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EDUCATION

Doctor of Philosophy (Ph. D.) in Chemistry, 2016, Jawaharlal Nehru University, New Delhi, India.
Master of Science in Chemistry (1st Class), 2009, University of Delhi, New Delhi, India.
Bachelor of Science in Chemistry (1st Class), 2006, Kirori Mal College, University of Delhi, New Delhi, India.

PROFESSIONAL HISTORY

03/2023 – till date	Research Scientist I, Molecular Biology and Biochemistry, University of Texas Medical Branch, Galveston, TX, USA
11/2019 – 02/2023	Postdoctoral Research Fellow, Molecular Biology and Biochemistry, University of Texas Medical Branch, Galveston, TX, USA
05/2017 – 11/2019	Postdoctoral Research Fellow, Mechanobiology Institute, National University of Singapore, Singapore
12/2016 – 04/2017	Research Associate, Advance Instrumentation and Research Facility (AIRF), Jawaharlal Nehru University, New Delhi, India
11/2015 - 11/2016	DBT-BUILDER Research Fellow/Research Assistant, School of Physical Sciences, Jawaharlal Nehru University, New Delhi, India
01/2010 - 07/2015	Ph.D. Student, Spectroscopy Laboratory, School of Physical Sciences, Jawaharlal Nehru University, New Delhi, India

Postdoctoral Research:

University of Texas Medical Branch, November 2019– to-date, with Prof. Linda J. Kenney and *Prof. Michael Sheetz*

- OligoSTORM/OligoDNA-PAINT Super-resolution imaging: Functional genome organization and its interplay with bacterial pathogenesis (*in collaboration with Dr. Guy Nir*, UTMB, USA)
- FLIM: Development and application of fluorescence lifetime dependent probe for measuring intracellular pH and its heterogeneity in bacterial cells.
- Genetic code expansion in ZIKV: Tracking of entry & uncoating of GCE labeled ZIKV into host cell (*In collaboration with Prof. Pei-Yong Shi,* UTMB, USA)
- PALM-STORM: Sequential single cell imaging of EnvZ/OmpR two-component regulatory system under environmental stress

National University of Singapore, May 2017 – November 2019, with Prof. Linda J. Kenney.

- Genetic code expansion: Developed and optimized a genetic code expansion-based platform for labeling & visualization of bacterial secreted effectors and secretion component into host cells.
- sptPALM: Tracked and studied the dynamics of signaling protein in bacteria under different environmental stress condition.
- PALM: Used PALM for counting copy number of signalling proteins in bacteria

Research Associate at AIRF, JNU:

Advance Instrumentation and Research Facility (AIRF), Jawaharlal Nehru University, December 2016 – April 2017, with *Prof. Rakesh K Tyagi* and *Prof. Sobhan Sen*

- FCS: Built a confocal Fluorescence Correlation Spectroscopy (FCS) for the central research facility

Graduate Research:

School of Physical Sciences, Jawaharlal Nehru University, 2009–2015, with *Prof. Sobhan Sen*

Ph.D. Thesis Title: *Study of Depth-Dependent Static and Dynamic Properties of Water-Lipid Bilayer Interface using Series of Fluorescent Probes of Different Hydrophobicity.*

- Membrane probe development: Designed and synthesised a series of suitably tailored fluorescent probes and utilized them to study and understand the depth-dependent static and dynamic properties of lipid/water interfaces.
    - Measured and studied probe-location dependent polarity and hydration at lipid/water interfaces.
    - Studied depth-dependent ultrafast solvation dynamics at lipid/water interfaces over a broad five decades of time from ~100 fs to 10 ns.
    - Probe-location dependent resonance energy transfer and electron transfer at lipid/water interfaces
- Time-resolved fluorescence spectroscopy: Extensively work on Femtosecond Fluorescence Up-conversion and Time Correlated Single Photon Counting (TCSPC) techniques. Applied these techniques to study the ultrafast dynamics in lipid/water interfaces and DNA from femtosecond to nanosecond time scale.
- Fluorescence Correlation Spectroscopy: Constructed a highly sensitive inexpensive FCS setup by assembling opto-mechanical components using inverted fluorescence microscope and utilized it to study and understand the ligand-DNA interactions at the (near) single molecule level.
- Supramolecular assemblies: FCS was used to measure the accurate size and size-distribution of supramolecular assemblies, viz., micelles and reverse micelles.

