

## Rajesh A. Shenoi, PhD

### *Affiliation*

Senior Scientist  
Centre for Drug Discovery  
Inter University Centre for  
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### **Education**

<b>Degree</b>	<b>Institution/University</b>	<b>Year</b>	<b>Subject(s)</b>
PhD	National Chemical Laboratory, Pune / University of Pune	2008	Chemistry
MSc	School of Chemical Sciences, Mahatma Gandhi University, Kottayam, Kerala	1997	Chemistry
BSc	S.D. College, Alappuzha/University of Kerala	1995	Chemistry

### **Advanced/Professional training**

<b>Position</b>	<b>Institute/University</b>	<b>Training/ Expertise</b>	<b>Year From - To</b>
Visiting Faculty	International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam	Nanomedicine, Drug delivery	2014-2015
Post-Doctoral Fellow	Centre for Blood Research and Department of Pathology & Laboratory Medicine, University of British Columbia, Vancouver BC, Canada	Polymer therapeutics, Macromolecular drug design and development	2008-2014

## Professional Experience

Position	Institute/Organization	Responsibilities	Year From - To
Senior Scientist	Centre for Drug Discovery at the Inter University Centre for Biomedical Research & Super Speciality Hospital (Govt. of Kerala)	Drug discovery & development, Nanomedicine	2016-
Scientist D (Adhoc)	Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram	Development of polymer scaffolds for tissue engineering	2015-2016
Scientist/Engineer 'SC'	Vikram Sarabhai Space Centre, Indian Space Research Organization, Thiruvananthapuram	Development of rocket ignition and separation systems	2004-2008

## Awards and Fellowships

1. Council for Scientific and Industrial Research Senior Research Fellowship (2000-2003)
2. Council for Scientific and Industrial Research Junior Research Fellowship (1998-2000).
3. Secured First Rank in M Sc. Chemistry (Polymer Science specialization) from School of Chemical Sciences, Mahatma Gandhi University.
4. Qualified Graduate Aptitude Test in Engineering (Chemistry) (GATE-97) with percentile score of 96.90 (All India Rank: 46).

## Research Interests

- Biodegradable biomaterials for targeted drug delivery
- Macromolecular drugs as heparin antidotes, polyphosphate inhibitors and antithrombotic agents
- Stimuli-responsive nanostructures for intracellular delivery
- Drugs, prodrugs and nanoformulations
- Synergistic values of multi-component-nanoformulations with therapeutic molecules

## Teaching Expertise/Interests

- Molecular Mechanisms of drug action and metabolism
- Principles of Drug Design and Development
- Nanomedicine
- Nano-Bio Interactions
- Macromolecular Therapeutics

## Publications

(Cumulative IF: 128; *h*-index: 9; *i*-10 index: 9; Total Citations: 281)

### *Peer reviewed journals*

1. Kalathottukaren MT, Srinivas A, Yu K, **Shenoi RA**, Creagh AL, Haynes CA and Kizhakkedathu, JN. A polymer therapeutic having universal heparin reversal activity: molecular design and functional mechanism. *Biomacromolecules* (2017). (Accepted) (IF: 5.246).
2. Wong NKY, **Shenoi RA**, Abbina S, Chafeeva I, Kizhakkedathu JN and Khan MK. Non-transformed and cancer cells can utilize different endocytic pathways to internalize dendritic polymer nanoparticle variants: implications on nanocarrier design. *Biomacromolecules* 18, 2427-2438 (2017) (IF: 5.246).
3. Kalathottukaren MT, Abraham L, Kapopara PK, Lai BFL, **Shenoi RA**, Rosell FI, Conway EM, Pryzdial ELG, Morissey JH, Haynes CA and Kizhakkedathu JN. Alteration of blood clotting and lung damage by protamine are avoided using the heparin and polyphosphate inhibitor, UHRA. *Blood* 129, 1368-1379 (2017) (IF: 13.164).
4. **Shenoi RA**, Abbina S and Kizhakkedathu JN. *In vivo* biological evaluation of high molecular weight multifunctional acid-degradable polymeric drug carriers with structurally different ketals. *Biomacromolecules* 17, 3683-3693 (2016) (IF: 5.246).
5. Wong NKY\*, Misri R\*, **Shenoi RA\***, Chafeeva I, Kizhakkedathu JN and Khan MK (\*equal contribution as first author). Design considerations for developing hyperbranched polyglycerol nanoparticles as systemic drug carriers. *J Biomed Nanotech*, 12, 1089-1100 (2016) (IF: 4.521).
6. Misri R\*, Wong NKY\*, **Shenoi RA\***, Lum C, Chafeeva I, Toth K, Rustum Y, Kizhakkedathu JN and Khan MK (\*equal contribution as first author). Investigation of hydrophobically derivatized hyperbranched polyglycerol with PEGylated shell as a nanocarrier for systemic delivery of chemotherapeutics. *Nanomedicine: NBM* 11, 1785-1795 (2015). (IF: 5.671).

