

CURRICULUM VITAE FOR ACADEMIC PROMOTION

The Johns Hopkins University School of Medicine

Kannan Rangaramanujam, Ph.D.

(Signature) 

(Typed Name) KANNAN RANGARAMANUJAM

(11/04/2014)

I use the name Rangaramanujam M. Kannan in publications

DEMOGRAPHIC AND PERSONAL INFORMATION

Current Appointments

8/11 -present

Professor
Full-time Faculty
Ophthalmology, Johns Hopkins Medicine
Baltimore, MD

Professor, Joint Appointment
Materials Science and Engineering
Johns Hopkins University
Baltimore, MD

Professor, Joint Appointment
Chemical and Biomolecular Engineering
Johns Hopkins University
Baltimore, MD

Research Scientist, Hugo Moser Research Institute
Kennedy-Krieger Institute

Personal Data

Ophthalmology, Wilmer Eye Institute
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Baltimore, MD 21287
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Education and Training (in chronological order):

Undergraduate:

1987 **B.E. (Hons.)**, Chemical Engineering Birla Institute of Tech. & Sci., India

Graduate/Doctoral:

1989 **M.S.**, Chemical Engineering Penn State University, University Park, PA

1991 **Ph.D.** Chemical Engineering California Institute of Technology, Pasadena, CA

Postdoctoral:

Professional Experience (in chronological order, earliest first)

8/95 - 7/97	Senior Research Engineer, 3M Corporate Research, St. Paul, MN
8/97 - 5/03	Assistant Professor, Chemical Engineering, Wayne State University, Detroit, MI
5/02 - 7/11	Assistant Professor, Biomedical Engineering, Wayne State University, Detroit, MI
5/03 - 7/11	Full Member, Barbara Ann Karmanos Cancer Institute, Detroit Medical Center, Detroit, MI
5/03 - 5/09	Associate Professor, Chemical Engineering, Wayne State University, Detroit, MI
3/04 - 5/05	Co-founder & Research Director, nanoScience Engineering Co., Detroit, MI
8/07 - 7/11	Co-director, Nanotechnology Lab, NICHD Perinatology Research Branch, Detroit, MI
5/09 - 8/11	Professor, Chemical Engineering, Wayne State University, Detroit, MI
8/11 - present	Professor (Pending Academic Review), Johns Hopkins School of Medicine, Ophthalmology, Baltimore, MD
1/12 - present	Co-director, Center for Nanomedicine, Wilmer Eye Institute, Johns Hopkins School of Medicine, Baltimore, MD
9/14 - present	Co-director, KKI-JHU Interdisciplinary CP center of research excellence
9/14 - present	Research Scientist, Hugo-Moser Research Institute, Kennedy-Krieger Institute

RESEARCH ACTIVITIES

Publications: *(total citations: 3486, h-index = 32, based on Google Scholar, Citations over last 5 years: 2453).*

