakash Mukherjee competition)**.
- Development Traveling Fellowship (2005) by Company of Biologists, UK, to visit and work in Dr. Sarah Bray's lab at University of Cambridge, UK.
- RIKEN Centre for Developmental Biology (CDB) Travel Fellowship (2009)from Japan to present poster at the 9th Japanese Drosophila Research Conference (JDRC9), Tsumagoi, Japan.

Postgraduation:

- Jawaharlal Nehru University(JNU) Merit Scholarship **(All-India 1st Rank)**

Undergraduation:

- TamilNadu Agricultural University(TNAU) Merit Scholarship (1994-1998).

Membership in Professional Bodies

- Indian Society of Developmental Biologists (InSDB), India- Regular member-InSDB10099
- Genetic Society of America (GSA), United States of America-Annual renewal-4533930
- ABC congress of Italian Science, Italy-10 years (upto 2024)- 134/2013
- Indian Society of Systems for Science and Technology (ISSE), Trichy Chapter- Life Member-LM05564

Publication:

- **Usha N** and Shashidhara LS. (2010) Interaction between Ataxin-2 Binding Protein 1 and Cubitus-interruptus during wing development in *Drosophila*. Developmental Biology 341, 389–399.
- Szuperak M, Salah S, Meyer E, **Usha N**, Ikmi A and Gibson M. (2011) Feedback modulation of *Drosophila* BMP signaling by the novel extracellular protein, Larval Translucida Development 138, 715-724.
- Subba* R M, Vasundhara* V, **Usha N**, Savitri M, Subhash G and Indumathi M (2013) Derivation, characterization and retinal differentiation of induced pluripotent stem cells J. Biosci. 38(1),123–134.
- Pakkiriswami S*, Couto A*, **Usha Nagarajan#,** Marios Georgiou# (2016) Glycosylated Notch and Cancer. Frontiers in Oncology *6(37), 1-7.* (**#** Corresponding Author)
- **Usha Nagarajan#**, Pakkiriswami S and Pillai AB. (2015) Sugar tags and tumorigenesis. Frontiers in Cell and Developmental Biology 3(69), 1-5. (**#** Corresponding Author)
- Pillai AB*#, **Usha Nagarajan*****, Mitra A, Krishnan, U, Rajendran, S, Hoti, SL; Mishra, RK# (2017) RNA interference in mosquito: understanding immune responses, dsRNA delivery systems and potential applications in vector control. Insect Molecular Biology 26(2), 127-139. (***** Equal Contribution)