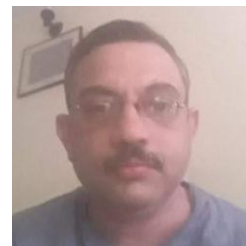


Amit Sharma, PhD

UGC-FRP Assistant Professor (since 29th June 2018)

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Current Research Interest

Licensed by light: Allostery in photoreceptors

All living organisms are endowed with an ability to perceive changes in their environment and respond accordingly. Accurate perception to changes in the environmental factors is essential for survival of an organism. Light is a particularly important factor that has strong influence on the growth and survival of many species. Light, not just triggers photosynthesis in plants and bacteria's, it also activates many important biological mechanisms in all the three domains (prokaryotes, archaea and eukaryotes) of life. All organisms possess light sensitive proteins called photoreceptors that can perceive wide range of light spectrum and can relay signals to structurally and functionally diverse effector molecules. These effector molecules could be a protein like kinase or a transcription factor that possess important biological activity. The effector molecule may by itself be light inert, its functionality can be regulated using light on the cognate photoreceptor. This concept seek many wider applications in the fields like optogenetics, artificial photosynthesis etc.

We are interested in

- (i) Understanding the molecular mechanisms by which these photoreceptors convert light signals to chemical signals and relay them to downstream effector molecules
- (ii) Developing technologies such as light based bio-molecular switches, photocultivators/ photobioreactors to conduct studies on photosynthetic and metabolic regulations in the photosynthetic organisms

Funding sources (as PI): DBT & UGC

Research Facilities developed:

1. Photo Biology Laboratory
2. Multicultivators and photobioreactors with micro illumination technology
3. Facilities for Biophysical/biochemical experiments
4. Computational facility to simulate macromolecular dynamics

Publication Profile:

<https://www.researchgate.net/profile/Amit-Sharma-205/research>

https://scholar.google.com/citations?hl=en&user=vKvPgnsAAAAJ&view_op=list_works&sortby=pubdate

Previous Appointments

May 2017 – June 2018 Associate Fellow (Adjunct Faculty Deakin University, Australia) at TERI-Deakin NanoBiotechnology Centre (TDNBC), TERI Gram, TERI, Gurgaon, Haryana 122 001, India

Research Area:

Light dependent mechanisms to study metabolic activities in algae

Nov 2016 – April 2017 Research Scientist at Department of Physics, Atomic Physics, Lund University and at FemtoMax beamline at MaxIV Synchrotron Source in Lund, Sweden

Research work:

Development of a time-resolved wide angle x-ray scattering (tr-WAXS) setup at the FemtoMax beamline at MaxIV to capture macromolecular structural dynamics at ultra-fast timescales

Oct 2012 – Oct 2016 Post-Doctoral Fellow, Department of Chemistry and Molecular Biology, University of Gothenburg, Sweden

Supervisor: Professor Richard Neutze

Research Area:

1. Membrane protein structure determination and dynamics using Serial Femtosecond Crystallography (SFX) and tr-WAXS
2. Integrating WAXS setup on the crystallography side stations (I911-2) at MaxLab, Lund, Sweden
3. Data processing tools for Serial Crystallography (SX) studies

2006 - 2012 National Centre for Biological Sciences (NCBS – TIFR)

- (i) April 2008 - Sep 2012: Ph.D. (Structural Biology and Biochemistry)

Thesis Supervisor: Dr. Deepak T Nair

Thesis Title: Structural and Biochemical analysis of Prokaryotic Y family DNA polymerases MsDpo4 and EcDpo4

- (ii) August 2006 – April 2008: Project in Cellular Biophysics

Supervisor: Dr. Kaustubh Rau

Project: Nanoscale Spatial organization of proteins on the endothelial cell surface and Probing Rheological Properties of an extracellular surface

2005 – 2006 Pre-Ph.D Course work in Physics, Institute of Physics, Bhubaneswar

Supervisor: Prof. Kalyan Kundu

Project (Mathematical Biology): Study of the limit cycle oscillations in Belousov Zhabotinsky reaction using relaxation model approximation for well stirred system

2003 - 2005 M. Sc. (Physics), Jawaharlal Nehru University, New Delhi

2000 - 2003 Worked as a Physics and Chemistry teacher for Higher Secondary Students and Engineering/Medical aspirants in New Delhi

