

Dr. Raja Shunmugam

Professor

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1. Personal Data:

1.1: Personal Details

Sex	Date of Birth	Nationality	Residence	Marital Status
Male	13.08.1974	Indian	Indian Permanent Resident	Married

1.2 Academic Qualifications:

1998-2003:

Indian Institute of Technology – Madras, India

Qualifications: Ph.D. in Polymer Chemistry

Title of Thesis:

Synthesis and Characterization of Functional Polystyrenes and Some Application Development Studies

1994-96:

V.O.C. College, Tamil Nadu, India

Qualifications: M.Sc. in Chemistry

1.3 Distinguished Awards:

- ✓ NASI-Reliance Industries Platinum Jubilee Award **2019** for Application Oriented Innovations.
- ✓ Research work of Dr. Raja Shunmugam's group on 'Multifunctional nanocarrier with a platinum prodrug as an efficient dual-imaging, site-specific cancer theranostic agent' has been selected as **Joint Runner-Up** for 8th NATIONAL AWARD FOR TECHNOLOGY INNOVATION, under the New Polymers category. The Award has been implemented by the Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, Govt. of India.
 - ❖ The Award was presented by Hon'ble Vice President of India - Shri M. Venkaiah Naidu, in the presence of Hon'ble Governor of Tamil Nadu - Shri Banwarilal Purohit, Hon'ble Minister of Statistics & Programme Implementation and Chemicals & Fertilizers, Govt. of India – Shri D.V. Sadananda Gowda and other dignitaries, during the function on Thursday, January 24, 2019, at Centenary Auditorium, University of Madras, Chennai.
- ✓ Research work of Dr. Raja Shunmugam's group on 'Nerve Agent Sensing' has been selected as **Joint Winner** for 7th NATIONAL AWARD FOR TECHNOLOGY INNOVATION under the Polymeric Materials category, implemented by Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, Govt. of India.
 - ❖ The Award was presented by Hon'ble Minister of Chemicals & Fertilizers, Shri Ananth Kumar, Government of India in the presence of Hon'ble Minister of State for Road Transport & Highways, Shipping and Chemicals & Fertilizers Govt. of India – Shri. Mansukh L. Mandaviya at New Delhi on Wednesday, March 01, **2017**.
- ✓ Research work of Dr. Raja Shunmugam's group on 'Arsenic Sensing and Trapping by Norbornene-based Polymer' has been selected as **Joint Runner-Up** for 6th NATIONAL AWARD FOR TECHNOLOGY INNOVATION, under the Polymeric Materials category, implemented by Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, Govt. of India.

- ❖ The Award was presented by Hon'ble Minister of Chemicals & Fertilizers, Shri Ananth Kumar, Government of India, in the presence of Shri Hansraj Gangaram Ahir, Hon'ble Minister of State for Chemicals & Fertilizers, Government of India, during the function at New Delhi on Wednesday, 20 January **2016**.
- ✓ Received Ramanujan Fellowship (DST, India) in 2010 for the Research Accomplishment.
- ✓ He was awarded Graduate Research Fellowship between 2000 – 2003 for GATE-NET 2000 with All India Rank 12.

1.4 Distinguished Honors:

- ✓ Elected Board of Governors (BoG) member for two years (July 2019 to July 2021).
- ✓ Associate Editor, Scientific Reports (Nature Publishing Group) Since January 2016
- ✓ Participated as Institute representative on the Festival of Innovation 2016 and 2017 at Rashtrapati Bhavan and presented a poster on Arsenic removal research.
- ✓ He was felicitated on Science day for three consecutive years (2017, 2018, 2019, and 2020) for his contribution to the field of Science and Technology Development.

1.5 Postdoctoral Fellowship:

2003 – 2008: Received Postdoctoral fellowship at UMASS, Amherst, in the PSE Department (Prof. Gregory N Tew's Lab)

2. Professional Qualifications

2006: Certificate from NSF, USA for my dedication in mentoring students.

2.1 Work Experience

- ✓ **October 2018 - Present: Professor**, Macromolecular Chemistry, Department of Chemical Sciences, Indian Institute of Science Education and Research, Kolkata.
- ✓ **March 2014 – March 2016: Head of the Department**, Department of Chemical Sciences, Indian Institute of Science Education and Research Kolkata.
- ✓ **January 2014 – September 2018: Associate Professor**, Macromolecular Chemistry, Department of Chemical Sciences, Indian Institute of Science Education and Research, Kolkata.

- ✓ **September 2008- December 2013: Assistant Professor**, Macromolecular Chemistry, Department of Chemical Sciences, Indian Institute of Science Education and Research, Kolkata.
- ✓ **December 2003 to August 2008: Research Associate** at University of Massachusetts, Amherst in the Department of Polymer Science and Engineering
- ✓ **2000-2003: Research and Teaching Assistant**, Indian Institute of Technology, Madras, India.
- ✓ **1998-2000: Research Assistant**, Indian Institute of Technology, Madras, India.

3. Teaching and Supervision Experience:

3.1 Experiences of teaching undergraduate and postgraduate programs

3.1.1 Current Experience

From 2008, I have been teaching the following undergraduate and postgraduate:

CH-321: Inorganic Chemistry: Chemistry of Transition Elements – (Jan 2009 – May 2009)
CH-212: Quantitative Analysis: (Sep 2008 – Dec 2008; Aug 2009 – Dec 2009)
CH-324: Polymer Synthesis (Lab course)
ID-426: Polymers
ID-414: Chemistry and Physical aspects of Polymers
ID-4103: Chemistry of Macromolecules
CH2202: Organic and Physical Laboratory
CH 1101: Elements of Chemistry

3.1.2 Previous Experience:

From 1996 - 1998: I worked as Teaching Assistant at V.O.C. College, Tuticorin, Tamil Nadu, India.

