

## Dr. KIRAN R. GORE

### Address for Correspondence:-

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## ACADEMIC RECORD

### Post-Doctoral studies

(Oct 2013-Jan 2015)

In **Bio-Organic Chemistry**, Max-Planck  
Institute for Biophysical Chemistry, Göttingen,  
Germany  
Supervisor: **Prof. Dr. Claudia Hoebartner**

### Ph.D.

(Jan 2008-Sep 2013)

In **Bio-Organic Chemistry**, Department of  
Chemistry, Indian Institute of Technology  
Bombay (IIT Bombay), Mumbai  
*Title: “Design, Synthesis, Biophysical, and  
Biological Studies of Chemically Modified Small  
Interfering RNAs and Damaged DNAs.”*  
Supervisor: **Prof. Dr. Pradeepkumar, P. I.**

### M. Sc.

(July 2005 -June 2007)

In **Organic Chemistry**, Ahmednagar College,  
University of Pune, Pune  
**(73 %, 2nd rank in college)**

### B.Sc.

(July 2002 -June 2005)

In **Chemistry**, Ahmednagar College, University  
of Pune, Pune  
**(82 %, 1<sup>st</sup> rank in college)**

## **AWARDS / HONORS**

1. Award for Outstanding Contribution and Dedication, Golden Jubilee Ceremony, Department of Chemistry, University of Mumbai, (March 2018).
2. Awarded Ph.D. Guideship Recognition, University of Mumbai (July 2016).
3. DST-INSPIRE Faculty Award from Government of India to pursue the research in RNA Interference field (Aug-2015).
4. Max-Planck Postdoctoral Fellowship, Max Planck Institute for Biophysical Chemistry (MPIBPC), Gottingen, Germany (Oct 2013-Jan 2015).
5. Junior Research Fellowship (JRF) and Senior Research Fellowship (SRF), CSIR-UGC, New Delhi, India (Jan 2008-Sep 2013).
6. Qualified State Eligibility Test (SET) for Lectureship and National Eligibility Test (NET) for Junior Research Fellowship (2007).
7. Dr. M. V. Vaidya Award for securing 1<sup>st</sup> rank in B.Sc. (Jun-2005).
8. Avatar Meherbaba P.P.C. Trust Merit scholarship (1998 to 2007).

## **PROFESSIONAL EXPERIENCE**

1. Young associates of the Maharashtra Academy of Sciences (MASc-2021)
2. Bentham Ambassador Award from Bentham science publisher for the year 2019-2020.
3. DST Inspire Faculty, Department of Chemistry, University of Mumbai (Oct-2015 to Sept-2019).
4. Tutor at SRSI Program, Kings Abdulla University Science and Technology, Saudi Arabia (June-2019 to Aug-2019)
5. Tutor at SRSI Program, Kings Abdulla University Science and Technology, Saudi Arabia (June-2018 to Aug-2018).
6. Group Principal Scientist, Innovassynth Technologies, Khopoli, Mumbai, Maharashtra (Mar-2015 to Oct 2015).
7. Postdoctoral Research Associate, Max Planck Institute of Biophysical Chemistry, Gottingen, Germany (Oct-2013 to Jan-2015).
8. Work Experience as Group Principal Scientist with Innovassynth Technologies, Khopoli, Maharashtra (Mar-2015 to Oct-2015).

9. Teaching Assistantship at Indian Institute of Technology Bombay, Tutor for undergraduate courses CH-103 (Organic Chemistry), CH-117L (General Chemistry Laboratory) (Jan 2009-Jun 2010).
10. Work experience at Ranbaxy Research Lab (New Drug Discovery and Research Department) as Trainee Chemist. (Jun 2007-Dec 2007).