AWARDS/HONOURS/FELLOWSHIPS

- Member of Review Editor Board of *Frontiers in Chemistry, Frontiers in Molecular Biosciences*
- Travel Grant Award from Gordon Research Conference for presenting work at '2019 *Salmonella* Biology and Pathogenesis GRC'.
- Best Poster Prize in "DAE-BRNS Theme Meeting on Ultrafast Science – 2016" held in Bhabha Atomic Research Centre, Mumbai, India (2016).
- Senior Research Fellow, Council of Scientific and Industrial Research, Govt. of India (2012-2014).
- Junior Research Fellow, Council of Scientific and Industrial Research, Govt. of India (2010-2011).

RESEARCH INTEREST

Single-molecule localization microscopy, Single-particle tracking photoactivation localization microscopy (sptPALM), multicolor-oligoSTORM, Fluorescence Correlation Spectroscopy, Functional genome organization & Signal transduction in bacteria and bacterial pathogenesis.

PUBLICATIONS

(a) Peer Reviewed

1. Shih-Chia Yeh, Tania Strilets, Wei-Lian Tan, David Castillo, Hacène Medkour, Félix Rey-Cadilhac, Idalba M. Serrato-Pomar, Florian Rachenne, Avisha Chowdhury, Vanessa Chuo, Sasha R. Azar, **Moirangthem Kiran Singh**, Rodolphe Hamel, Dorothée Missé, R. Manjunatha Kini, Linda J. Kenney, Nikolaos Vasilakis, Marc A. Marti-Renom, Guy Nir, Julien Pompon* and Mariano A. Garcia-Blanco*. "The anti-immune dengue subgenomic flaviviral RNA is found in vesicles in mosquito saliva and associates with increased infectivity". *PLOS Pathogens* **2023,** 19, e1011224**.** (https://doi.org/10.1371/journal.ppat.1011224).

2. **Moirangthem Kiran Singh**, Linda J. Kenney*. "Super-resolution imaging of bacterial secreted effectors using genetic code expansion" *J. Vis. Exp.* **2023**, 192, e64382. (https://doi.org/10.3791/64382).

3. Lauren G. Mascibroda, Mohammad Shboul, Nathan D. Elrod, Laurence Colleaux, Hanan Hamamy, Kai-Lieh Huang, Natoya Peart, **Moirangthem Kiran Singh**, Hane Lee, Barry Merriman, Jeanne N. Jodoin, Laura A. Lee, Raja Fathalla, Baeth Al-Rawashdeh, Osama Ababneh, Mohammad El-Khateeb, Nathalie Escande-Beillard, Stanley N. Nelson, Yixuan Wu, Liang Tong, Linda Kenney, William K. Russell, Jeanne Amiel, Bruno Reversade*, and Eric J. Wagner*. "INTS13 variants causing a recessive developmental ciliopathy disrupt assembly of the Integrator complex". *Nature Communications.* **2022,** 13, 6054; (https://doi.org/10.1038/s41467-022-33547-8).

4. **Moirangthem Kiran Singh,** Parisa Zangoui, Yuki Yamanaka and Linda J. Kenney*. "Genetic code expansion enables visualization of *Salmonella* type three secretion system components and secreted effectors". *eLife* **2021,** 10, e67789 (https://elifesciences.org/articles/67789). ***

   *** A tour-de-force, this study applies genomic expansion mediated protein labeling to investigate the mechanism of *Salmonella*-induced filament (SIF) formation in infected cells as catalyzed by secreted effectors of the *Salmonella* pathogenicity island 2 type-3 secretion system. Using this cutting-edge approach, the authors demonstrate that a key factor, SsaP, controls the secretion-specificity switch from injectisome substrate secretion to translocon and effector secretion, clarifying the mechanism driving SIF formation.

5. **Moirangthem Kiran Singh** and Linda J Kenney*. "Super-resolution imaging of bacterial pathogens and visualization of their secreted effectors". *FEMS Microbiology Reviews* **2020**, 45, fuaa050. (https://doi.org/10.1093/femsre/fuaa050).

6. Andrew Tze Fui Liew, Yong Hwee Foo, Yunfeng Gao, Parisa Zangoui, **Moirangthem Kiran Singh**, Ranjit Gulvady, and Linda J. Kenney*. "Single cell, super-resolution imaging reveals acid-dependent SPI-2 gene regulation by SsrB". *eLife* **2019**, 8, e45311. doi: 10.7554/eLife.45311 **(**https://elifesciences.org/ articles/45311).

