

Recipients of INSA Medal for Young Scientists 2022

1. **Dr Lakshman Abhilash** (16.11.1990), PhD, Neuroscience Initiative Advanced Science Research Center at the Graduate Center of the City University of New York, New York.

Dr. Abhilash Lakshman has carried out a number of studies that ably demonstrate the inter-relationship between timing of behaviour, circadian organisation and mechanisms of entrainment in *Drosophila melanogaster*. Using early and late chronotypes, along with their ancestral, unselected control lines, Dr. Lakshman has explored the correlated evolution of circadian organisation and entrainment properties of their circadian clocks under time cues of light and temperature. His studies have helped understand the hierarchical organisation of the circadian network revealing a strong temperature sensitive clock in the stocks of *D. melanogaster*. Dr. Abhilash's research has addressed several important questions related to the nature of the circadian clock that impacts life at scales ranging from the molecular to the ecological scales.

2. **Dr Sarit S Agasti** (25.03.1983), PhD, New Chemistry Unit (NCU) and Chemistry & Physics of Materials Unit (CPMU), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur, Bengaluru.

Dr. Agasti has contributed significantly to the development of molecular assemblies by incorporating various dynamically interacting synthetic host-guest motifs and exploiting these systems to do useful biological work. They combined macrocyclic receptors and DNA based systems with the biological interface to develop various programmable and reconfigurable systems with relevance to both fundamental and medical research. Dr. Agasti is also actively involved in developing easy to implement and live-cell compatible super-resolution imaging strategies by using dynamic molecular interactions. He has recently developed a simple, robust, and easy-to-implement super-resolution imaging method using highly selective, strong yet dynamic supramolecular interaction between synthetic host-guest pairs.

3. **Dr Gaurav Ahuja** (24.09.1987), PhD, Department of Computational Biology, Indraprastha Institute of Information Technology-Delhi (IIIT-Delhi), New Delhi.

Gaurav Ahuja has made elegant attempts to decipher the underlying mechanisms and codes involving odorant-receptor interactions, provided an understanding of the molecular basis of loss of smell in the COVID-19 infected patients, and established a link between the diversity of olfactory receptors per cell and cancer cell stemness.

4. **Dr Arvind B** (18.07.1989), MD, DM, Department of Cardiology, All India Institute of Medical Sciences, New Delhi.

Dr. Arvind is a clinician cardiologist and a researcher. His seminal contribution involves in determining the etiology of acute pulmonary exacerbations in children with cystic fibrosis and in drug trials for the management of Junctional Ectopic Tachycardia (JET), a potentially life-threatening abnormality of cardiac rhythm that is usually seen in children after cardiac surgery. In addition, he is involved in many

other projects like identification of markers of endothelial injury and activation in patients with acute rheumatic fever and other rheumatic heart diseases.

5. **Dr Shamik Banerjee** (18.03.1982), PhD, Institute of Physics, Bhubaneswar.

For his outstanding contributions to study of asymptotic symmetries of quantum gravity and to flat space holography.

6. **Dr Dipanshu Bansal** (20.08.1989), PhD, Department of Mechanical Engineering, IIT Bombay, Mumbai.

For his fundamental contributions in time-resolved mapping of lattice dynamics in real- and momentum-space for better and accurate depiction of several ubiquitous phenomena such as thermal energy transport, phase transition, thermal conductivity etc.

7. **Dr Subhro Bhattacharjee** (14.09.1982), PhD, International Centre for Theoretical Sciences, TIFR, Bengaluru.

For his outstanding contributions to the theory of phase transitions beyond the conventional symmetry-breaking framework, the relation between transport and chaos, and an unexpected connection between granular elasticity and gauge theories.

8. **Dr Arnab Bhattacharjee** (23.12.1982), PhD, School of Computational and Integrative Sciences, Jawaharlal Nehru University, New Delhi.

