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**Research Statement**

Short tandem repeats, which are 1 to 6 nucleotide(s) in length, are frequently observed in eukaryotic genome. Abnormal expansion of these short tandem repeats destabilizes the secondary structure and subsequently triggers the formation of unusual (non-B-DNA) nucleic acid conformations. Most of these unusual conformations are associated with tri nucleotides (or triplet repeats) such as CAG•CTG, CGG•CCG and GAC•GTC repeats that cause major genetic instability. Triplet repeats are associated with over 22 incurable neurological and neuromuscular disorders like Huntington's disease (CAG•CTG repeats), fragile X syndrome (CGG•CCG), skeletal dysplasia (GAC•GTC), Frederick's ataxia (GAA•TTC), etc. The severity of the disease depends on the repeat length. These repeats are found throughout the genome and form unusual conformations such as hairpin structure (A...A mismatch), G-quadruplexes (G...G mismatch) and i-motif structures (C...C mismatch), which contain non-canonical base pairs. Our research focuses on characterizing the conformational dynamics and structural properties of unusual nucleic acids and their interaction with proteins involved in several neurological disorders. We address these challenges using several interdisciplinary techniques, including molecular biology, single-molecule techniques, and computational methods.

Professional Experience

2026 (February-Present): Assistant Professor, Dept. of Animal Biology, SLS, University of Hyderabad, India.

2024-2026 (January-February): Postdoctoral Fellow, Clemson University, SC, USA.

2024 (March-September): Visiting Scholar, Emory University, Atlanta, USA.

2022-2023 (April-December): Postdoctoral Associate, UMass Chan Medical School, Worcester, USA.

2018-2022 (December-March): Postdoctoral Fellow, Clemson University, SC, USA.

2014-2016 (January-December): Graduate Teaching Assistant. Dept. of Biotechnology, IIT Hyderabad.

Education

2013-2018: PhD in Biotechnology, Indian Institute of Technology Hyderabad, India.

2009-2011: M.Sc in Biochemistry, Osmania University, Hyderabad, India.

2005-2008: B.Sc in Biotechnology, Osmania University, Hyderabad, India.

Awards and Fellowships

2022: Recipient of the "Biophysical Society (BPS) travel award", San Francisco, USA.

2022: Recipient of the "Clemson University Post-Doctoral Association (CUPDA) Distinguished Service Award", Clemson University, USA.

2019: Co-recipient of the "Gandhian Young Technological Innovation (GYTI) Award", Government of India.

2018: Co-recipient of the "GYTI Appreciation/Award, Government of India.

2018: Recipient of "Excellence in Research" Award in IIT Hyderabad, India.

2017: Co-recipient of the "GYTI Award", Government of India.

2017: Recipient of "Dr. KV Rao Research Award (Runner-up 1)", Hyderabad, India.

2016: Recipient of "Excellence in Research" Award in IIT Hyderabad, India.

Publications († Equal contribution)

1. **Kolimi N.**, Ghimire S., Duffy F., Peulen T., Medina E., Sanabria H., “Time-resolved fluorescence anisotropy from single molecules for characterizing local flexibility in biomolecules”. *JoVE*, 10.3791/67802 (2025).
2. **Kolimi N.**, Ballard J., Peulen T., Goutam R., Duffy III FX., Ramirez-Sarmiento C., Babul J., Medina E., Sanabria H., “DNA controls the dimerization of the human FoxP1 Forkhead domain”. *Cell Reports Physical Science*, 5, 101854 (2024).
3. Cruz P., Paredes N., Asela I., **Kolimi N.**, Molina A., Ramirez-Sarmiento C., Goutam R., Huang G., Medina E., and Sanabria H., "Domain tethering impacts dimerization and DNA-mediated allostery in the human transcription factor FoxP1". *J. Chem. Phys.* 158, 195101 (2023).
4. **Kolimi N**[†], Pabbathi A[†], Saikia N, Ding F, Sanabria H, and Alper J., “Out-of-Equilibrium Biophysical Chemistry: The Case for Multidimensional, Integrated Single-Molecule Approaches”. *J. Phys. Chem. B*, 125, 37, 10404–10418 (2021).
5. Ajjugal Y.[†], **Kolimi N**[†]. & Rathinavelan T., Secondary structural choice of DNA and RNA associated with CGG/CCG trinucleotide repeat expansion rationalizes the RNA misprocessing in FXTAS. *Scientific Reports* 11, 8163. <https://doi.org/10.1038/s41598-021-87097-y> (2021).
6. Tsytlonok M, Hemmen M, Hamilton G, **Kolimi N**, Felekyan S, Seidel CAM, Tompa P and Sanabria H., “Specific conformational dynamics and expansion underpin a multi-step mechanism for specific binding of p27 with Cdk2/Cyclin A”. *Journal of Molecular Biology*, 432 (9), 2998-3017 (2020).
7. **Kolimi N.**[†], Ajjugal Y[†] and Rathinavelan T., “A B–Z junction induced by an A...A mismatch in GAC repeats in the gene for cartilage oligomeric matrix protein promotes binding with the hZ α _{ADAR1} protein”. *Journal of Biological Chemistry* 2017 292: 18732-. doi:10.1074/jbc.M117.796235 (2017).
8. Patro L.P.P., Kumar A.[†], **Kolimi N.**[†] and Rathinavelan T., “3D-NuS: A Web Server for Automated Modeling and Visualization of non-canonical 3-Dimensional Nucleic Acid Structures”. *Journal of Molecular Biology*, 429, 2438-2448 (2017).
9. Sachdeva S.[†], **Kolimi N.**[†], Nair S.A.[†] and Rathinavelan T., “Key diffusion mechanisms involved in regulating bidirectional water permeation across *E. coli* outer membrane lectin”, *Scientific Reports* 28157. doi: 10.1038/srep28157 (2016).
10. Khan N.[†], **Kolimi N**[†] and Rathinavelan T.[†], “Twisting Right To Left: A...A Mismatch In A CAG Trinucleotide Repeat Overexpansion Provokes Left-Handed Z-DNA Conformation”, *PLoS Computational Biology*, 10.1371/journal.pcbi.1004162 (2015).