* denotes corresponding author

Peer-reviewed Original Science Research

1. **Kannan RM**, Kornfield JA*. The third normal stress difference in entangled melts: quantitative stress-optical measurements in oscillatory shear. *Rheologica Acta*. 1992;31(6):535-544.
2. **Kannan RM**, Kornfield JA*, Schwenk N, Boeffel C. Rheology of side-group liquid-crystalline polymers: effect of isotropic-nematic transition and evidence of flow alignment. *Macromolecules*. 1993;26(8):2050-56.
3. **Kannan RM**, Arendt BH, Zewail M, Kornfield JA*. Dynamics of each component in miscible blends of polyisoprene and polyvinylethylene. *Rheologica Acta*. 1994;33(4):322-36.
4. **Kannan RM**, Kornfield JA*, Schwenk N, Boeffel C. Shear-induced orientation of side-group liquid-crystalline polymers. *Advanced Materials*. 1994;6(3):214-216.
5. **Kannan RM**, Kornfield JA*. Stress-optical manifestations of molecular and microstructural dynamics in complex polymer melts. *J Rheology*. 1994;38(4):1127-50.
6. **Kannan RM**, Rubin SF, Kornfield JA*, Boeffel C. Dynamics of flow-induced alignment of side-group liquid-crystalline polymers. *J Rheology*. 1994;38(5):1609-22.
7. **Kannan RM**, Kornfield JA*. Evolution of microstructure and viscoelasticity during flow alignment of a lamellar diblock copolymer. *Macromolecules*. 1994;27(5):1177-86.
8. Rubin SF, **Kannan RM**, Kornfield JA*, Boeffel C. Effect of mesophase order and molecular weight on the dynamics of nematic and smectic side-group liquid-crystalline polymers. *Macromolecu*. 1995;28(10):3521-30
9. Arendt BH, Krishnamoorti R, **Kannan RM**, Seitz K, Kornfield JA*, Roovers J. Dynamics of disordered diblocks of polyisoprene and polyvinylethylene. *Macromolecules*. 1997;30(4):1138-45.
10. **Kannan RM**, Lodge TP*. Viscoelastic properties of highly entangled poly(vinyl methyl ether). *Macromolecules*. 1997;30(12):3694-95.
11. Lodge TP*, Hamersky M, Milhaupt J, **Kannan RM**, Dalvi MC, Eastman CE. Diffusion in microstructured block copolymer melts. *Macromolecular Symposia*. 1997;121(1):219-233.
12. **Kannan RM**, Lodge TP, Su J. Effect of composition fluctuations on tracer diffusion in symmetric diblock copolymers. *J Chem Phys*. 1998;108(11):4634-39.
13. Kharchenko SB, **Kannan RM***, Cernohous JJ, Venkataramani S, Babu GN. Unusual contributions of molecular architecture to rheology and flow birefringence in hyperbranched polystyrene blends. *J Polymer Sci. Part B*. 2001;39(21):2562-71.
14. Parthasarthy G, Sevegney MS, **Kannan RM***. Rheo-optical FTIR Spectroscopy of the deformation behavior in quenched and slow-cooled isotactic polypropylene films. *J Polymer Sci. Part B*. 2002;40(22):2539-51.