Dr Bhattacharjee has developed novel multiscale computer simulation techniques to investigate the physical and molecular factors that modulate the accessibility of genes within compact genome assemblies. He has shown how the crowded nuclear environment influences the target search dynamics of DNA binding proteins, and elucidated the various transport modes of proteins on stretches of DNA, with excellent match with the experimental findings.

9. **Dr Hillol Chakdar** (12.04.1984), PhD, ICAR-NBAIM, Kushmaur, Uttar Pradesh.

Dr. Chakdar has developed cost effective and easy to implement methodology for detecting infections of plants by fungal pathogens especially two fungal pathogens of rice. This includes methodology for high throughput DNA isolation, Loop Mediated Isothermal Amplification (LAMP) and a portable device for performing isothermal amplification.

10. **Dr Debashree Chakraborty** (06.06.1982), PhD, Department of Chemistry, National Institute of Technology, Mangalore.

Dr. Chakraborty has made significant contributions in the area of molecular dynamics simulations of complex biomolecular systems using network analysis and other immunoinformatic tools. The use of immunoinformatics techniques accelerates the design, development and optimization process of drug candidates, which, otherwise, is extremely computation-intensive.

11. **Dr Siddhartha Chaudhuri** (30.07.1982), PhD, Adobe Tower, Prestige Tech Park, Bengaluru.

For his fundamental scientific contributions to scalable computational and data driven approaches towards shape understanding, synthesis and re-construction of high quality three-dimensional digital object.

12. **Dr Sabyasachi Das** (30.12.1986), PhD, Manipal University College Malaysia, Bukit Baru, Melaka, Malaysia.

Dr. Sabyasachi Das has made seminal contributions in malaria research of public health importance notably on the drug resistant strains in Indian isolates. He discovered the existence of novel polymorphisms in Kelch protein sequences associated with the Artemisinin resistant Plasmodium falciparum in Indian population. Also, he has developed innovative nano mediated drug delivery systems against bacterial infections.

13. **Dr Tamal Das** (13.07.1982), PhD, TIFR Hyderabad, Hyderabad.

Dr Das' research is in collective cellular dynamics that governs embryonic development, wound healing and cancer. Using epithelial monolayers as a model tissue system, his group evaluates forces and stresses that work at cellular and multicellular levels. These studies shed light on the role of so-called leader cells and how individual cells in a tissue tune their mechanosensing ability and structural organization in normal and diseased conditions.

14. **Dr Sonali Garg** (19.09.1987), PhD, Department of Environmental Studies, Systematics Lab, University of Delhi, Delhi.

Dr. Sonali Garg has carried out original and creative research on systematics, taxonomy and biogeography of frogs and other amphibian taxa of the Western Ghats and the northeast Indian region. She has employed traditional and modern molecular tools to circumscribe new species, solve existing taxonomic confusions, and published four dozen new frog species. Dr. Garg has reported a number of novel reproductive and ecological behaviors in frogs that were hitherto unknown to science. She has made sustained and focused research contribution in an area of important global biodiversity and conservation significance located in India.

15. **Dr Srimonta Gayen** (01.04.1982), PhD, Indian Institute of Science, Bangalore.

For his significant contributions on the reversible epigenetic modifications and their role in development and disease. Dr Gayen's work focused on the mechanism of epigenetic regulation through the study of X-chromosome inactivation, imprinting, and stochastic allelic, transcriptional bursting during early-mammalian development. His work has potential applications in developing a clinical strategy to prevent the gender bias issue in babies born through in vitro fertilization (IVF) and enhancing of IVF success rate.

16. **Dr Jino George** (01.04.1982), PhD, Department of Chemical Sciences, IISER Mohali, Mohali

Dr. Jino George has contributed significantly toward the development and utilization of techniques for controlling chemical as well as physical properties of molecules exploiting the light-matter strong coupling inside Fabry-Perot (FP) cavity. His group has introduced cavity catalysis by strong coupling of the C=O stretching mode of an ester to a FP cavity mode. Further, he introduced the concept of cooperative vibrational coupling that utilizes the coupling of the normal modes of solvent molecules to the cavity modes. He demonstrated that cooperative coupling indeed holds great promise in speeding up chemical reaction rates many fold. This work is a real breakthrough in the field of 'chemistry under vibrational strong coupling' and has a tremendous transformative potential. Additionally, his group recently demonstrated the electronic band structure modification of 2D materials under strong coupling.