From 2000 - 2003: I worked as a Research Assistant and Teaching Assistant at the Indian Institute of Technology, Madras, India.

3.2 Experience in Supervising Postgraduates

❖ **BS-MS:**

Ten Integrated MS (by thesis) students have completed their studies under my Supervision. My first Integrated MS student, Mr. Alok Kumar submitted his thesis in 2012. My second Integrated MS student, Mr. Rohit Gupta submitted his thesis in 2013. Mr. Pawan Kumar, my third Integrated MS student, submitted his thesis in 2014. Mr. Litesh Shashank, Ms. Parvathy Venu and Ms. Ashlin S. received their MS award in 2015. Mr. Ajith Nair received his MS degree in 2016. Mr. Vikash received his MS degree in 2017. Ms. Elizabathe Davis, Mr. Manikandan M, Mr. Pintu, Ms. Usha Meena, Mr. Anubhav Rajpoot received their MS degree in 2018. Ms. Rohni J Chethalen, Mr. Sreehari S, Mr. Amritangshu Roy received their MS degree in 2019. B. Sharmistha, Swaraj Biswas, Sristi Gautam received their MS degree in 2020.

❖ **Ph. D.:**

My three students Dr. Vijayakameswara Rao N., Dr. Shivshankar R Mane, and Dr. Santu Sarkar, received their Doctoral degrees in the 2014 convocation. My fourth student, Dr. Sourav Bhattacharya, received their Doctoral degree in the 2015 convocation. My fifth student Dr. Mutyalanaidu Ganivada finished his Ph.D. in July 2016. Dr. Saikat Mukherjee received his degree in 2018. Dr. Sayantani Bhattacharya, Dr. Rajan Kumar, Dr. Tapendu Samanta, and Dr. Pawan Kumar received their degree in 2021.

❖ **Research Associates:**

Dr. Tapan K. Das - NPDF from August 2017 to January 2020.

Dr. Thokchom Prasanta Singh- Institute Postdoctoral Fellow October 2014 to October 2015.

Dr. Madhumita Mukherjee - DST Women Scientist since 2013-2016.

Dr. Moumita Gupta – From 2021 onwards

❖ **Present Group Members:**

I am currently guiding 10 Ph.D. students and three 5th year Integrated MS students in my research group.

4. Research Interests

4.1 Current Research Interests

My overall objective and agenda are just not only to build a research plan that impacts future technologies but also training my students in the multidisciplinary field of polymer science, where students in my lab have the privilege to come across a variety of novel monomer syntheses, technical know-how of living/controlled polymerization and material characterization. Training students across these areas, in my view, ultimately result in a new breed of robust research scholars with a broad background necessary for any career they pursue. Our group's overall long-term objective is to develop polymers that have great potential application in drug delivery and sensors. Building chemically rich monomers and placing them into discrete locations within polymeric architectures will yield novel functional materials. It will lead to a new paradigm in materials synthesis where block copolymers commonly exploit are much more than a simple carrier of drug molecules. This research combines state-of-the-art organic and polymer chemistry with structural characterization and drug release measurements. One of the significant advantages of ongoing work in designing prodrugs is that one block is linked to the nanoparticle. Such external stimuli like magnetic force facilitating targeted delivery can influence the drug carrier's path. Controlled/living polymerization techniques such as ROMP and/or ATRP will be used to synthesize random and block copolymers where the composition of the copolymer length that contains drugs can be controlled. Also, development of polymers that are used to sense heavy metals such as arsenic and mercury is currently under progress.

Area of Research

- Synthetic Macromolecules
- Drug Carriers
- Self-assembling Nanomaterials
- Sensors

4.2 Research Activities undertaken to date and funding sources

Sponsored Project / Consultancy (in reverse chronological order)							
Sl. No.	Title	Sponsoring Agency	Sponsored Amount	Period		Co-PI	PI name
				From	To		
1.	“Design of fiber-like crosslinked high stable polymeric material to remediation of textile generated waste management.”	Ministry of Textile, India	79.8 Lakhs	30/03/2022	29/03/2025	NA	Raja Shunmugam
2.	Halide Ion Scavenging Macromolecules for Waste Water Treatment No. RD/PROP/COL/422/2019	TATA Steel Limited	12 Lakhs	01/07/2019	30/06/2020		Raja Shunmugam
2.	Norbornene based polymers for construction materials	ADO	56 Lakhs	04/07/2015	03/07/2020		Raja Shunmugam
3.	New Class of Biodegradable polymers as Theranostic Agent for multiple tumors using a single	DST	64 lakhs	05/01/2016	04/01/2018		Raja Shunmugam

	target EMR/2015/00160 0						
4.	Norbornene Based Multi-Drug Containing Nanocarrier for Efficient Tuberculosis Therapy No 4198/NS-EMRII/2013	CSIR	9 Lakhs	01/03/2015	28/02/2017		Raja Shunmugam
5.	Norbornene Dervied Doxorubicin Copolymers as Drug Carrier. BT/PR6778/NNT/28/610/2012	DBT	99.3 Lakhs	30.03.2015	31.03.2018	Jayasr Dassa ma	Raja Shunmugam
6.	Ramanujan Fellowship, SR/S2/RJN-27/2009	DST	73 Lakhs	01/04/2010	01/04/2015	None	Raja Shunmugam
7.	"Sensing of chemical warfare agents with norbornene based polymers" ERIP/ER/0904503/14/01	DRDO	17.47 Lakhs	01/04/2011	01/04/2014	None	Raja Shunmugam
8.	Synthesis and characterize	CARS/DRDO	9.5 Lakhs	01/05/2013	12/04/2013	None	Raja Shunmugam

	semiconducting polymer nanowires of regioregular polymer NPOL/12CR0002/MS/PR225	(Phase-II)					
9.	“Turn On” Sensors for Arsenic Threats in Drinking Water SR/FT/CS-017/2009	DST	14 Lakhs	01/12/2009 -	01/12/2012	None	Raja Shunmugam
10.	Fluorometric sensor for cadmium in drinking water DST/TSG/PT/2009/100	DST	47 Lakhs	01/12/2010	01/12/2012	None	Raja Shunmugam
11.	Synthesis and characterize semiconducting polymer nanowires of regioregular polymer NPOL/12CR0002/MS./PR225	CARS/ DRDO (Phase-I)	9.5 Lakhs	01/01/2012	30-12-2012	None	Raja Shunmugam