7. **Shenoi RA**, Chafeeva I, Lai BFL, Horte S and Kizhakkedathu JN. Bioreducible hyperbranched polyglycerols with disulfide linkages: Synthesis and biocompatibility evaluation. *J. Polym. Sci, Part A: Polym. Chem.* 53, 2104-2115 (2015) (IF: 3.318).
8. Kumar P, **Shenoi RA**, Lai BFL, Nguyen M, Kizhakkedathu JN and Straus SK. Conjugation of aurein 2.2 to HPG yields an antimicrobial with better properties. *Biomacromolecules* 16, 913-923 (2015) (IF: 5.583).
9. **Shenoi RA**, Kalathottukaren MT, Travers RJ, Lai BFL, Creagh AL, Lange D, Yu K, Weinhart M, Chew BH, Du C, Brooks DE, Carter CJ, Morrissey JH, Haynes CA and Kizhakkedathu JN. Affinity-based design of a synthetic universal reversal agent for heparin anticoagulants. *Sci. Transl. Med.* 6, 260ra150 (2014). (IF: 15.843). (This work also highlighted as Cover Story in *Science-Business eXchange*, Nature Publishing Group, 2014; as Research Highlights in *Nature Reviews: Drug Discovery*, Vol 14, January 2015; and as News of the week in *Chemical & Engineering News*, Vol. 92, November 2014).
10. Travers RJ, **Shenoi RA**, Kalathottukaren MT, Kizhakkedathu JN and Morrissey JH. Non-toxic polyphosphate inhibitors reduce thrombosis while sparing hemostasis. *Blood* 124, 3183-3190 (2014). (IF: 10.452). (This article was published as Plenary Paper and the work was also highlighted as Commentary in *Blood*, 2014, 124, 3177-3178)
11. **Shenoi RA**, Lai BFL, Imran ul-haq M, Brooks DE and Kizhakkedathu JN. Biodegradable polyglycerols with randomly distributed ketal groups as multifunctional drug delivery systems. *Biomaterials* 34, 6068-6081 (2013) (IF: 8.312).
12. Imran ul-haq M, Hamilton JL, Lai BFL, **Shenoi RA**, Horte S, Constantinescu I, Leitch H and Kizhakkedathu JN. Design of long circulating nontoxic dendritic polymers for the removal of iron in vivo. *ACS Nano* 7, 10704-10716. (2013) (IF: 12.033).
13. Imran-ul-haq M, **Shenoi RA**, Brooks DE and Kizhakkedathu JN. Solvent-assisted anionic ring opening polymerization of glycidol: Toward medium and high molecular weight hyperbranched polyglycerols. *J. Polym. Sci. Part A. Polym. Chem.* 51, 2614-2621 (2013). (IF: 3.245).
14. **Shenoi RA**, Narayanannair JK, Hamilton JL, Lai BFL, Horte S, Kainthan RK, Varghese JP, Rajeev KG, Manoharan M and Kizhakkedathu JN. Branched multifunctional polyether polyketals: Variation of ketal group structure enables unprecedented control over polymer degradation in solution and within cells. *J. Am. Chem. Soc.* 134, 14945-14957 (2012). (IF: 10.677).
15. **Shenoi RA**, Lai BFL and Kizhakkedathu JN. Synthesis, characterization and biocompatibility of biodegradable hyperbranched polyglycerols from

- acid-cleavable ketal group functionalized initiators. *Biomacromolecules* 13, 3018-3030. (2012) (IF: 5.371).
16. Beaudette P, Rossi NAA, Huesgen PF, Yu X, **Shenoi RA**, Doucet A, Overall CM and Kizhakkedathu JN. Development of soluble ester-linked aldehyde polymers for proteomics. *Anal. Chem.* 83, 6500-6510 (2011). (IF: 5.856).
  17. **Rajesh A** and Sivaram S. Polymerization of ethylene using amido-functional half-sandwich complexes of Group 4 metals. *Polym. Eng.Sci.* 51, 2103-2108 (2011). (IF: 1.302).
  18. **Rajesh A** and Sivaram S. Polymerization of ethylene to branched poly(ethylene)s using ansa- $\eta$ 5-mono-fluorenyl cyclohexanolato zirconium (IV) complex/methylaluminumoxane. *Polym. Bull.* 67, 383-399 (2011). (IF: 1.532).
  19. Kizhakkedathu JN, Creagh AL, **Shenoi RA**, Rossi NAA, Brooks DE, Chan T, Lam J, Dandepally SR and Haynes CA. High molecular weight polyglycerol-based multivalent mannose conjugates. *Biomacromolecules* 11, 2567-2575 (2010). (IF: 5.325).