17. **Dr Amalendu Ghosh** (07.05.1984), PhD, Advanced Centre for Plant Virology, ICAR-Indian Agricultural Research Institute, New Delhi.

Dr. Ghosh has done excellent work on understanding the biology of the interactions between several insects and the viruses that they vector. He has identified insect genes that are involved in development/virus transmission and has made formulations of dsRNA constructs that he is evaluating for application in insect control. He has also developed multiplex PCR assays for identifying insect vectors of tospoviruses.

18. **Dr Sakshi Goel** (09.10.1990), PhD, Department of Biological Sciences & Bioengineering, Indian Institute of Technology, Kanpur (IITK), Kanpur.

Dr. Sakshi Goel, has demonstrated functional significance of a homeobox gene, DLX1 in prostate cancer progression and metastases. Moreover, she also identified therapeutic strategy to target DLX1-positive subset for the treatment of advanced stage prostate cancer. She has also contributed to research projects ongoing in the lab to explore the mechanistic insights of various molecular aspects involved in the progression of prostate and colorectal cancer.

19. **Dr Subhojoy Gupta** (08.02.1983), PhD, Department of Mathematics, Indian Institute of Science, Bangalore.

Subhojoy Gupta's main research area is the geometry of Riemann surfaces. More specifically, Gupta's work concerns understanding parameter spaces of Riemann surfaces with additional geometric structures. A point of the Teichmüller space T_g , $g > 1$, is a compact connected marked genus g Riemann surface S . The space of quadratic differentials on S may be identified with the cotangent space of T_g at S . A major theme of the work of Subhojoy deals with relation among several geometric objects that arise in the theory of Riemann surfaces, namely, projective structures on S , the space of meromorphic quadratic differentials on S , the space of measured foliations on S with "crown structures" and the Teichmüller space of such S . In a significant work, he has shown that the Teichmüller space is not biholomorphic to a bounded symmetric domain with C^2 boundary. Another important result of his is the determination of the image of the monodromy map of meromorphic projective structure (with poles of order greater than 2) as the set of non-degenerate framed representations.

20. **Dr Mohit Kumar Jolly** (15.01.1990), PhD, Biological Sciences Building, Indian Institute of Science, Bangalore.

Dr. Jolly has used a systems-level approach of integrating mechanism- and data-based mathematical models with experimental and clinical data related to metastasis and drug resistance to provide important insights into the dynamics of how cancer cells adapt and survive therapeutic attacks, causing tumors at different organs in the body. This improved dynamical understanding has led to potentially better intervention strategies to curtail cancer metastasis and therapy resistance.

21. **Dr Nirupam Karmakar** (23.09.1987), PhD, Indian Institute of Tropical Meteorology, Pashan, Pune.

Dr. Karmakar has contributed extensively to the understanding of active and break phases of Indian monsoon, and contributed to their relationship with intra-seasonal oscillations and demonstrated that extreme rainfall in the break phases reduces the intensity of following active phase. His study highlights the redistribution of monsoon rainfall periodic and non-periodic modes and provide a way to understand the intraseasonal variability under a global warming scenario.

22. **Dr Mehak Zahoor Khan** (05.06.1991) PhD. National Institute of Immunology, New Delhi.

Dr Mehak's work unveiled the mechanistic understanding of how protein kinase G (PknG) maintained redox homeostasis of *Mycobacterium tuberculosis* (Mtb) through a central metabolic regulator. Her work showcased PknG as a promising drug target to shorten the tuberculosis treatment duration and reduce disease relapse. Additionally, she discovered that oxidative stress altered the conformation of a novel transcription factor-AosR (Actinomycetes oxidative stress response regulator) through intrasubunit disulfide bond formation. Deletion of AosR or its target gene *cysM* dampened the pathogen's ability to combat oxidative stress, attenuating Mtb's intracellular survival.