4.3 Impact of My Research Based On Coverage in Mainstream News Media:

- ❖ Zoha M. AL-Badri, R. R. Maddikeri, Y. Zha, H. D. Thaker, P. Dobriyal, **R. Shunmugam**, T. P. Russell, G. N. Tew. Room temperature magnetic materials from nanostructured diblock copolymers. Nature Communications, 2: 482 DOI:10.1038/ncomms1485 (2011).

- ❖ Highlighted in Science Daily: University of Massachusetts at Amherst (2011, September 27). New nanostructure-based process will streamline production of magnetic materials. Science Daily. Retrieved October 16, 2011, from <http://www.sciencedaily.com/releases/2011/09/110927124642.htm>

4.4 Student Supervision

Student Name	Level of Study	Title of Project	Year	Present Position
<u>Ph.D. Students</u>				
Dr. Vijayakameswara Rao N	PhD	Engineering Polymers for Biomedical applications	2009-2014	Assistant Professor NTUST, Taiwan
Dr. Shivshankar Rao Mane	PhD	Synthesis of Macromolecules and Drug Carriers	2009-2014	Scientist, NCL-Pune, India
Dr. Santu Sarkar	PhD	Synthesis of CdSe Nanoparticle Attached Macromolecules for Sensors and Cancer Drug Delivery	2009-2014	Senior Research Associate, Department of Chemistry , Virginia Tech, USA
Dr. Sourav Bhattacharya	PhD	Arsenic and Other Heavy Metal Sensing	2009-2015	Research Associate, Calcutta University.
Dr. Mutyala Naidu Ganivada	PhD	Design & Synthesis of Biodegradable Polymers for Biological Applications	2011-2016	Research Associate, University of Hyderabad
Dr. Saikat Mukherjee	PhD	Design, Synthesis and		

		Development of Multi-Responsive Nano-Carriers for Ovarian Cancer Therapy	2012-2017	Industry Job
Dr. Sayantani Bhattacharya	Int. PhD	Caprolactone based soft-material	2014-2020	Post doctoral Researcher, Chalmers University of Technology, Sweden
Dr. Rajan Kumar	PhD	Unique Design to make a Variety of Hydro- as well as Organic Gels and their Applications in Materials	2015-2020	Assistant Professor Department of Chemistry, Royal School of Applied and Pure Sciences, Royal Global University, Guwahati, India
Dr. Tapendu Samanta	PhD	Norbornene Based Polymers for Sensing Applications	2015-2021	
Dr. Pawan Kumar	PhD	Design and Development of new class of polymeric prodrug using Ring Closing Metathesis Polymerization (RCMP)	2015-2021	
Dr. Parvathy Venu	PhD	Design, Synthesis and Evaluation of Functional Amphiphilic Polymers for Therapeutic Applications	2015-2022	
Dr. Diptendu Patra	Int. PhD	NIPAM based norbornene - A New Class of Polymers for Thermosensitive Applications	2015-2022	
Dr. Piyali Mandal	PhD	An efficient route to prepare	2015-	

		multi cancer drug conjugated nano-carriers	2022	
Dr. Jyotirlata Singha	PhD	Polynorbornene for sensing heavy metals	2016-2022	
Current Ph.D. Students				
Mr. Narayan Das	PhD	Heavy Metals and Gas Sensing	2018-present	
Mr. Dwaipayan Pal	PhD	Design and Synthesis of Theranostics Polymers	2018-present	
Ms. Sangita Rajwar	PhD	Development of Anion Sensing Polymers	2021-present	
Ms. Asmita Nandi	PhD	Functional, Self-assembled Polymers for Bio-medicinal Application	2021-present	
Mr. Ratan Haldar	PhD	Functional Polymers for Bio-imaging application	2021-	
Post-Doc Supervision				
Dr. Thokchom Prasanta Singh	Post-Doc	Design and synthesis of biodegradable polymer as biomaterials	2014-2015	Assistant Professor, Manipur University, India.
Dr. Madhumita Mukherjee	CSIR-Post Doc	Polymer-Based Gels	2014-2016	Research Associate, Culcutta University
Dr. Moumita Gupta	Institute Post Doc	Multi-tasking Polymers	2021-	
BS-MS students Supervision				
Mr. Alok Kumar	Int. MS	Synthesis and characterization of functional polystyrene	2012	Industry Job
Mr. Rohit Gupta	Int. MS	Study of the effect of asphaltenes on properties of bitumen	2013	Graduate Student, Polymer Science and Engineering,