15. Kolhe P, **Kannan RM***. Improvement in ductility of chitosan through blending and copolymerization with PEG: FTIR investigation of molecular interactions. *Biomacromolecules*. 2003;4(1):173-80.
16. Kharchenko SB, **Kannan RM***, Cernohous JJ, Venkataramani S. Role of architecture on the conformation, rheology, and orientation behavior of linear, star, and hyperbranched polymer melts: 1. Synthesis and Molecular Characterization. *Macromolecules*. 2003;36(2):399-406.
17. Kharchenko SB, **Kannan RM***. Role of architecture on the conformation, rheology, and orientation behavior of linear, star, and hyperbranched polymer melts: 2. Linear viscoelasticity and flow birefringence. *Macromolecules*. 2003;36(2):407-15.
18. Kolhe P, Misra E, **Kannan RM***, Kannan S, Lieh-Lai M. Drug complexation, in vitro release, and cellular entry by dendrimers and hyperbranched polymers. *Int J Pharm*. 2003;259(1-2):143-60.
19. Sevegney MS, Parthasarathy G, **Kannan RM***. Deformation-induced morphology changes and orientation behavior in syndiotactic polypropylene. *Macromolecules*. 2003;36(17):6472-83.
20. Kannan S, Kolhe P, Raykova V, Glibatec M, **Kannan RM***, Lieh-Lai M, Bassett D. Dynamics of cellular entry and drug delivery by dendritic polymers into human lung epithelial carcinoma cells. *J Biomater Sci Polym Ed*. 2004;15(3):311-30.
21. Sevegney MS, Hofmann V, **Kannan RM***. A rheo-optical FTIR spectrometer for the investigation of deformation behavior in complex polymers. *Int J Poly Anal Char*. 2004;9(4):245-74.
22. Kolhe P, Khandare J, Pillai O, Kannan S, Lieh-Lai V, **Kannan RM***. Hyperbranched polymer-drug conjugates with high drug payload for enhanced cellular delivery. *Pharm Res*. 2004;21(12):2185-95.
23. Sevegney MS, **Kannan RM***, Siedle AR, Percha PA. FTIR spectroscopic investigation of thermal effects in semi-syndiotactic polypropylene. *J Polymer Science. Part B*. 2005;43(4):439-461.
24. Parthasarathy G, Sevegney MS, **Kannan RM***. Monitoring elasticity in syndiotactic polypropylene films. *Polymer*. 2005;46(17):6335-46.
25. Khandare J, Kolhe P, Pillai OP, Kannan S, Lieh-Lai M, **Kannan RM***. Synthesis, cellular transport and activity of PAMAM dendrimer-methylprednisolone conjugates. *Bioconjugate Chem*. 2005;16(2):330-337.
26. Gurdag S, Khandare J, Staples S, **Kannan RM***, Matherly L. Activity of dendrimer-methotrexate conjugates in sensitive and resistant cell lines. *Bioconjugate Chem*. 2006;17(2):275-83.
27. Kolhe P, Khandare J, Pillai O, Kannan S, Lieh-Lai M, **Kannan RM**. Preparation, cellular transport, and activity of polyamidoamine-based dendritic nanodevices with a high drug payload. *Biomaterials*. 2006;27(4):660-69.
28. Sevegney M, **Kannan RM***, Naik R, Naik V. Vibrational spectroscopic investigation of stereoregularity effects in syndiotactic polypropylene structure and morphology. *Vibrational Spectrosc*. 2006;40(2):246-56.
29. Kulkarni A, Kharchenko S, **Kannan RM***. Rheo-optical measurements of the first and third normal stresses of homopolymer polyvinyl methyl ether melt. *Rheologica Acta*. 2006;45(6):951-58.
30. Horsch S, Serhatkulu G, Gulari E, **Kannan RM***. Supercritical CO₂ dispersion of nano-clays and clay/polymer nanocomposites. *Polymer*. 2006;47(21):7485-96.
31. Wang X, Inapagolla R, Kannan S, Lieh-Lai M, **Kannan RM***. Synthesis, characterization and in vitro release of dendrimer-streptokinase conjugates. *Bioconjugate Chem*. 2007;18(3):791-99.
32. Yu H, Bellair R, **Kannan RM**, Brock SL*. Engineering Strength, Porosity, and Emission Intensity of Nano-structured CdSe Networks by Altering the Building-Block Shape. *J Am Chem Soc*. 2008;130(15):5054-5.
33. Perumal OP, Inapagolla R, Kannan S, **Kannan RM***. The effect of surface functionality on cellular trafficking of dendrimers. *Biomaterials*. 2008;29(24-25):3469-76.
34. Manitiu M, Bellair RJ, Horsch S, Gulari E, **Kannan RM***. Supercritical carbon dioxide-processed dispersed polystyrene-clay nanocomposites. *Macromolecules*. 2008;41(21):8038-46.
35. Navath RS, Kurtoglu YE, Wang B, Kannan S, Romero R, **Kannan RM***. Dendrimer-drug conjugates for tailored intracellular drug release based on glutathione levels. *Bioconjugate Chem*. 2008;19(12):2446-2455.
36. Perumal OP, Khandare J, Kolhe P, Kannan S, Lieh-Lai M, **Kannan RM***. Effects of Branching Architecture and Linker on the Activity of Hyperbranched Polymer-Drug Conjugates. *Bioconj. Chem*. 2009;20(5):842-6.
37. Kurtoglu YE, Navath RS, Wang B, Kannan S, Romero R, **Kannan RM***. Poly(amidoamine) dendrimer-drug conjugates with disulfide linkages for intracellular drug delivery. *Biomaterials*. 2009;30(11):2112-21
38. Manitiu M, Horsch S, Gulari E, **Kannan RM***. Role of polymer-clay interactions and nano-clay dispersion on the viscoelastic response of supercritical CO₂ dispersed polyvinylmethylether (PVME)-Clay nanocomposites. *Polymer*. 2009;50(15):3786-3796.
39. Wang B, Navath RS, Romero R, Kannan S, **Kannan RM***. Anti-inflammatory and anti-oxidant activity of anionic dendrimer-N-acetyl cysteine conjugates in activated microglial cells.. *Int J Pharm*. 2009;377(1-