23. **Dr Vidya Kochat** (26.12.1986), PhD, Materials Science Centre, Indian Institute of Technology, Kharagpur, West Bengal.

For her outstanding work on topological defects and their implications on transport in graphene and on localization phenomena in disordered graphene.

24. **Dr Manas Shreekanth Kulkarni** (06.10.1984), PhD, International Center for Theoretical Sciences (of Tata Institute of Fundamental Research), Bengaluru.

For his groundbreaking work on the phenomena of localization, chaos and transport in isolated and open systems, both quantum and classical.

25. **Dr Modhu Sudan Maji** (13.07.1982), PhD, Department of Chemistry, Indian Institute of Technology Kharagpur, Kharagpur.

Dr. Maji has contributed significantly to the synthesis of natural products in fewer steps employing novel strategies. One such notable reaction is organo-catalytic

alkenylation of indoles and pyrroles using aldehydes as alkenyating agents under sequential Brønsted acid and tertiary-amine catalysis. In addition to the development of organocatalysis, he has employed new methodologies using Co catalysts. He has demonstrated for that enolizable ketones are efficient directing groups for several transformation involving C–H bonds. Application of his methods have led to the synthesis of isoquinoline and acridone based alkaloids and other important heterocycles are also realized. The annulative- π -extension reaction paved the way to several polyaromatic hydrocarbons which are highly valuable precursors for the synthesis of organic semiconducting materials.

26. **Dr Vijay Singh Meena** (14.11.1988), PhD, CIMMYT-Borlaug Institute for South Asia (BISA), Pusa, Samastipur, Bihar.

Dr. Vijay Singh Meena has done excellent work in the field of natural resource management for sustainable agricultural production. He identified carbon management index as the key indicator to measure soil degradation in different agro-ecosystems.

27. **Dr Poonam Mehra** (16.11.1988), PhD, Department of Plant Molecular Biology, University of Delhi, New Delhi.

Dr Poonam focused on understanding the mechanisms of phosphate deficiency in modern rice and developing possible approaches to alleviate the problems. She employed multifaceted techniques integrating several functional genomics tools and identified novel candidate genes to impart low phosphate tolerance in rice. Her team genetically engineered three candidate genes to generate low phosphate tolerant rice by enhancing phosphate use efficiency (PUE) or increasing phosphate acquisition efficiency (PAE). Dr Poonam's contributions paved the way for improving low phosphate tolerance of elite rice genotypes through biotechnological interventions.

28. **Dr Sandip Mondal** (25.09.1986), PhD, Department of Electrical Engineering, Indian Institute of Technology Mumbai, Mumbai.

For his contributions on the development of 96 layer-based, low temperature (< 200°C) solution processed tunable flash memory device without the traditional tunneling and blocking layer, and in the development of ultrahigh speed (nano-second) Capacitance–Voltage measurement technique for characterizing the electronic deep traps in solution processed dielectric aluminum oxide phosphate. These resulted some outstanding publications.

29. **Dr Subhronil Mondal** (30.03.1987), PhD, Indian Institute of Science Education and Research (IISER), Kolkata.

Dr. Mondal's research has contributed to studies on spatio-temporal variation of local and regional ecological patterns to examine if local patterns scale up to global patterns. He analyzed different macroecological megatrends to test the established notion that ecological interactions vary predictably with latitudes and through marine molluscs of the last ~200 Ma and established that ecological interaction show neither proportional nor inverse relationship with latitudes.

30. **Dr Subham Mukherjee** (17.05.1988), PhD, Department of Geology, University of Delhi, Delhi

The nominee has made cutting-edge contributions integrating the fields of petrology, geochemistry and geodynamics. Through his innovative studies he has resolved the antiquity of the CGGC in the East Indian shield and for the first time quantified the nature of crust-mantle interaction vis-a-vis repeated felsic magmatism during ~1.70 to ~1.45 Ga and characterized the response of the resulting magmatic rocks during the subsequent super-continental cycles. The fundamental work of the nominee and his co-workers modelled the mechanism and fixed the timing of emergence of the continents (>3 Ga) above the sea level.