7. Jasvir Kaur, Neetu Singh Yadav, **Moirangthem Kiran Singh**, Mohd Jahir Khan, Sobhan Sen, Aparna Dixit, Dvapriya Choudhury*. "Role of Ser65, His148 and Thr203 in the Organic Solvent Dependent Spectral Shift in Green Fluorescent Protein". *Photochem. Photobiol*. **2018**, 95, 543-555. DOI: 10.1111/php.13018 (http://dx.doi.org/10.1111/php.13018).

8. **Moirangthem Kiran Singh***, Mohammad Firoz Khan, Him Shweta and Sobhan Sen*. "Probe-Location dependent Resonance Energy Transfer at Lipid/ Water Interfaces: Comparison between Gel- and Fluid-Phase of Lipid Bilayer". *Phys. Chem. Chem. Phys***. 2017,** *19*, 25870-25885. DOI:10.1039/C7CP03108D (http://dx.doi.org/10.1039/C7CP03108D) **(*Inside Front Cover Article*)**.

9. Him Shweta, **Moirangthem Kiran Singh**, Kavita Yadav, Sachin Dev Verma, Nibedita Pal**,** Sobhan Sen*. "Effect of T·T-Mismatch on DNA Dynamics Probed by Minor Groove Binders: Comparison of Dynamic Stokes Shifts of Hoechst and DAPI". *J. Phys. Chem. B* **2017**, *121*, 10735-10748. DOI: 10.1021/acs.jpcb.7b06937 (http://dx.doi.org/10.1021/acs.jpcb.7b06937) **(*Cover Article*)**.

10. **Moirangthem Kiran Singh**, Him Shweta, Mohammad Firoz Khan and Sobhan Sen*. **"**New Insight of Probe-Location Dependent Polarity and Hydration at Lipid/Water Interfaces: Comparison between Gel- and Fluid-Phase of Lipid Bilayers**".** *Phys. Chem. Chem. Phys.* **2016**, *18*, 24185-24197. (http://dx.doi.org/10.1039/C6CP01201A) **(*Inside Front Cover Article*)**.

11. **Moirangthem Kiran Singh***, Him Shweta and Sobhan Sen*. "Dispersed Dynamics of Solvation in G-Quadruplex DNA: Comparison of Dynamic Stokes Shifts of Probes Bound to Parallel and Antiparallel Quadruplex Structures". *Methods Appl. Fluoresc.* **2016,** *4*, 034009 (https://doi.org/10.1088/2050-6120/4/3/034009) ***(Optics Within Life Sciences – 2016 special issue)***.

12. Mohammad Firoz Khan, **Moirangthem Kiran Singh**, and Sobhan Sen*. "Measuring Size, Size Distribution, and Polydispersity of Water-in-Oil Microemulsion Droplets using Fluorescence Correlation Spectroscopy: Comparison to Dynamic Light Scattering". *J. Phys. Chem. B* **2016**, *120*, 1008–1020 (http://dx.doi.org/10.1021/acs.jpcb.5b09920).

13. Mohammad Firoz Khan, **Moirangthem Kiran Singh** and Sobhan Sen*. "Quantifying Size Parameters of Water-in-Oil Microemulsion Droplets: Why Fluorescence Correlation is Advantageous over Light Scattering Correlation?" *ISRAPS Bull.* **2016,** *28*, 40-50 (Invited Review). PDF

14. Nibedita Pal, Him Shweta, **Moirangthem Kiran Singh**, Sachin Dev Verma, and Sobhan Sen*. "Power-Law Solvation Dynamics in G-Quadruplex DNA: Role of Hydration Dynamics on Ligand Solvation inside DNA". *J. Phys. Chem. Lett.* **2015***, 6,* 1754 – 1760 (http://dx.doi.org/10.1021/acs.jpclett.5b00653).

15. Sachin Dev Verma, Nibedita Pal, **Moirangthem Kiran Singh**, and Sobhan Sen*. "Sequence-Dependent Solvation Dynamics of Minor Group Bound Ligand inside Duplex-DNA". *J. Phys. Chem. B* **2015**, *119,* 11019–11029 (http://dx.doi.org/10.1021/acs.jpcb.5b01977).