- 2):159-68.
40. Baker KC, Bellair R, Manitiu M, Herkowitz HN, **Kannan RM***. Structure and mechanical properties of supercritical carbon dioxide processed porous resorbable polymer constructs. *J Mech Behav Biomed Mater*. 2009;2(6):620-6.
 41. Kurtoglu YE, Mishra MK, Kannan S, **Kannan RM***. Drug release characteristics of PAMAM dendrimer-drug conjugates with different linkers. *Int J Pharm*. 2010;384(1-2):189-94.
 42. Han H, **Kannan RM***, Wang S, Mao GZ, Kusanovic JP, Romero R. Multifunctional Dendrimer-templated Antibody Presentation on Biosensor Surfaces for Improved Biomarker Detection. *Adv Func Materials*. 2010;20(3):409-421.
 43. Navath RS, Wang B, Kannan S, Romero R, **Kannan RM***. Stimuli-responsive star poly(ethylene glycol) drug conjugates for improved intracellular delivery of the drug in neuroinflammation. *J Control Release*. 2010;142(3):447-56.
 44. Bassett D*, Hirata F, Gao X, **Kannan RM**, Kerr J, Doyon-Reale N, Wilson S, Lieh-Lai M. Reversal of the effects of methylprednisolone in allergen-exposed female balb/c mice. *J Toxicol Environ Health*. 2010;73(11):711-24.
 45. Bellair RJ, Manitiu M, Gulari E, **Kannan RM***. Investigation of Clay Modifier Effects in Supercritical Carbon Dioxide Processed Nanocomposites. *J Polymer Sci. Part B*. 2010;48(8):823-831.
 46. Menjoge AR, Navath RS, Asad A, Kannan S, Kim CJ, Romero R, **Kannan RM**. Transport and biodistribution of dendrimers across human fetal membranes: implications for intravaginal administration of dendrimer-drug conjugates. *Biomaterials*. 2010 ;31(18):5007-21.
 47. Navath RS, Menjoge AR, Wang B, Romero R, Kannan S, **Kannan RM***. Amino acid-functionalized dendrimers with heterobifunctional chemoselective peripheral groups for drug delivery applications. *Biomacromolecules*. 2010;11(6):1544-63.
 48. Inapagolla R, Guru BR, Kurtoglu YE, Gao X, Lieh-Lai M, Bassett DJ, **Kannan RM***. In vivo efficacy of dendrimer-methylprednisolone conjugate formulation for the treatment of lung inflammation. *Int J Pharm*. 2010;399(1-2):140-7.
 49. Wang B, Navath RS, Menjoge AR, Balakrishnan B, Bellair R, Dai H, Romero R, Kannan S, **Kannan RM***. Inhibition of bacterial growth and intramniotic infection in a guinea pig model of chorioamnionitis using PAMAM dendrimers. *Int J Pharm*. 2010;395(1-2):298-308.
 50. Dai H, Navath RS, Balakrishnan B, Guru BR, Mishra MK, Romero R, **Kannan RM***, Kannan S. Intrinsic targeting of inflammatory cells in the brain by polyamidoamine dendrimers upon subarachnoid administration. *Nanomedicine (Lond)*. 2010;5(9):1317-29.
 51. Bosnjakovic A, Mishra MK, Ren W, Kurtoglu YE, Shi T, Fan D, **Kannan RM***. Poly(amidoamine) dendrimer-erythromycin conjugates for drug delivery to macrophages involved in periprosthetic inflammation. *Nanomedicine*. 2011;7(3):284-94.
 52. Menjoge AR, Rinderknecht A, Navath RS, Faridnia M, Romero R, Miller R, **Kannan RM***. Transfer of PAMAM dendrimers across the human placenta: prospects for use as drug carrier during pregnancy. *J Control Release*. 2011;150(3):326-38.
 53. Baker KC, Manitiu M, Bellair R, Gratopp C, Herkowitz H, **Kannan RM***. Supercritical carbon dioxide processed resorbable polymer nanocomposite bone graft substitute.. *Acta Biomater*. 2011;7(9):3382-9.
 54. Menjoge AR, Navath RS, Dai H, Abbas A, Romero R, Kannan S, **Kannan RM***. Injectable PAMAM dendrimer-PEG hydrogels for the treatment of ascending genital infections: Formulation, in-vitro and in-vivo evaluation. *Mol Pharm*. 2011;8(4):1209-23.
 55. Mishra MK, Kotta K, Hali M, Wykes S, Gerard HC, Hudson AP, Whittum-Hudson JA, **Kannan RM***. PAMAM dendrimer-azithromycin conjugate nanodevices for the treatment of Chlamydia trachomatis infections. *Nanomedicine*. 2011;7(6):935-44.
 56. Iezzi R, Guru BR, Glybina IV, Mishra MK, Kennedy A, **Kannan RM***. Dendrimer-based targeted intravitreal therapy for sustained attenuation of neuroinflammation in retinal degeneration. *Biomaterials*. 2012;33(3):979-88. *Highlighted in Retina Today(August 13)*.
 57. Mishra MK, Gérard HC, Whittum-Hudson JA, Hudson AP, **Kannan RM***. Dendrimer-Enabled Modulation of Gene Expression in Chlamydia trachomatis. *Mol Pharm*. 2012;9(3):413-21.
 58. Bosnjakovic A, Mishra MK, Han HJ, Romero R, **Kannan RM***. A dendrimer-based immunosensor for improved capture and detection of tumor necrosis factor- α cytokine. *Anal Chim Acta*. 2012;720:118-25.
 59. Kannan S*, Dai H, Navath RS, Balakrishnan B, Jyoti A, Janisse J, Romero R*, **Kannan RM***. Dendrimer-based postnatal therapy for neuroinflammation and cerebral palsy in a rabbit model. *Sci Transl Med*.