1997 - 2000

B. Sc. (Physics, Chemistry and Mathematics), University of Delhi

Teaching Experience

S.No	Subject taught	Course Level	Years	Institute	Responsibility level
1.	Biophysics	Ph.D	Since 2018	MCARS, JMI	Full
2.	Bio-statistics	Post Graduate	Since 2019	MCARS, JMI	Full
3.	Instrumentation	M.Sc/Ph.D	Semester: 2017-18	TDNBC	Full
4.	Biostatistics and simulation approaches	M.Sc/Ph.D	Semester: 2017-18	TDNBC	Full
5.	Photobiology of Microbes	M.Sc/Ph.D	Semester: 2017-18	TDNBC	Full
6.	Methods in Structure Biology	M.Sc/Ph.D	Semesters: 2013-14 & 2015-16	University of Gothenburg, Sweden	Teaching Assistant

Fellowships/Achievements

1. Karl Tygger Fellowship (2012 - 2014) for Postdoctoral Research in Sweden
2. Selected for TIFR Physics PhD program 2006
3. Selected for NCBS – TIFR interdisciplinary – Biology (i-Bio) PhD program 2006. Opted to do PhD under this program at NCBS
4. Graduate Aptitude Test in Engineering (GATE) in Physics, 2005 - Percentile – 97.6
5. Junior Research Fellowship from Central Council of Scientific and Industrial Research (CSIR) Scheme and eligibility for Lectureship National Eligibility Test in Physics, 2005 – Fellowship availed from 2006 - 2011. Nominated for Shyama Prasad Mukherji Award
6. Joint Entrance Screening Test (JEST) in Physics, 2005 – Fellowship availed from 2005 - 2006. All India rank 36

Conferences and Schools

1. The interface of Life an International School on Bio membrane Physics 2008, Indian Institute of Technology Madras (IITM), Chennai, India
2. Structure and function of DNA replicating machinery - Perspective to multi drug resistance in Tuberculosis. Institute of Physics, Bhubaneswar, India, November 2011
3. Serial Crystallography Data Processing Workshop 2013 - Centre for Free electron Lasers - DESY, Hamburg, Germany
4. Imaging Retreat for X-ray Free Electron Laser 2013, Frankfurt, Germany
5. International Symposium-cum-Workshop – New Advances in x-ray diffraction and cryo electron microscopy. Indian National Science Academy and Regional Centre for Biotechnology. December 2014
6. Benzon Symposium No. 61, STRUCTURAL BIOLOGY ON THE MOVE, August 2015, Copenhagen, Denmark
7. NANOFORAGRI 2017, International Conference on Nanobiotechnology for Agriculture: From Research to Innovation, 20th – 21st November 2017, New Delhi, India
8. Photoinduced Processes in Nucleic Acids and Proteins: Faraday Discussion, Royal Society of Chemistry, 11th – 14th January 2018, Trivandrum, Kerala, India

9. Structure Assisted development of Novel Therapeutics, Regional Centre for Biotechnology, Faridabad, 13-16 February 2019
10. Indian Biophysical Society Meeting, TIFR Hyderabad, March 2024

Invited Talks

1. Serial Protein micro-Crystallography and Generic approach to TR-WAXS for Protein Structural Dynamics – Special Centre for Nano-Sciences, JNU; School of Biotechnology, JNU; InStem, Bangalore, India, 2014
2. Serial Femtosecond Crystallography and Time Resolved Studies for Protein Structure and Dynamics. Kusuma School of Biological Sciences, IIT Delhi. January, 2015
3. An approach to SAXS/WAXS studies for protein structure and dynamics. BARC, Mumbai. January, 2015
4. Protein Structure Determination Using Serial Femtosecond Crystallography and in – Solution Structural Dynamic Studies. IGIB, New Delhi
5. Protein Structure Determination Using Serial Femtosecond Crystallography and in – Solution Structural Dynamic Studies. IIT, Indore
6. Protein Structure Determination Using Serial Femtosecond Crystallography and in – Solution Structural Dynamic Studies. Institute of Physics, Bhubaneswar
7. Protein Structure Determination Using Serial Femtosecond Crystallography and in – Solution Structural Dynamic Studies. IMTECH Chandigarh
8. Protein Structure Determination Using Serial Femtosecond Crystallography and in – Solution Structural Dynamic Studies. KIIT Bhubaneswar, January 2016
9. Photosynthetic Reaction Centre Structure and Dynamics Studies Using Serial Femtosecond Crystallography and Time Resolved Wide Angle X-ray Scattering – National Institute of Science Education and Research, Bhubaneswar, 2017
10. Photosynthetic Reaction Centre Structure and Dynamics Studies Using Serial Femtosecond Crystallography and Time Resolved Wide Angle X-ray Scattering – MS University, Baroda 2017
11. Photosynthetic Reaction Centre Structure and Dynamics Studies Using Serial Femtosecond Crystallography and Time Resolved Wide Angle X-ray Scattering – Interdisciplinary School of Life Sciences, Banaras Hindu University, January 2017
12. Photosynthetic Reaction Centre Structure and Dynamics Studies Using Serial Femtosecond Crystallography and Time Resolved Wide Angle X-ray Scattering – School of Biotechnology and Bioinformatics, Pune University, January 2018
13. Photosynthetic Reaction Centre Structure and Dynamics Studies Using Serial Femtosecond Crystallography and Time Resolved Wide Angle X-ray Scattering – Department of Biochemistry, University of Hyderabad, February 2018
14. Photosynthetic Reaction Centre Structure and Dynamics Studies Using Serial Femtosecond Crystallography and Time Resolved Wide Angle X-ray Scattering – Centre for Cellular and Molecular Biology, February 2018
15. Ultrafast structural changes in Photosynthetic reaction centers, NIPGR, Delhi, October - 2018
16. Poster Presentation at Indus Synchrotron User meeting, UGC-DAE-CSR Symposium, RRCAT, Indore, 27-29 March 2019
17. Ultrafast structural changes during photosynthesis probed through nano crystallography-based approaches, Department of Chemistry, IIT Delhi, April 2019