				University of Massachusetts, Amherst, USA.
Mr. Pawan Kumar	Int. MS	Hydrogels for Drug delivery	2014	Graduate Student, IISER Kolkata.
Mr. Litesh Shasank	Int. MS	Cobalt based magnetic polymers.	2015	Graduate Student
Ms. Parvathy Venu	Int. MS	Synthesis of Functional Norbornene Monomers.	2015	Graduate Student, IISER Kolkata.
Ms. Ashlin Sathyan	Int. MS	Barbiturate Derived Norbornene Monomers and Polymers.	2015	Graduate Student, Polymer Science and Engineering, University of Massachusetts, Amherst, USA.
Mr. Ajith Nair	Int. MS	Synthesis of Magnetic Hydrogels	2016	Graduate Student
Mr. Ajin Babu	Int. MS	Caprolactum Based Polymers for Self-assembly Studies	2016-17	Higher Studies
Mr. Vikas Verma	Int. MS	Design and Development of new class of polymeric prodrugs using Ring Closing Metathesis Polymerization (RCMP)	2016-17	Graduate Student, Indian Institute of Petroleum, Dehradun, India
Mr. Pintu Kanjilal	Int. MS	Synthesis of Functional Monomers for Ring Closing Polymerization	2017-18	Graduate Student, University of Massachusetts, Amherst, USA.
Mr. Manikandan M	Int. MS	Engineering Multi-arm Homopolymer using Ring Closing Metathesis Polymerization for Enhancing Conductivity.	2017-18	Graduate Student, Georgetown University, Washington, USA
Mr. Anubhav Rajpoot	Int. MS	"In-situ" derived tool for removal of organo-amphiphilic toxicants from polluted water bodies.	2017-18	Higher Studies
Ms. Usha Meena	Int. MS	Engineering photo-crosslinked norbornene based hydrogels and studying the effect of PEG molecular weight on the gel property.	2017-18	Higher Studies

Ms. Elizabathe Davis	Int. MS	Design, synthesis and characterization of therapeutically important functional monomers.	2017-18	Graduate Student, University of California, San Diego, USA
Ms. Roshni J Chethalen	Int. MS	Caprolactone based Functional Monomers and Amphiphilic Copolymers for Engineering Self-Assembled Superstructures	2018-19	Graduate Student, Polymer Science and Engineering, University of Massachusetts, Amherst, USA.
Mr. Sreehari S	Int. MS	Engineering Amphiphilic Functional Polymeric Resin as Efficient Material for Removal of Aqueous Chronic Contaminants	2018-19	Teacher, PA International School, Pollachi, Tamil Nadu, India
Amritangshu Roy	Int. MS	Magnetic polymers for Imaging and sensor application	2018-19	Higher Studies
Swaraj Biswas	Int. MS	Ring Closing polymerization	2019-20	Higher Studies
Sristi Goutam	Int. MS	Biodegradable polymers	2019-20	Higher Studies
Sharmista B	Int. MS	Polymers for sensing.	2019-2020	Higher Studies
Durga B S	Msc.	Poly acrylic acid based polymers for self assembly application.	2019-2020	Industry Job
Prasad Behra	Int. MS	Multi-Functional Polymers for drug Delivery.	2020-21	Higher Studies
Bashim Bhasher	Int. MS	Functional monomers for drug Delivery.	2021-22	Higher Studies
Ancy, C.	Int. MS	Functional monomers for Theranastics.	2021-22	Graduate Student, Polymer Science and Engineering, University of Massachusetts, Amherst, USA.
Sugam Mishra	Int. MS	Functional monomers for imaging Applications.	2021-22	Higher Studies
Harsh Vardhan	Int. MS	Functional monomers for Sensing Applications.	2021-22	Higher Studies
Soumyadip D.	Int.	Functional monomers for	2021-	Higher Studies

	MS	amphiphilic Polymers	22	
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4.5 Examiner Appointments

4.5.1 Appointments as External Examiner for Ph. D. Degree

- ❖ **2022:** Ms. ARPITA ROY “Hydrogels/Nanocomposites based on β -Cyclodextrin and their Potential Application in the Biomedical Field” IIT Dhanbad
- ❖ **2022:** Mr. Laxmi Raman Adil " Design and Development of Aggregation Induced Emission based Probes " IIT Guwahati
- ❖ **2022:** Mrs. Tanwar Archana Gajendra “Synthesis Characterization and Controlled Drug Delivery Application of Gelatin based Biodegradable Hydrogels”, Pune University
- ❖ **2022:** Ms. V. THAMIL PRIYA "STUDIES ON BIOACTIVE COMPOUNDS, PURIFICATION, CHARACTERIZATION FROM DODONAEA VISCOSA (L.) JACQ AND THEIR EFFICACY IN MEDICINAL PROPERTIES" Madurai Kamaraj University.
- ❖ **2021:** Ms. Mehak Malhotra “Linear and Star Block Copolymer Nano-architectures for Drug Delivery” IISER Pune, India
- ❖ **2021:** Ms. G. Kaladevi " Simultaneous Detection of Nitrite in the Presence of Sulfite and Hydrazine as Inorganic Pollutants in Water Sources using Silver and Gold Nanoparticles Dispersed Conducting Polymer/rGO Nanocomposite Modified Electrodes” MCC, Chennai, India.
- ❖ **2021:** Mr. Ramesh K. Gajula “Covalent Organic Cage Materials for CO₂ gas adsorption and Chemosensing applications” NIT Rurkela, India
- ❖ **2020:** Mr. Alex Daniel:"High Temperature Composites for Thermal Protection Systems" Dept. of Metallurgical & Materials Engineering Defence Institute of Advanced Technology Pune, India.
- ❖ **2020:** Ms. Nimmy Edwin: “Synthesis of Strontium Incorporated and Reduced Graphene Oxide Modified Hydroxyapatite as Biomaterial Nanocomposites for Cytocompatibility and Selective Sensing of Acetaminophen” Madras Christian College, Chennai, Tamil Nadu.
- ❖ **2020:** Mr. M. Mohan: "Synthesis and Self-assembly studies of Semi-synthetic facially amphiphilic proteins" Indian Institute of Science Education and Research Pune (IISER Pune).
- ❖ **2020:** Mr. Priyapratim Patra: “Novel Modified Biopolymer Based Hydrogels And Nanogels: Synthesis, Characterization And Application” IIT Dhanbad.
- ❖ **2020:** Mr. Abhishek Saha: “Development of Synthetic Organic-carriers for Drug Molecules and Chloride Ion” IIT Guwahati.
- ❖ **2020:** Ms. Himanshi Jankir: " Exploring Sulfides to Design Strategies for Sustainable Agriculture and Green Energy” IIT Kanpur.