Conference proceedingsPoster presentations

1. **Kolimi N**, Qian J, Cosentino-Lagomarsino M, Scolari V, Dunlap D, and Finzi L. (2025), “The Effect of Macromolecular Crowding on DNA under Tension”. Biophysical Society annual meeting, Los Angeles, USA, Feb 15-19, 2025.
2. Ucuncuoglu S, **Kolimi N**, Wang B, Artsimovitch I, Finzi L and Dunlap D. (2025), “Assay transcription with quantitative PCR”. Biophysical Society annual meeting, Los Angeles, USA, Feb 15-19, 2025.
3. **Kolimi N**, Peulen T, Ballard JH, Molina JA, Ramirez-Sarmiento CA, Babul J, Medina E, Sanabria H. (2023), “DNA-induces intra-and inter-molecular changes in dimerization of the human FOXP1”. *Biophysical Journal* 122 (3), 430a.

4. **Kolimi N**, Krishnamohan A, Goutam R, Morcos F, Sanabria H. (2022), “Integrative structural dynamics of calmodulin showcases sequence-to-function”. *Biophysical Journal* 121 (3), 43a.
5. **Kolimi N**, Medina E, Ramírez-Sarmiento C, Sanabria H, and Babul J. (2021), “Ensemble Switching of the DNA-Binding Domain of Human FoxP1”. *Biophysical Journal* 120 (3), 18a.
6. Hamilton GL, Sanabria H, Morcos F, **Kolimi N**, and Krishnamohan A. (2021), “Sequence and Structure Based Approach for Automated FRET Network Design”. *Biophysical Journal* 120 (3), 188a
7. **Kolimi N** and Sanabria H. (2020), “Integrated Structural Dynamics of Calmodulin”. *Biophysical Journal* 118 (3), 40a
8. Tsytlonok M, Hemmen M, Hamilton G, **Kolimi N**, Felekyan S, Seidel CAM, Tompa P and Sanabria H. (2020), “Expansion Upon Binding Guides p27 Binding to Cdk2/cyclin A”. *Biophysical Journal* 118 (3), 371a.
9. Tsytlonok M, Hemmen M, Hamilton G, **Kolimi N**, Felekyan S, Seidel CAM, Tompa P and Sanabria H. (2019), “A compact unbound state of p27 guides its specific binding with Cyclin A/Cdk2”. Methods and Applications of Fluorescence during August 20-24, 2019, at La Jolla, San Diego, CA.
10. **Kolimi N.** and Rathinavelan T. (2017), “Molecular dynamics simulations of nucleic acid duplexes comprising of CCG repeats and its implication in Fragile XE syndrome”. Poster presentation at the National Symposium on Biophysics and Indian Biophysical Society, during March 23-25, 2017, at IISER Mohali, India.
11. **Kolimi N.**, Sachdeva S., Nair SA and Rathinavelan T. (2016), “Key Diffusion Mechanisms Involved in Water Conduction of Wzi”. Poster presentation at the National Symposium on Biophysics and Indian Biophysical Society from February 8-10, 2016, at the Indian Institute of Science, Bangalore, India.

Oral presentation

1. **Kolimi N**, Khan N., and Rathinavelan T. “A...A mismatch instigates B-to Z-DNA transition in a DNA duplex comprising of CAG and GAC trinucleotide repeat expansions”. *Journal of Proteins and Proteomics ISSN: 0975-8151; 6(1)*, (2015). Indian Biophysical Society, February 14-17, 2015, New Delhi, India.

Volunteer experiences

1. Vice-President (July 2021-March 2022)
Vice-President for Clemson University Postdoctoral Association (CUPDA), Clemson University, SC, USA.
2. Treasure (July 2022-June 2023)
Treasure for UMass Postdoctoral Association (UMPA), UMass Chan Medical School, MA, USA.
3. Workshop (July 13-17, 2017)
Organized workshop as a team member on “Essential Programing for Life Scientists”, Department of Biotechnology, IIT Hyderabad, India.
4. Workshop (March 19, 2016)
Organized workshop with a team on “Multiscale Modeling of Biomacromolecules”, Department of Biotechnology, IIT Hyderabad, India.
5. Representative (July 2015 to June 2016)
Worked as representative of the Department of Biotechnology, IIT Hyderabad, India.

Peer-reviewed work

- ❖ **Served as a reviewer for 13 journals (22 articles):** Current Opinion in Structural Biology (1), Vaccines (1), Non-Coding RNA (4), Physiologia (1), Biophysica (2), Hindawi (2), IJERPH (1), International Journal of Molecular Sciences (5), Biologics (1), BBA (1), Pharmaceutics (1), Nutrients (1) and Genes (1).