31. **Dr Swarnava Mukhopadhyay** (12.11.1986), PhD, School of Mathematics, TIFR, Mumbai.

Swarnava Mukhopadhyay works mainly in Algebraic Geometry and Representation Theory. Swarnava with his collaborators defined special polynomials called graph potentials and constructed a TQFT, which was used to construct mirror partners (in the sense of mirror symmetry) of moduli spaces of vector bundles and to decompose their derived categories. Swarnava used conformal embedding and developed a widely applicable framework for proving/disproving rank-level dualities. By analyzing boundary behavior, he gave applications to the birational geometry of moduli of curves. In another work, Swarnava realized twisted conformal blocks as crossed modular categories and computed their crossed S matrices. This generalized and proved a Verlinde type conjecture which was open for twenty years.

32. **Dr Vignesh Muthusamy** (06.09.1986), PhD, Division of Genetics, ICAR-Indian Agricultural Research Institute, New Delhi.

Dr. Vignesh Muthusamy has made significant contributions for developing nutritionally-rich maize hybrids through genomics-assisted breeding. He has successfully developed provitamin-A rich maize inbreds through marker-assisted selection, which were used to develop world's first provitamin-A rich maize hybrid 'Pusa Vivek QPM- 9 Improved'

33. **Dr Lakshmi Prasad Natarajan** (19.07.1987), PhD, Department of Electrical Engineering, Indian Institute of Technology Hyderabad, Sangareddy.

For his work in cutting-edge coding theory at a very high level of sophistication, including his recent major contribution to a new family of capacity-achieving codes and his earlier work on algebraic coding techniques, index coding, and broadcast channels with side information.

34. **Dr Saraswati Nayar** (19.01.1986), PhD, Division of Plant Molecular Biology, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram.

Dr Nayar demonstrated for the first time the LONELY GUY, a putative cytokinin activating enzyme, has a role in cell division, cell growth, and chloroplast function of *Chlorella*. LONELY GUY's overexpression led to the formation of a stay-green

phenotype and a high biomass-producing strain in *Chlorella*. She also characterized a MADS box transcription factor (TF) for the first time in *Coccomyxa subellipsoidea*, a unicellular green microalga. She discovered that this TF homodimerizes to localize precisely in the nucleus.

35. **Dr Venkatesh Rajendran** (04.05.1987), PhD, Department of Mathematics, IISc, Bengaluru.

The area of specialisation of R. Venkatesh is Kac-Moody algebras and their representations. He obtained a uniqueness theorem for tensor products of irreducible integrable highest weight representations of symmetrizable Kac-Moody algebras, vastly generalising the result for finite dimensional simple Lie algebras obtained by C S Rajan. He obtained a formula for the root multiplicities of a symmetrizable Kac-Moody algebra in terms of the chromatic polynomial of its Dynkin graph. As a consequence, the chromatic polynomial is related to the q-Kostant partition formula. He later generalized this result to the case of Borcherds algebra. Venkatesh obtained a generalisation of a result of G Fourier and P Littelmann concerning fusion product of Demazure submodules of certain integrable highest weight module over an affine Kac-Moody algebra associated to a finite dimensional semi simple Lie algebra. Recently he has developed a Borel-de Siebenthal theory of maximal closed subroot systems for affine reflections system. In the case of real affine Lie algebras, a complete classification of maximal closed subroot system has been obtained.

36. **Dr K Sony Reddy** (15.08.1986), PhD, School of Biotechnology, KIIT University, Bhubaneswar.