- ❖ **2020:** Ms. A. Aruna Devi: “ Synthesis, Characterization, DNA Binding and Cleavage Studies of Biologically Active Amino Acid Based Coordination Compounds of Transition Metals” Madurai Kamaraj University, Tamil Nadu.
- ❖ **2018:** Mr. Suresh Kumar Perala. "Orthogonally Functionalizable Hyperbranched Polymers: Uses in Amphiphilic Hydrogels and Supported Catalysis" IISC Bangalore, India.
- ❖ **2018:** Ms. Londiwe Simphiwe Mbatha. "Starburst Poly-amidoamine Dendrimer Grafted Gold Nanoparticles as Scaffolds for Targeted Gene Delivery in vitro" University of Kwazulu-Natal, South Africa.
- ❖ **2018:** Mr. Suresh Annam, VIT Vellore, Tamil Nadu, India.
- ❖ **2018:** Mr. Dines Chandra Santra. Jadavpur University, West Bengal, India.
- ❖ **2018:** Mr. S.M. Rajesh Kotcherlakota. “Design, synthesis, characterization of gold nanobioconjugates for targeted delivery of drugs & nucleic acids in ovarian cancer and non-invasive bio-imaging.” IICT Hyderabad.
- ❖ **2018:** MS. LARUSHKA HOLISTER “Synthesis and Characterisation of Collagen based Hydrogel Hybrids for Biomedical Applications” The University of Sydney, Australia.
- ❖ **2017:** Mr. Sahnawaz Ahmed. IIT Guwahati
- ❖ **2017:** Mr. Rajamouli Boddula NIT Roorkeela
- ❖ **2016:** Ms. Sonia Ansari. “The Effect of Interpenetrating Network on the Physico-Chemical Properties of Polymer-Bioactive Glass Hybrid Monolith for Bone Tissue Regeneration” The University of Sydney, Australia.
- ❖ **2016:** Mr. Manas Kumar Bera. “Fluorene Based Copolymers and their Applications” Polymer Science Unit, IACS, Jadavpur University.
- ❖ **2016:** Mr. Anantharaj S. “Development of Melt Polymerization Route for Amino acid Based Functional Polymers and their Self-assembled Nanostructures” Department of Chemical Sciences, IISER Pune.
- ❖ **2014:** K. Ponnusamy, "Synthesis and Characterization of Block Copolymers (AB, ABC) by SET-RAFT, Thermal RAFT and SET-LRP Polymerizations" Department of Chemistry, IIT Madras.
- ❖ **2014:** S. Kumari Nisha, “Solution Processable Random Copolyesters containing Perylenbisimide and Oligo(p phenylenevinylene) by Reactive Blending. " Department of Chemistry, NCL, University Pune.
- ❖ **2012:** E. Linga Reddy, "Decomposition of Hydrogen Sulfide to Hydrogen and Sulfur Assisted by nonthermal plasma Dielectric Barrier Discharge Reactor" Department of Chemistry, NIT Trichy

4.5.2 Appointments as Internal Examiner:

I have been appointed as Research Progress Committee Member (RPC) for several internal Ph.D. Students.

5. Research Outputs:

5.1 Products and Start ups:

- ❖ The work entitled: Polynorbornene derived 8-hydroxyquinoline paper strips for ultrasensitive chemical nerve agent surrogate sensing has been recommended by the expert reviewer from DRDO, mentioning that the technology developed shall be the upgrading to the existing technology.
- ❖ ADO Additives PVT Ltd., Kolkata, are doing commercialization of ADONORC, Arsenic trap and Arsenic Sensor.

5.2 Patents:

5. As Sensor and trapper; Sanjib Pariyal, Rajan Kumar, Tapendu Samanta, Pawan Kumar, **Raja Shunmugam** TEMP/E-1/46586/2018-KOL (2019).
4. Unique norbornene polymer based "in-field" sensor for As(III); Sourav Bhattacharya[#], Santu Sarkar[#] and **Raja Shunmugam*** PCT/IB2015/051113. (International Patent)
3. Unusual Red Shift of the Sensor While Detecting the Presence of Cd²⁺ in Aqueous Environment; Santu Sarkar and **Raja Shunmugam*** PCT/IB2014/066077. (International Patent)
2. G. N. Tew, **R. Shunmugam** Terpyridine substituted compounds and related selective detection methods for mercury ion. U.S. Pat. Appl. Publ. US 20110065195 A1 20110317, (2011).
1. G. N. Tew, **R. Shunmugam**, Z. M. AL-Badri, T. P. Russel Ferromagnetic block copolymers and related methods U.S. Pat. Appl. Publ. US 20110064944 A1 20110317, (2011).

5.3 Books and Book Chapters Published

5.3.1 Books:

- "Functional Polymers: Design, Synthesis and Applications" edited by **Raja Shunmugam**, CRC press, Taylor and Francis publisher, 2017, pp 1-432.

5.3.2 Book Chapters:

6. Sayantani Bhattacharya and Raja Shunmugam, "Recent Applications of Macromolecular Gels for Environmental Remediation" Edited by S. Ananthan "Progress in Polymer Research for Biomedical, Energy and Specialty Applications" CRC Press, Taylor and Francis publisher, **2022**, Chapter 14.