## AREA OF RESEARCH INTEREST

### Broad area of research: **Bioorganic Chemistry**

#### ***1. Chemically modified siRNAs for therapeutic applications***

RNA interference is a naturally occurring gene silencing mechanism that is mediated by RNA. Small interfering RNA (siRNA) is 21-22 nucleotides double-stranded RNA with two nucleotide 3'-overhangs. siRNAs have great potential in therapeutic applications. There are also some challenges associated with siRNA applications like nuclease susceptibility, unwanted binding to off-target due to partial complementarity, activation of unwanted immuneresponses, and *in vivo* delivery. The rational use of chemical modifications in sugar, nucleobase, and backbone of siRNAs can address most of these challenges.

Our objective is to synthesize chemically modified siRNAs and test their biochemical properties. Our primary goal is to carry out duplex stability study, serum stability study, and gene silencing studies using chemically modified siRNAs (References: *J. Org. chem* 2012, 77, 3233–3245; *Chem. Comm.* 2012, 48, 9619–9621; *J. Org. chem* 2013, 78, 9956–9962). Our research area will also cover broad nucleic acid fields such as synthesis and applications of fluorescent nucleosides in RNA imaging, targeted delivery of chemically modified ASOs and siRNA (Gore, K.R. *et al.*, *Nucleic Acid Therapeutics* 2018, 209–224), synthesis, and biochemical applications of various sugar and base modified novel ASOs and siRNAs.

#### ***2. Design and development of chromogenic sensors for the detection of biologically important molecules.***

We aim to develop fluorescent probes for the rapid and selective detection of environmentally and biologically important molecules.

**Fluorescent probe for detection of hydrogen sulfide:** H<sub>2</sub>S was considered as toxic gas for many years. After a period, along with nitric oxide (NO) and carbon monoxide (CO), H<sub>2</sub>S was

recognized as endogenously produced gaseous neurotransmitters. Interestingly, H<sub>2</sub>S plays an important role in many physiological processes, such as cell growth, vasodilation, anti-inflammation, and regulation of blood pressure. Intracellular regulation of H<sub>2</sub>S is also considered as one of the potential targets for anticancer therapy as it is known to promote tumor angiogenesis and metastasis in certain cancer types. Owing to its complex biological role and its gaseous nature, accurate detection of H<sub>2</sub>S is necessary to find out its production and consumption. We are interested in developing fluorescent probes for the detection and discrimination of biothiols (H<sub>2</sub>S, Cys, Hcy, GSH, etc.). For this purpose, we designed a probe with an Acryloyl protected GFP chromophore analog (AHBI), which is a completely novel strategy for the detection of H<sub>2</sub>S. This strategy will be more advantageous in terms of its high selectivity and sensitivity towards H<sub>2</sub>S, rapid response time, low detection limit (1000 fold lower than WHO limit), detects H<sub>2</sub>S in complete water and in live cells, high fluorescence stability, etc. (Gore, K.R. *et al. Sens. Actuators B* 2019, 298, 126875).

**Fluorescent probe for detection of cyanide:** Cyanide is one of the most toxic anions among all the anions and exhibits a strong affinity for the heme unit of cytochrome oxidase. Cyanide is widely used in many industrial applications such as metallurgy, electroplating, fishing, gold mining, production of organic chemicals and polymers, etc. We have developed turn-on fluorescent probe based upon silyl protected modified HBI analog for the detection of cyanide in water, on a solid support, and in living cells (Gore, K.R. *et al. Sens. Actuators B* 2018, 265, 257).

**Synthetic Methodology:** We are also working on developing novel bioconjugation strategies for oligonucleotides conjugations, synthesis of chemically modified oligonucleotides, fluorescent nucleosides, and optical sensor field

## RESEARCH PUBLICATIONS

1. Synthesis, Gene Silencing, and Molecular Modelling Studies of 4'-C-Aminomethyl-2'-O-Methyl-Modified Small Interfering RNAs. Gore, K. R.; Nawale, G. N.; Harikrishna, S.; Chittoor, V; Pandey, S.; Höbartner, C; Patankar, S; Pradeepkumar, P.I. *Journal of Organic Chemistry* **2012**, 77, 3233–3245.