16. Sachin Dev Verma, Nibedita Pal, **Moirangthem Kiran Singh**, and Sobhan Sen*. **"**Probe Position Dependence of Ion Dynamics in DNA: Comparison of the Time-Resolved Stokes Shift of Groove-Bound to Base-Stacked Probes". *J. Phys. Chem. Lett.* **2012**, *3*, 2621-2626 (http://dx.doi.org/10.1021/jz300934x).

17. Sachin Dev Verma, Nibedita Pal, **Moirangthem Kiran Singh**, Him Shweta, Mohammad Firoz Khan, and Sobhan Sen*. "Understanding Ligand Interaction with Different Structures of G-Quadruplex DNA: Evidence of Kinetically Controlled Ligand Binding and Binding-Mode Assisted Quadruplex Structure Alteration". *Anal. Chem.* **2012**, *84*, 7218-7226 (http://dx.doi.org/10.1021/ac3015998).

18. Nibedita Pal, Sachin Dev Verma, **Moirangthem Kiran Singh**, and Sobhan Sen*. "Fluorescence Correlation Spectroscopy: An Efficient Tool for Measuring Size, Size-Distribution and Polydispersity of Microemulsion Droplets in Solution". *Anal. Chem.* **2011**, *83*, 7736-7744 (http://dx.doi.org/10.1021/ac2012637).

(b) Book Chapters

19. **Moirangthem Kiran Singh**, Him Shweta and Sobhan Sen*. "New Family of 4-Aminophathalimide-Based Fluorescent Probes for Measuring Depth-Dependent Static and Dynamics Properties at Lipid/Water Interfaces" in *Analysis of Membrane Lipids* **2020** In: Prasad R., Singh A. (eds) *Analysis of Membrane Lipids*. Springer Protocols Handbooks. Springer, New York (https://doi.org/10.1007/978-1-0716-0631-5_10).

20. Him Shweta, Nibedita Pal, **Moirangthem Kiran Singh**, Sachin Dev Verma, Sobhan Sen*. "Dynamics of Water and Ions Near DNA: Perspective from Time-Resolved Fluorescence Stokes Shift Experiments and Molecular Dynamics Simulation". In: Geddes C. (eds*) Reviews in Fluorescence 2017*. Reviews in Fluorescence. Springer, Cham; **2018**, pp231-279. DOI: 10.1007/978-3-030-01569-5_10 (https://doi.org/10.1007/978-3-030-01569-5_10).

(c) Manuscripts under review/revision/preparation

21. **Moirangthem Kiran Singh**, Linda J. Kenney*. "Fluorescence Lifetime Based pH Mapping of Bacterial Lifestyle using Genetically Encoded mCherryTYG.

22. John Yun-Chung Chen‡, **Moirangthem Kiran Singh**‡, Linda J. Kenney, Pei-Yong Shi*. Site-specific labeling of ZIKV capsid enable visualization of ZIKV-host interactions. ‡*equal contribution*

23. **Moirangthem Kiran Singh**, Mohammad Firoz Khan and Sobhan Sen. "Probing Depth-Dependent Solvation Dynamics across Lipid/Water Interfaces: 4-Aminophthalimide Derivatives at the Interfaces".

SCIENTIFIC EXPERTISE

- OligoSTORM super-resolution imaging
- Single-particle tracking photoactivation localization microscopy (SptPALM) imaging and analysis
- Fluorescence-lifetime imaging (FLIM)
- Single Molecule Spectroscopy - Designed and built two state-of-the-art confocal FCS
- Ultrafast Laser Spectroscopy
- Genetic code expansion technology
- Purification and in vivo/vitro labelling of proteins
- Molecular biology (PCR, SDS- and Urea-PAGE, Western blot, and cloning etc.)
- Organic synthesis
- Data analysis: MATLAB (intermediate), ImarisPro 9.0, ImageJ, IgorPro and GraphPad Prism