5. Afaq Hussain, Vineeth A R, Soumya Kundu, Tapendu Samanta, **Shunmugam R.**, Debnath Pal and Jayasri Das Sarma "Arsenic binding to proteins alters tissue homeostasis" edited by Margarita Stoytcheva, Intech Publishers, **2018**, Chapter 5, Page 59-80.

4. Sarkar S., Bhattacharya, S. and **Shunmugam R.**, "Polynorbornene based sensors for "in-field" heavy metal and nerve agent sensing applications" edited by Raja Shunmugam, CRC press, Taylor and Francis publisher, **2017**, Page 370-432.

3. Rao, V. N., Mane, S. R., **Shunmugam, R.** "Ring Opening Metathesis Polymerization is a Versatile Technique for Making Polymeric Biomaterials" Computational and Experimental Chemistry: Developments and Applications, edited by Tanmoy Chakraborty, Michael J. Bucknum and Eduardo A. Castro; CRP press, Taylor and Francis publisher, **2013**, Page 193-240.

2. G. N. Tew, K. Aamer, **Shunmugam, R.**, "Novel Block Copolymers with Terpyridine Pendant Groups, in Metal-Containing and Metallo-Supramolecular Polymers and Materials," G.R. Newkome, I. Manners, U.S. Schubert, Eds. ACS Symp. Ser., **2006**, Page 126-140.

1. K. Aamer, **Shunmugam, R.**, G. N. Tew, "Supramolecular Block Copolymers Containing Metal-Ligand Binding Sites: From Synthesis to Properties, in Block Copolymer in Nanoscience," M. Lazzari, S. Lecommandoux, and G. Liu, Eds. Wiley-VCH, **2006**, 169-189.

5.4 Publications

2022

110. Piyali Mandal, Madhumita Mukherjee, and Raja Shunmugam Cosolvent effect on morphogenic changes with the biodegradable lactone backbones, Journal of Macromolecular Science, Part A: Pure and Applied Chemistry, 2022. DOI: [10.1080/10601325.2022.2111971](https://doi.org/10.1080/10601325.2022.2111971)

109. Rajan Kumar, Rajib Dey, Tanmoy Kalita, Sanjib Pariyal, Bijoy Sankar Goswami* Jayanta Halder,* and Raja Shunmugam* "Engineering a Unique Multi-tasking Polymer that Specifically

Prevents Rhodamine B and Fluoride Ion Toxicity with Antibacterial Responses Against MRSA” European Polymer Journal, 2022. <https://doi.org/10.1016/j.eurpolymj.2022.111401>.

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5.6 International Conferences:

- ❖ **MACRO 2018, International Conference held between 19 Dec to 22 Dec 2018 in IISER Pune.**
- ❖ **RAFMN 2017, International Conference held between 15 Feb to 17 Feb 2017 at NIT Patna. "Polynorbornene Derived Multi-Functional Nano-vehicles for the Potential Application as Theranostic Agent"** Shunmugam, R.
- ❖ **MACRO 2017, International Polymer Conference held between 7 to 11 January 2017 at Thiruvananthapuram. "Unique Polymer Based Nano-carriers for Theranostics Application".** Shunmugam, R.
- ❖ **Supramolecular and Polymer Assembly on 05-January-2017 at IACS Kolkata. "Self-Assembled Super Structures from Amphiphilic Norbornene Based Polymers".** Shunmugam, R.
- ❖ **"Advanced Polymers for Science and Technology" at VIT University, Vellore during 24-26th October 2016. "A Dual Responsive Polynorbornene Derived Smart Nano-vehicles for Cancer Therapy".** Shunmugam, R.
- ❖ **"International Conference on Functional Materials-2016" (ICFM-2016) at IIT Kharagpur from December 12-14, 2016. "Unique Norbornene Polymer Based "In-Field" Sensor and Trap for As (III)".** Shunmugam, R.
- ❖ **5th INDIGO Research Conference held between Feb 21 to 24 2016 at Lucknow Polymer Based Smart Nano-carriers for Theranostics Application.** Shunmugam, R.
- ❖ **FAPS-MACRO 2013, International Conference held between 15th-18th May 2013 at IISc Bangalore, India.**
Polynorbornene Based Noncarriers for Biomedical Application. **Shunmugam, R..**

- ❖ **INDO-US Bilateral workshop on Bio-inspired Supramolecular and Polymer Assembly "BSPA-2013" at The Travancore Heritage Resort, Thiruvananthapuram, Kerala, India (Dec, 15th -17th 2013)**
Self-Assembled Super Structures from Amphiphilic Norbornene Based Homopolymers: Promising Nanocarriers for Biomedical Application, **Shunmugam, R.**
- ❖ **Macro 2010 International Conference on Polymers held between 15th-17th Dec. 2010 at Delhi, India**
Designing polymers towards drug delivery and sensor applications. Vijay, N., Sarkar, S., Mane, S., Bhattachariya, S., Das Sarma, J., **Shunmugam, R.**
- ❖ **Nanotech 2010 International Conference held between 19th-21st Nov. 2010 in Kochi, India**
Engineering polymers towards drug delivery and sensor applications. **Shunmugam, R.**
- ❖ **STIPOMAT 2007 Conference, Les Diablerets, Switzerland, Oct 2007**
An invited poster presented: **R. Shunmugam**, G. N. Tew, Novel Materials from Side-Chain Terpyridine Polymers.
- ❖ **American Chemical Society, Boston, MA, Aug 2007**
R. Shunmugam, G. N. Tew, Sensing Chemical Warfare Agents with Terpyridine Based Polymers.
- ❖ **American Chemical Society, Boston, MA, Aug 2007**
R. Shunmugam, G. N. Tew, Side Chain Terpyridine Motifs for Supramolecular Materials.
- ❖ **Polymers West Gordon Research Conference, Ventura, CA, USA, January 2007**
An invited poster presented: **R. Shunmugam**, G. N. Tew, Side Chain Terpyridine Polymers with Random and Blocky Architecture for Luminescence and Nano Assembly Applications.
- ❖ **ACS Spring National Meeting, Atlanta, GA, Mar 2006** **R. Shunmugam**, G. N. Tew, Unique emission from side chain terpyridine polymer based lanthanide alloys.
- ❖ **Polymers East Gordon Research Conference, South Hadley, MA, Jun 2005**
R. Shunmugam, G. N. Tew, Side Chain Terpyridine Polymers with Random and Blocky Architecture for Luminescence and Nano Assembly Applications.
- ❖ **American Chemical Society, Philadelphia, PA, Aug 2004**
R. Shunmugam, G. N. Tew, Macromolecules with Side Chain Terpyridine Motifs for Use in Supramolecular Materials.
- ❖ **4th International Petroleum Conference and Exhibition-PETROTECH 2001, New Delhi S. Raja**, R. Dhamodharan, Water-Soluble Barbiturate and Thiobarbiturate Functionalized Polystyrenes- Synthesis and Fluorescence Studies.