Dr. K. Sony Reddy has made outstanding contributions in the biology of malarial parasite infection. Most significant contribution is on elucidating the molecular mechanisms of erythrocyte invasion by *Plasmodium falciparum*. He demonstrated the existence of the essential parasite ligand pfRH5 on the parasite surface in the form of multiprotein complex consisting of two proteins one of them being CyRPA. Most importantly, he demonstrated that CyRPA antibodies potently neutralized the parasite by abrogating complex formation, suggesting this as a potential target.

37. **Dr Anand Sawant** (02.09.1987), PhD, School of Mathematics TIFR, Mumbai.

Anand Sawant works in the emerging area of A^1 homotopy theory. He has made important progress in recasting this highly abstract theory in terms of relatively concrete geometric concepts. In 2015 Anand, along with Hogadi and Balwe, constructed counterexamples to a conjecture of Asok-Morel regarding the notion of connected components in A^1 homotopy theory. His work with Balwe sheds new light on the important case of anisotropic groups, and is a key input in the characterisation of anisotropic groups in terms of the failure of homotopy invariance of torsors. In another pair of works with Balwe, Anand studies in detail A^1 connected components of birationally ruled surfaces, thereby proving a conjecture of Morel in this context. His recent work with Balwe and Hogadi, is about the interaction of R-equivalence with homotopy theory for norm varieties, and presents a refinement of a result on 0-cycles for these varieties due to Karpenko-Merkurjev.

38. **Dr Asmita Sengupta** (22.03.1986), PhD, Ashoka Trust for Research in Ecology and the Environment Royal Enclave, Bengaluru.

Dr. Asmita Sengupta has carried out researches on rhesus macaque, a well-researched primate species. Her research work marks an important effort on the ecology of this primate species, in particular with reference to its role in seed dispersal and recruitment of forest species. Her research confirmed that gut-digested seeds from the rhesus macaque readily germinate and are protected from fungal and other pest attacks. Dr. Sengupta has quantified the impact of providing food subsidies to wildlife on their ecological functions. She has demonstrated that large-scale deforestation or environmental pollution can modify ecosystem structure and function which is comparable to a seemingly benign action such as human feeding of wildlife.

39. **Dr Aakansha Sharma** (08.03.1993), PhD, Department of Zoology, University of Delhi, Delhi.

Dr. Aakansha Sharma has made important contributions to our understanding of transcriptome-wide changes and overall molecular differences between crucial seasonal metabolic and reproductive life-history states of birds. Several of her research findings are novel to our understanding of the mechanisms behind seasonal migration in birds. Dr. Aakansha has raised new important questions with regard to the differences in the control strategy between spring and autumn migrations which occur before and after the breeding season, respectively. Her research demonstrates the context and nature of migratory journey in birds.

40. **Dr Suhas Suresh Shetye** (28.11.1983), PhD, National Institute of Oceanography, Dona Paula, Goa.

Dr. Suhas S. Shetye made noteworthy contributions to regional and global carbon biogeochemical processes and acidification of the Southern and North Indian Oceans are based on large dataset. His work highlights the difference in the pH within the oxygen minimum zone of the Arabian Sea and Bay of Bengal; provides rates of ocean acidification in the northern Indian Ocean and its impact on calcareous organisms. His work on CO₂ sequestration in the ocean using natural material such as rice husk that can provide silicates for marine diatoms, and has shown increased production of organic carbon.

41. **Dr Bijay Prakash Tripathi** (06.12.1982), PhD, Department of Materials Science & Engineering, Indian Institute of Technology Delhi, New Delhi.

For his commendable original contributions in molecular grafting and functionalization to impart tunable wetting and anti(-bio) fouling properties in separation membranes by tailoring relevant surface and bulk properties in terms of surface energy, charge, porosity, roughness, wettability, physical and chemical reactivity, and compatibility with organic compounds and foulants useful for novel filtration membranes for separation and purification.

42. **Dr Mayur Vaidya** (22.09.1986), PhD, Indian Institute of Technology Hyderabad, Sangareddy.

For his very significant contribution of deciphering the mechanism of diffusion in high entropy alloys (HEA). The understanding developed through his work will help in the development of better HEAs for novel technological applications.