18. Ultrafast structural changes during photosynthesis. NCBS-TIFR, 1st August, 2019
19. Ultrafast structural changes during photosynthesis. Molecular Biophysics Unit, IISc, 2nd August, 2019
20. Allostery in Photoreceptors: Licesensed by Light. Indian Biophysical Society Meeting, TIFR Hyderabad, March 2024

Publications

1. Manisha Chauhan, Syeda Amna Arshi, Naveen Narayanan, Haseeb Ul Arfin, Amit Sharma. A possible mechanistic insight on how Compromised Hydrolysis of Triacylglycerol 7 (CHT7) restrains the involvement of it's DNA binding CXC domain from quiescence repression. **International Journal of Biological Macromolecules** **2024**, 265, 1, 130844, doi: 10.1016/j.ijbiomac.2024.130844
2. Syeda Amna Arshi, Manisha Chauhan, and Amit Sharma. Disruption of the FMN-A524 interaction cascade and Glu513-induced collapse of the hydrophobic barrier promotes light-induced Ja-helix unfolding in AsLOV2. **Biophys J.** **2023** Dec 19;122(24):4670-4685. doi: 10.1016/j.bpj.2023.11.011
3. Ayushi Mishra, Amit Sharma, Suneel Kateriya. Effect of tryptophan mutation on the structure of LOV1 domain of phototropin1 protein of *Ostreococcus tauri*: A combined molecular dynamics simulation and biophysical approach. **Biochim Biophys Acta Gen Subj** **2023** Mar;1867(3):130304. doi: 10.1016/j.bbagen.2023.130304
4. Dods R, Båth P, Morozov D, Gagnér VA, Arnlund D, Luk HL, Kübel J, Maj M, Vallejos A, Wickstrand C, Bosman R, Beyerlein KR, Nelson G, Liang M, Milathianaki D, Robinson J, Harimoorthy R, Berntsen P, Malmerberg E, Johansson L, Andersson R, Carbajo S, Claesson E, Conrad CE, Dahl P, Hammarin G, Hunter MS, Li C, Lisova S, Royant A, Safari C, Sharma A, Williams GJ, Yefanov O, Westenhoff S, Davidsson J, DePonte DP, Boutet S, Barty A, Katona G, Groenhof G, Brändén G, Neutze R. Ultrafast structural changes within a photosynthetic reaction centre. **Nature** 2021 Jan;589(7841):310-314. doi: 10.1038/s41586-020-3000-7
5. Sunita Sharma, Sibaji K Sanyal, Kumari Sushmita, Manisha Chauhan, Amit Sharma, Gireesh Anirudhan, Sindhu K Veetil, Suneel Kateriya. Modulation of Phototropin Signalingosome with Artificial Illumination Holds Great Potential in the Development of Climate-Smart Crops, **Curr Genomics** (2021);22(3):181-213. doi: 10.2174/1389202922666210412104817
6. Shivlee Nirwal, Dhananjaya S. Kulkarni, Amit Sharma, Desirazu N. Rao, Deepak T. Nair. Mechanism of formation of a toroid around DNA by the mismatch sensor protein **Nucleic Acids Research** **2018** Jan 9;46(1):256-266. <https://doi.org/10.1093/nar/gkx1149>
7. Amit Sharma, Peter Berntsen, Rajiv Harimoorthy, Roberto Appio, Jennie Sjöhamn, Michael Järvå, Alexander Björling, Greger Hammarin, Sebastian Westenhoff, Gisela Brändén, Richard Neutze. A simple adaptation to a protein crystallography station to facilitate difference X-ray scattering studies, **J Appl Crystallogr** **2019** Mar 28;52(Pt 2):378-386. doi: 10.1107/S1600576719001900
8. Amit Sharma, Linda Johansson, Elin Dunevall, Weixiao Y Wahlgren, Richard Neutze, Gergely Katona. Asymmetry in serial femtosecond crystallography data. **Acta Crystallogr A Found Adv** **2017** Mar 1;73(Pt 2):93-101. doi: 10.1107/S2053273316018696
9. Johansson LC, Arnlund D, Katona G, White TA, Barty A, DePonte DP, Shoeman RL, Wickstrand C, Sharma A, Williams GJ, Aquila A, Bogan MJ, Caleman C, Davidsson J, Doak RB, Frank M, Fromme R, Galli L, Grotjohann I, Hunter MS, Kassemeyer S, Kirian RA, Kupitz C, Liang M, Lomb L, Malmerberg E, Martin AV, Messerschmidt M, Nass K, Redecke L, Seibert MM, Sjöhamn J, Steinbrener J, Stellato F, Wang D, Wahlgren WY, Weierstall U, Westenhoff S, Zatsepin NA, Boutet S, Spence JC, Schlichting I, Chapman HN, Fromme P, Neutze R. Structure of a photosynthetic reaction centre determined by serial femtosecond crystallography. **Nat. Commun** **2013**;4:2911. doi: 10.1038/ncomms3911