5.6 National Conferences:

- ❖ **Symposium on Polymer Science (SPS) 2019, IISER KOLKATA-** Organizing Secretary for the Conference - **SPS-2019**.
- ❖ **Inter-IISER Chemistry Meet – 2017 (IICM - 2017) at IISER Bhopal during January 20 - 22, 2017.** “ Polynorbornene Derived Multi-Functional Nano-vehicles for the Potential Application in Cancer Therapy” Shunmugam, R
- ❖ **UGC sponsored National Level Seminar on “Chemistry in Human Life- Current Aspects” on December 9&10, 2016 at Gurudas College, Kolkata.** “A Dual Responsive Polynorbornene Derived Smart Nano-vehicles for the Potential Application in Cancer Therapy”. Shunmugam, R.
- ❖ **National Conference on Advanced Research in Medical Science held on 28 September 2016 at SRM Medical College, Chennai.** Polymer Based Nano-carriers for Theranostics Application, Shunmugam, R..
- ❖ **Recent Trends in Research in Chemical Sciences" (RTRCS 2014) at Manipal University Jaipur, Rajasthan (Feb, 21st -22nd 2014)**
Polynorbornene Based Nonocarriers for Cancer Therapy, Shunmugam, R..
- ❖ **Recent Advances in Polymer & Rubber Science & Technology, RAPT 2014, Calcutta University (23rd January, 2014)**
Polymer Based Detection Approach to Metal Poisoning in Drinking Water, Shunmugam, R..
- ❖ **National Symposium on Recent Advances in Chemistry (NSRAC-2013) held between 22nd-23rd March, 2013 at Pondichery University**
ROMP is a Versatile Synthetic Tool for Making Polymers for Biomaterials. Shunmugam, R..
- ❖ **PolyTech 2012 15th -17th Dec, 2012 at Bharti Vidhyapith University, Pune**
ROMP is a Versatile Synthetic Tool for Making Functional Biopolymers. Shunmugam, R..
- ❖ **Advances in Polymer Science & Nanotechnology: Design and Structure (PSNDS-11) held between 16th -17th Dec, 2011 at Applied Chemistry Department, M. S. University Vadodara, Gujarat**
Designing Functional Polymers for Biological Applications. Shunmugam, R..
- ❖ **Chemistry in the 21st Century for the Benevolence of the Society, held between 27th-28th July 2011 at Department of Chemistry, Vidyasagar College, and Kolkata**
Designing Polymers Towards Drug Delivery and Sensor Applications. Shunmugam, R..

- ❖ **Perspective in Polymer Science and Technology held on 27th November 2010 at Indian Association for the Cultivation of Science, Jadavpur, and Kolkata**
Engineering block copolymers for metal assisted self-assembled super structures.
Shunmugam, R..

5.7 Student Awards

- ❖ Symposium on Polymer Chemistry (SPS)-2019, IISER Kolkata, (Jul, 5th -6th, 2019).
Sayantani Bhattacharya, and Raja Shunmugam, "A study on the effect of PEG in the thiol-norbornene crosslinked network for the removal of toxic cationic dye" (**Selected for the Best poster award**)
- ❖ Pawan Kumar, Rajan Kumar and Tapendu Samanta received "**Best Performing Student of the Year Award**" in Department of Chemical Sciences Day, IISER Kolkata on 8 March 2019.
- ❖ NMSB 2017, Newton Bhabha Researcher Links Workshop on Functional NanoMaterials: From Spectroscopy to Bioimaging, IISER Kolkata, Dec 14th - 16th, 2017.
Saikat Mukherjee and Raja Shunmugam, "Norbornene Based Copolymer for Site-Specific Theranostic Application in Cancer Therapy." (**Selected for the Best poster award**)
- ❖ "Department Day, Department of Chemical Sciences, IISER Kolkata, 28th January, 2016.
Sayantani Bhattacharya, Mutyala Naidu Ganivada and Raja Shunmugam, "Biodegradable Copolymer for Stimuli Responsive Sustained Release of Doxorubicin (**Selected for the Best poster award**)
- ❖ "**International Symposium on Polymer Science and Technology, IACS Kolkata (Jan, 23rd - 26th, 2015)**
Mutyala Naidu Ganivada and Raja Shunmugam "Magnetic particle attached cationic copolymers as the potential DNA binders" (**Selected for the Best Poster Award by ACS**)
- ❖ "**Recent Trends in Research in Chemical Sciences" (RTRCS 2014) at Manipal University Jaipur, Rajasthan (Feb, 21st -22nd 2014)**
Shivshankar Mane and Raja Shunmugam, "Norbornene Derived Polymeric Nano-Carrier for Anti-Tuberculosis Therapy", (**Selected for the Best Poster Award**)
- ❖ "**Recent Advances in Polymer & Rubber Science & Technology, RAPT 2014, Calcutta university (23 rd January, 2014)**
Sourav Bhattachayra, Santu Sarkar and Raja Shunmugam, "Unique norbornene based polymers for sensing & removing of As (III)". (**Selected for the Best Poster Award**)
- ❖ "**Department Day, Department of Chemical Sciences, IISER Kolkata, (Dec. 11th 2013)**
Saikat Mukherjee, and Raja Shunmugam, "Synthesis and characterization of norbornene based Copolymers for Imaging Applications." (**Selected for Best Poster Award**).