TALKS AND PRESENTATION

Selected/Invited Talks

- **BMB Retreat 2020** held at Biochemistry and Molecular Biology, University of Texas Medical Branch at Galveston, TX, USA during November 13-14, 2020. Title: "*Genetic code expansion enables visualization of Salmonella type three secretion system components and secreted effectors*".
- **One Day Symposium: Frontiers in Mechanobiology** held at Mechanobiology Institute, National University of Singapore, Singapore during July 15, 2019. Title: "*Labeling and Visualization of Salmonella Secreted Effector SifA by Genetic Code Expansion*".
- **Gordon Research Conference on *Salmonella* Biology and Pathogenesis** held at Stonehill College in Easton, MA United States during June 02-07, 2019. Title: "*Visualization of Salmonella-induced Filaments through Site-Specific Fluorescent Labeling of SPI-2 SifA Effector Protein*".
- **Innovative Approaches to the Study of Bacterial Pathogens** held at International Center for Interdisciplinary Science Education (ICISE), Quy Nhon, Vietnam during September 16-21, 2018. Title: "*Visualization of Salmonella-induced Filaments through Site-Specific Fluorescent Labeling of SPI-2 SifA Effector Protein*".
- **Mechanobiology Institute (MBI) Seminar**: *Understanding Dynamics and Molecular Interactions in Lipid Bilayer, DNA and Microemulsion droplets using Femosecond and Single Molecule Spectroscopy*. Moirangthem Kiran Singh at Mechanobiology Institute, National University of Singapore, Singapore on 17th January 2017.

Posters

- **Gordon Research Conference on Sensory Transduction in Microorganisms** held at Ventura Beach Marriott in Ventura, CA United States during January 12-17, 2020. Title: "*Labeling and visualization of Salmonella secreted effector SifA by genetic code expansion".*
- **Mechanobiology after 10 Years: The Promise of Mechanomedicine** held at Shaw Foundation Alumni House, National University of Singapore, Singapore on November 07-10, 2018. Title: *"Visualization of Salmonella-induced Filaments through Site-Specific Fluorescent Labeling of SPI-2 SifA Effector Protein".*
- **National Workshop on Fluorescence and Raman Spectroscopy: FCS-2018** held in Jawaharlal Nehru University, India during November 12-17, 2018. Title: *"Visualization of Salmonella-induced Filaments through Site-Specific Fluorescent Labeling of SPI-2 SifA Effector Protein".*
- **National Science Day - 2017** held at Jawaharlal Nehru University, New Delhi India on February 28, 2017. Title: *Fluorescence Spectroscopy: Application in Chemistry and Biology*.

- **DAE-BRNS Theme Meeting on Ultrafast Science - 2016** held in Bhabha Atomic Research Centre, Mumbai, India during November 24-26, 2016. Title: *Probing Location-Dependent Polarity, Solvation Dynamics and Energy Transfer at Lipid/Water Interfaces: Comparison between Gel- and Fluid- Phases of Lipid Bilayers"* (**Best Poster Award**).
- **Light in Chemistry, Material and Biology** held in Indian Institute of Technology Kharagpur, India during February 24-25, 2014. Title: *Probing Depth-Dependent Polarity and Dynamics at Phospholipid Bilayer Interface using Fluorescent Molecular Rulers".*
- **National Fluorescence Workshop: FCS-2013** held in Indian Institute of Science and Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India during November 24 - 28, 2013. Title: "*Probing Depth-Dependent Dynamics at Phospholipid Bilayer Interface using Fluorescent Molecular Rulers".*
- **March Meeting 2013** held in School of Physical Sciences, Jawaharlal Nehru University, India during March 7-8, 2013. Title: *"Probe Position Dependent Counterions Stokes Shift of Groove-Bound to Base-Stacked Probes in Presence of Different Monovalent Counterions".*
- **Trombay Symposium on Radiation and Photochemistry (TSRP-2012)** held in Bhabha Atomic Research Centre, Mumbai, India during 4-7 January 2012. Title: *"Looking at Single Particle Diffusion in Solution: Fluorescence Correlation vs Light Scattering Correlation".*
- **National Fluorescence Workshop: FCS-2012** held in Saha Institute of Nuclear Physics, Kolkata, India on December 05, 2012. Title: *"Probe Position Dependent Counterions Stokes Shift of Groove-Bound to Base-Stacked Probes in Presence of Different Monovalent Counterions".*
- **March Meeting 2012** held in School of Physical Sciences, Jawaharlal Nehru University, India during March 2012. Title: *"Looking at Single Particle Diffusion in Solution: Fluorescence Correlation vs Light Scattering Correlation".*

PERSONAL DETAILS

Full Name: Moirangthem Kiran Singh
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REFERENCES

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4. **Prof. Mariano Garcia-Blanco**
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