2. Incorporation of 4'-C-Aminomethyl-2'-O-Methylthymidine into DNA by Thermophilic DNA Polymerases. Nawale, G. N.; **Gore, K. R.**; Höbartner, C.; Pradeepkumar, P.I. *Chemical Communications* **2012**, 48, 9619–9621.
3. Influence of 2'-Fluoro versus 2'-O-Methyl Substituent on the Sugar Puckering of 4'-C-Aminomethyl-uridine. **Gore, K. R.**; Harikrishna, S.; Pradeepkumar, P. I. *Journal of Organic Chemistry* **2013**, 78, 9956–9962.
4. Design, Synthesis, Biophysical and Primer Extension Studies of Novel Acyclic Butyl Nucleic Acid (BuNA). Kumar, V.; **Gore, K. R.**; Pradeepkumar, P. I.; Kesavan, V. *Organic and Biomolecular Chemistry* **2013**, 11, 5853–5865.
5. Unique Structural Features in DNA polymerase IV Enable Efficient Bypass of the N2 Adduct Induced by the Nitrofurazone Antibiotic. Kottur, J.; Sharma, A.; **Gore, K. R.**; Narayan. N.; Samanta, B.; Pradeepkumar, P. I.; Nair, D. T. *Structure* **2015**, 23, 56–67.
6. The N2-Furfural Deoxyguanosine (fdG) Adduct Does Not Alters The Structure of B-DNA, Ghodke, P. P.; **Gore, K. R.**; Harikrishna, S.; Samanta, B.; Kottur, J.; Nair, D. T.; Pradeepkumar, P. I. *Journal of Organic Chemistry* **2016**, 81, 502–511 (Joint First Author).
7. Novel Silylated HBI Analog for Rapid, Selective, and Sensitive Detection of Cyanide in Water and Living Cells. Abhishek L. Mirajkar, Lavanya L. Mittapelli, Ganesh N. Nawale, **Gore, K. R.\*** *Sensors and actuators: Chemical B*, **2018**, 265, 257–263.
8. Journey of siRNA: Clinical Developments and Targeted Delivery. Nikam, R. R., and **Gore, K. R.\*** *Nucleic Acid Therapeutics* **2018**, 209–224.
9. A large Stokes shift fluorogen-activating RNA aptamer. Steinmetzger, C. Palaniswamy, N.; **Gore, K. R.**, Höbartner, C. *Chemistry-European Journal* **2019**, 25, 1931–1935.
10. Towards elucidation of catalytic DNA: an EPR spectroscopic approach on copper (Cu<sup>2+</sup>) binding site (s). Sicoli, G., **Gore, K. R.**, Hoebartner, C., Mouesca, J. M., Gambarelli, S. *Eur. Biophys. J.* 44, S157–S1576.
11. Microwave-Assisted Selective Acetonide Cleavage Involved in Multi-Step Sugar Synthesis: A Greener Approach Over Conventional Synthetic Route. Nikam, R. R. Chavan, A. R., **Gore, K. R.\*** *Recent Trends in Chemical and Physical Sciences* **2019**, ISBN: 978-93-5346-273-4.
12. A Novel Green Florescent Protein Analog for Selective and Rapid Detection of H<sub>2</sub>S in Water as well as in Living Cells. Lavanya L. Mittapelli, Ganesh N. Nawale, **Gore, K. R.\*** *Sensors and actuators: Chemical B* **2019**, 298, 126875.

13. A mild and convenient approach for selective acetone cleavage involved in carbohydrate synthesis using PPA-SiO<sub>2</sub> Nikam, R. R., and **Gore, K. R.\*** *Journal of Carbohydrate Chemistry* **2020**, *39*, 63-74.
14. LiHMDS: Facile, Highly Efficient, and Metal-Free Transesterification under Solvent-Free Condition, Mittapelli, L. M. and **Gore, K. R.\*** *Catalysis Communications* **2021**, *149*, 106194-106199.
15. Folate Receptor-Mediated siRNA Delivery: Recent Developments and Future Directions for RNAi Therapeutics. Gangopadhyay, S.; Nikam, R. R.; **Gore, K. R.\*** *Nucleic Acid Therapeutics* **2021**, 1-15.
16. Tuning Sugar Conformation via Dual 4'-C-Azidomethyl/Aminomethyl-2'-O-Ethyl-Uridine Nucleosides and Oligonucleotides, Nikam, R. R.; Harikrishna, S.; **Gore, K. R.\*** *European Journal of Organic Chemistry* **2021**, *1*, 924-932.
17. Advances in siRNA Therapeutics and Exploring Synergistic Effect of Emerging Dual Modifications in Sugar on siRNA Activity, Gangopadhyay, S. and **Gore, K. R.\*** *RNA Biology* **2022**, *19*, 452–467.