- ❖ **INDO-US Bilateral workshop on Bio-inspired Supramolecular and Polymer Assembly “BSPA-2013” at The Travancore Heritage resort, Thiruvananthapuram, Kerala, India (Dec, 15th -17th 2013)**
Shivshankar Mane and Raja Shunmugam, “Norbornene Derived Polymeric Nano-Carrier for Anti-Tuberculosis Therapy”. **(Selected for the Best Poster Award)**
- ❖ **Department Day, Department of Chemical Sciences, IISER Kolkata (Nov. 7th 2012)**
Shivshankar Mane and Raja Shunmugam, “Synthesis and Characterizations of Amphiphilic Polymer”. **(Selected for the Best Speaker Award).**
- ❖ **Polymer & Rubber Technology for 21st Century “PRC 2012” at Centre for research in nanoscience and Nanotechnology, Uni. Of Calcutta (Oct. 12th-13th 2012)**
Shivshankar Mane, Saikat Mukharjee and Raja Shunmugam, “Synthesis and Characterizations of Amphiphilic Polymer”. **(Selected for the Best Poster Award).**
- ❖ **Advances in Polymer Science & Nanotechnology: Design and Structure (PSNDS-11) at Applied Chemistry Department, M. S. Uni. Baroda, Gujarat (Dec. 16th -17th 2011)**
Shivshankar Mane, and Raja Shunmugam, “Synthesis and Characterization of Norbornene Derived Functional Materials”. **(Selected for the Best Poster Award).**
- ❖ **Symposium on Polymer Science-2011 at IISER-Kolkata (Dec. 10th 2011)**
Vijayakameswara Rao. N., and Raja Shunmugam, “Norbornene derived Doxorubicin copolymer as drug carriers with pH responsive hydrazone linker”. **(Selected for the Best Poster Award).**

6 Leadership Position

6.1 Formal and Informal leadership positions held

- ❖ I am the principal investigator of my research group since September 2008.
- ❖ I was the Head, Department of Chemical Sciences from March 2014 to March 2016. Major Activity Involved: During my Headship, nearly 9 Faculty members were recruited in the Department of Chemical Sciences. The 5 year Departmental review happened successfully. The High resolution TEM machine was procured under the DST-FIST scheme and RSC Accreditation Process was successfully done.
- ❖ I was the Warden of Boys Hostel, at IISER Kolkata for 4 years (2009 to 2013).

6.2 Involvement in the academic environment

Institute level	1.	Responsible for establishment of Polymer Research Centre (PRC) at IISER-Kolkata along with Dr. Priyadarsi De. It took almost one and half years to establish PRC. The PRC got inaugurated in April, 2011, and it become completely operational since September 2011.
	2.	Responsible for development and maintenance of FE-SEM facility as central facility of IISER-Kolkata (development of this facility took three years from 2010-2013).
Institute level	3.	Responsible for creating the nano particle size analyzer (DLS Instrument) as the central facility.
Institute level	4.	Responsible for creating Spectroscopy facility along with Dr. Priyadarsi De.
Institute level	6.	Maintaining the Gel Permeation Chromatography (GPC) as central facility.
Institute level	7.	Since 2009 to August 2010: I served as Assistant Warden for APC Roy, 2010 to 2011: Warden for M. N. Saha Boys Hostel 2011 to 2013 July: Warden for S. N. Bose Boys Hostel I served for Hostel Administration more than 4 years.
Institute level	8.	Served as member for several disciplinary committees from 2009 to 2013 July.
Institute level	9.	Served as a member of Bio-safety committee of IISER-Kolkata since 2010-2012.
Institute level	10.	Served as a member of the Committee for Counselling of the Incoming students during admissions for the academic year 2009 – 2010.
Institute level	11.	Served as a member of the committee for selecting candidates for the PhD program of IISER-Kolkata during 2010-2011

Institute level	12.	Served as a member of short listing committee for the post of technical assistant during 2013
Departmental level	1.	Served as a member of departmental advisory committee during 2011.
	2.	Served as a member of departmental research committee during 2011.

7. Community Engagements

7.1 Involvement in the Academic Community:

- ❖ Role as reviewer of research manuscripts, research proposals from funding agencies and postgraduate thesis examination
- ❖ Reviewer for the International Journals: Biomacromolecules, Biomaterials, Acta Biomaterialia, Macromolecules, Chemical Communications, European Polymer Journal

7.2 Service to the Community in and Around Campus:

I have been involving in the out-reach activity. I was the convener of the Department out-reach activity committee (2014-2016).

8. REFEREES:

1. **Professor Gregory N. Tew**, PSE, UMASS, Amherst, USA. (tew@mail.pse.umass.edu)
2. **Professor S. Thaymanavan**, Chemistry, UMASS, Amherst, USA.(thai@chem.umass.edu)
3. **Professor R. Dhamodharan**, IIT Madras, India. (damo@iitm.ac.in).