10. Robert Dods, Petra Båth, David Arnlund, Kenneth R. Beyerlein, Garrett Nelson, Mengling Liang, Rajiv Harimoorthy, Peter Berntsen, Erik Malmerberg⁶, Linda Johansson¹, Rebecka Andersson¹, Robert Bosman, Sergio Carbajo, Elin Claesson, Chelsie E. Conrad, Peter Dahl, Greger Hammarin, Mark S. Hunter, Chufeng Li, Stella Lisova, Despina Milathianaki, Joseph Robinson⁴, Cecilia Safari, Amit Sharma, Garth Williams, Thomas White, Cecilia Wickstrand, Jan Davidsson, Daniel P. DePonte, Anton Barty, Gisela Brändén¹, Richard Neutze. From macrocrystals to microcrystals: a strategy for membrane protein serial crystallography. **Structure** **2017** Sep 5;25(9):1461-1468.e2. doi: 10.1016/j.str.2017.07.002
11. Rhawnie Caing-Carlsson, Parveen Goyal, Amit Sharma, Swagatha Ghosh, Thanuja Gangi Setty, Rachel A. North, Rosmarie Friemann and S. Ramaswamy. Crystal structure of N-acetylmannosamine kinase from *Fusobacterium nucleatum*. **Acta Crystallogr F Struct Biol Commun.** **2017** Jun 1;73(Pt 6):356-362. <https://doi.org/10.1107/s2053230x17007439>
12. Jithesh Kottur, Amit Sharma, Kiran R. Gore, Naveen Narayanan, Biswajit Samanta, P. I. Pradeepkumar and Deepak T. Nair, Unique Structural Features in DNA Polymerase IV Enable Efficient bypass of the N2- Adduct induced by the Nitrofurazone Antibiotic. **Structure** **2015** Jan 6;23(1):56-67. doi: 10.1016/j.str.2014.10.019
13. Amit Sharma, Jithesh Kottur, Naveen Narayanan and Deepak T. Nair. A strategically located serine residue is critical for the mutator activity of DNA Polymerase IV from *Escherichia coli*. **Nucleic Acids Res** **2013** May;41(9):5104-14. doi: 10.1093/nar/gkt146
14. Amit Sharma, Vidya Subramanian and Deepak T. Nair. The PAD region in the mycobacterial DinB homologue MsPolIV exhibits positional heterogeneity. **Acta Crystallogr D Biol Crystallogr** **2012** Aug;68(Pt 8):960-7. doi: 10.1107/S0907444912017623
15. Amit Sharma and Deepak T. Nair. MsDpo4 a DinB homolog from *Mycobacterium smegmatis* is an error prone DNA Polymerase that can promote G:T and T:G mismatches. **J Nucleic Acids** **2012**;2012:285481. doi: 10.1155/2012/285481
16. Amit Sharma and Deepak T. Nair. Cloning, expression, purification, crystallization and preliminary crystallographic analysis of MsDpo4 - a Y - family DNA polymerase from *Mycobacterium smegmatis*, **Acta Crystallogr Sect F Struct Biol Cryst Commun** **2011** Jul 1;67(Pt 7):812-6