### *Book Chapters*

1. **Shenoi RA**. Sugar-based systems *in* Engineering of biomaterials for drug delivery systems, edited by Anilkumar Parambath, Elsevier (2017) (in press)
2. **Shenoi RA**, Gao F, Imran ul-haq M, Kizhakkedathu JN. Bioconjugates based on poly(ethylene glycol)s and polyglycerols *in* Chemistry of Bioconjugates: Synthesis, characterization and biomedical applications, edited by Ravin Narain, John Wiley & Sons, Inc. (2014) ISBN:9781118159248.

### **Patents**

#### *Granted*

1. Kizhakkedathu JN, **Shenoi RA**, Carter CJ and Brooks DE. Polymers for reversing heparin based anticoagulation. **US Patents 20120308546** (December 6, 2012), **8519189** (August 27, 2013), **8637008** (January 28, 2014), **9095666** (August 4, 2015).

#### *Filed*

1. Brooks D, Kizhakkedathu J, **Shenoi R**, Weinhart M, Haag R, Groeger D. Anionic linear polyglycerol derivatives, a method for manufacturing and

- applications. **PCT Application WO 2016116489**. (Date of filing: January 20, 2016)
2. Khan MK, Kizhakkedathu JN, Misri R, **Shenoi RA**, Wong NKY and Brooks DE. Hydrophobically derivatized hyperbranched polyglycerol for intravascular drug delivery. **PCT Application WO 2016000070** (Date of filing: June 26, 2015)
  3. Kizhakkedathu JN, Morrissey JH, Travers RJ, **Shenoi RA** and Kalathottukaren MT. Antithrombotic compounds, methods and uses thereof. **PCT Application WO 2015179958** (Date of filing: May 29, 2015)
  4. Kizhakkedathu J, **Shenoi R**, Manoharan M, Kallanthottathil R and Narayanannair JK. Polyacetal or polyketal and polyether polymers. **PCT Application WO 2011140644** (Date of filing: May 11, 2011).

### **Abstracts/Extended Abstracts Published**

1. Kalathottukaren MT, **Shenoi RA**, Lai BFL, Rosell F, Kizhakkedathu JN and Pryzdial ELG. A universal heparin antidote with negligible effect on fibrin(ogen) and plasma coagulation. *Blood* 124, 4231 (2014).
2. Imran ul-haq M, Hamilton JL, Lai BFL, **Shenoi RA** and Kizhakkedathu JN. Hyperbranched polyglycerols based iron chelators for iron chelation therapy. *Polymer Preprints* 53, 604-605 (2012).
3. **Shenoi RA**, Lai BFL, Lange D, Brooks DE, Chew B, Carter CJ and Kizhakkedathu JN. A novel polymer based antidote for reversing the anticoagulation effect of clinically used heparins. *Blood* 118, 1440-1441 (2011).
4. **Shenoi RA** and Kizhakkedathu JN. Acid degradable core-functionalized hyperbranched polyglycerols: A New class of biodegradable polymers. *Polymer Preprints*, 52, 170-171 (2011).
5. Imran ul-haq M, **Shenoi RA** and Kizhakkedathu JN. Solvent assisted anionic ring opening polymerization of glycidol: Synthesis of high molecular weight hyperbranched polyglycerol. *Polymer Preprints* 52, 150-151 (2011).

### **Papers presented in conferences**

- Oral presentations: 8
- Poster presentations: 14

## Countries travelled

Sl. No.	Country	Purpose	Duration
1	Canada	Post-Doctoral Fellowship at University of British Columbia, Vancouver	November 2008- July 2014
2	USA	241 <sup>st</sup> ACS National Meeting and Exposition, Anaheim, CA	March 27-31, 2011
3	USA	53 <sup>rd</sup> Annual Meeting of the American Society of Hematology, San Diego, CA	December 10-13, 2011
4	USA	Gordon Research Conference on Polymers, Mount Holyoke College, South Hadley, MA	June 12-17, 2011

## Memberships in Professional Bodies/Societies

- Founder Member of 'Words Worth' Society, India (2017)
- Member of International Chemical Biology Society (2017)
- Annual Member of the American Chemical Society, USA (2011)
- Annual Member of the Canadian Biomaterials Society (2011)
- Life Member of the Society for Polymer Science, India (2003 onwards)
- Life Member of the High Energy Materials Society of India (2005 onwards)