#### MANUSCRIPT UNDER REVIEW/REVISION

18. Vinyl Substituted Triphenylamine Based Turn-Off Fluorescent Probe for Selective and Sensitive Detection of Mercury (II) in Water and Live Cells, Lavanya L. Mittapelli; Pritam Kumar Roy; Gourav Das; Mahitosh Mandal, **Gore, K. R.\*** *Analytica Chimica Acta* (submitted)

#### PATENT FILED TO INDIAN PATENT OFFICE

19. Synthesis of *N*<sup>2</sup>-furfuryl deoxyguanosine phosphoramidite and modified oligonucleotides. **Gore, K. R.**; Nair, D. T.; Pradeepkumar, P. I. (**Granted**, Patent Number 295309).
20. Novel Silylated HBI Analog for Rapid, Selective, and Sensitive Detection of Cyanide in Water and Living Cells. **Gore, K. R.** Lavanya L. Mittapelli, Abhishek L. Mirajkar, Ganesh N. Nawale (**Application number 201821004548**).

21. Highly Selective Detection and Discrimination of H<sub>2</sub>S over Cysteine Based Upon Novel Acryloyl GFP Chromophore Analog. **Gore, K. R.** Lavanya L. Mittapelli, Ganesh N. Nawale (**Application number 201821031531**).
22. Distinguishing Fluoride and Cyanide Using Turn-On Fluorescent Chemodosimeter Based Upon Synthetic GFP Chromophore Analog in Polar Protic Solvent. **Gore, K. R.** Lavanya L. Mittapelli, Ganesh N. Nawale (**Application number 201821031530**).
23. Synthesis and Characterisation of 2'-O-Ethyl and 2'-O-Propyl-Uridine Modified Nucleosides, **Gore K. R.**, Rahul R. Nikam. (**Patent application filed dated 11/01/2021**, Application number 202121001106)

## RESEARCH PROJECTS

1. **Project title:** *Synthesis and In Vivo Applications of Modified Small Interfering RNAs (2015-2021)*; **Funding Agency:** Department of Science and Technology, New Delhi, India.  
**Budget:** 35.00 lakhs
2. **Project title:** *Synthesis, Biochemical and Biophysical Evaluation of Novel 4'-C-Aminomethyl-2'-O-Propyl and 2'-O-Propyl Pyrimidines Modified Small Interfering RNAs (2020-2023)*; **Funding Agency:** ISIRD, SRIC, IIT Kharagpur  
**Budget:** 28.00 lakhs
3. **Project title:** *Synthesis of 4'-C-Aminomethyl-2'-O-Methoxyethyl Pyrimidines Modified siRNAs and Study Their Duplex Stability, Nuclease Resistance, and RNAi Activity for Potential Therapeutic Applications (2020-2022)*; **Funding Agency:** Science & Engineering Research Board (SERB), Government of India  
**Budget:** 32.66 lakhs
4. **Project title:** *Correlating Physical, Chemical and Structural Characterization of Anionic Polyacrylamides (APAMs) and their Performance in Brines (APAM) (2021-2022)*  
**Funding Agency:** PfP Industries, 14227 Fern St., Houston, Tx 77079, 281-5840047  
**Budget:** 11.67 lakhs
5. **Project title:** *Synthesis and Biological Studies of 4' 2' Dual and Mono Chemical Modifications for Potential Applications in Antisense Technology (2021-2024)*  
**Funding Agency:** Council of Scientific And Industrial Research (CSIR), Government of India  
**Budget:** 14.00 lakhs

## PRESENTATIONS IN CONFERENCES

1. Poster presentation at 6<sup>th</sup> Junior National Organic Symposium Trust (JNOST) conference, held at the University of Hyderabad, Hyderabad India (Jan 28- 31<sup>st</sup>, 2011).
2. Poster presentation at *In-House Symposium-2010*, Department of Chemistry, IIT-Bombay, India (Feb. 27, 2010).
3. Poster presentation at 3<sup>rd</sup> Indo-German Symposium on “Frontiers of Chemistry,” Department of Chemistry, IIT-Bombay, India (Sep. 27-28, 2011).
4. Poster presentation at “New Horizons in Chemistry” held at the Department of Chemistry, IIT Bombay, India (Oct. 3-4, 2011).
5. Oral presentation at *In-House Symposium-2013*, Department of Chemistry, IIT-Bombay, India (Mar. 2, 2013).
6. Poster presentation at RDCS-2018, Department of Chemistry, University of Mumbai, India (7-8<sup>th</sup> march 2018).
7. Poster presentation at DST/DBT/CSIR joint Conclave at Hotel Marriott, Jaipur, India (8-10<sup>th</sup> Jun-2018).
8. Oral Presentation at “31<sup>st</sup> RSM 2019” held at Centre for excellence for basic sciences, University of Mumbai, (8<sup>th</sup> Feb. 2019).

## RESEARCH ACTIVITIES

- No. of M.Sc. Projects (guided-15, Ongoing-3);
- Ph.D. students: (completed-2, ongoing-7);
- Summer Internship: (completed-1, ongoing-1)

## SEMINARS/LECTURES DELIVERED

- Delivered lecture Entitled “*Design, Synthesis, Biophysical, and Biological Studies of Chemically Modified Small Interfering RNAs and Damaged DNAs.*” at **Department of Chemistry, Max Planck Institute of Biophysical Chemistry, Gottingen Germany, Nov-2013.**



- Delivered lecture on doctoral and postdoctoral research work in **Research and Development division, Innovassynth Technologies, Khopoli, Mumbai (Mar-2015).**
- Delivered lecture Entitled “Advancements in Nucleic Acids” in the **Refresher course, Department of Chemistry and UGC-HRDC University of Mumbai, Nov-2017,** to the teacher participants in Mumbai University.
- Delivered lecture Entitled “Recent Advances in Nucleic Acids Therapeutics” in the **Refresher course, Department of Chemistry and UGC-HRDC University of Mumbai, Nov-2018,** to the teacher participants in Mumbai University.
- Delivered lecture Entitled “Organic  $^1\text{H}$ ,  $^{13}\text{C}$ , and 2D NMR spectroscopy” in **Birla College, University of Mumbai, Dec-2018,** to MSc (organic) students.
- Delivered lecture Entitled “Chemical Modifications in siRNAs for Therapeutic Applications and Turn-ON Fluorescent Probes for Detection of Biologically Relevant Molecules” in **Department of Chemistry, IIT Goa, May 2019.**
- Delivered lecture Entitled “Chemical Modifications in siRNAs for Therapeutic Applications and Turn-ON Fluorescent Probes for Detection of Biologically Relevant Molecules” in **Department of Chemistry, IIT Indore, Aug 2019.**
- Delivered guest lecture Entitled “Chemistry Skills and Opportunities in Higher Education in Chemistry” at **Department of Chemistry, Ahmednagar College, Pune University, Dated 25<sup>th</sup> Sept 2020.**
- Delivered guest lecture Entitled “Advancements in Nucleic Acids” at **Department of Chemistry, Wilson College, Mumbai University, Dated 7<sup>th</sup> Nov 2020.**
- Delivered guest lecture Entitled “Scope for higher studies after BSc/MSc Chemistry and Research Opportunities at **Thakur College of Science and Engineering, India (30-03-2021).**