- 2012;4(130):130ra46. *Highlighted in Nature, Science, Nature Review Drug Discovery, Chemical and Engineering News, and other media.*
60. Sk UH, Kambhampati SP, Mishra MK, Lesniak WG, Zhang F, **Kannan RM***. Enhancing the efficacy of Ara-C through conjugation with PAMAM dendrimer and linear PEG: a comparative study. *Biomacromolecules*. 2013;14(3):801-10.
 61. Kim A, Boylan NJ, Hwangbo M, Suk JS, Yu T, Cebotaru L, Lesniak WG, Oh JS, Adstamongkonkul P, Choi AY, **Kannan RM**, Hanes JS*. Use of Single-Site Functionalized PEG-Dendrons to Prepare Gene Vectors that Penetrate Human Mucus Barriers. *Angew Chem Int Ed Engl*. 2013;52(14):3985-8.
 62. Gérard HC, Mishra MK, Mao G, Wang S, Hali M, Whittum-Hudson JA, **Kannan RM***, Hudson AP*. Dendrimer-enabled DNA delivery and transformation of *Chlamydia pneumoniae*. *Nanomedicine*. 2013;9(7):996-1008.
 63. Lesniak WG, Jyoti A, Mishra MK, Louissaint N, Romero R, Chugani DC, Kannan S, **Kannan RM***. Concurrent Quantification of Tryptophan and Its Major Metabolites. *Anal Biochem*. 2013;443:222-231.
 64. **Kannan RM**, Gérard HC, Mishra MK, Mao G, Wang S, Hali M, Whittum-Hudson JA, Hudson AP*. Dendrimer-enabled transformation of *Chlamydia trachomatis*. *Microb Pathog*. 2013;65:29-35.
 65. Lesniak WG, Mishra MK, Jyoti A, Balakrishnan B, Zhang F, Nance E, Romero R, Kannan S, **Kannan RM***. Biodistribution of fluorescently-labeled PAMAM dendrimers in neonatal rabbits: effect of neuroinflammation. *Mol Pharm*. 2013;10:4560-4571.
 66. Balakrishnan B, Nance E, Johnston MV, **Kannan RM**, Kannan S*. Nanomedicine in cerebral palsy. *Int J Nanomedicine*. 2013;8:4183-95.
 67. Mishra MK, Beatty CA, Lesniak WG, Kambhampati SP, Zhang F, Wilson MA, Blue ME, Troncoso JC, Kannan S, Johnston MV, Baumgartner WA*, **Kannan RM***. Dendrimer brain uptake and targeted therapy for brain injury in a large animal model of hypothermic circulatory arrest. *ACS Nano* 2014;8(3):2134-2147.
 68. Benchaala I, Mishra MK, Wykes SM, Hali M, **Kannan RM***, Whittum-Hudson JA*. Folate-functionalized dendrimers for targeting to *Chlamydia*-infected tissues in a mouse model of reactive arthritis. *Int J Pharm*. 2014;466(1-2):258-65.
 69. Burd I, Zhang F, Dada T, Mishra MK, Borbiev T, Lesniak WG, Baghlaf H, Kannan S, **Kannan RM***. Fetal uptake of intra-amniotically delivered dendrimers in a mouse model of intrauterine inflammation and preterm birth. *Nanomedicine*. 2014. doi: 10.1016/j.nano.2014.03.008.
 70. Yang F, Manitiu M, Kriegel R, **Kannan RM***. Structure, Permeability, and Rheology of Supercritical CO₂ Dispersed Polystyrene-Clay Nanocomposites. *Polymer* 2014. DOI: 10.1016/j.polymer.2014.05.020.
 71. Mastorakos P, Kambhampati SP, Mishra MK, Wu TT, Song E, Hanes JS, **Kannan RM***, Hydroxyl PAMAM dendrimer-based gene vectors for transgene delivery to human retinal pigment epithelial cells. *Nanoscale*. 2014. DOI: 10.1039/C4NR04284K.
 72. Kambhampatia SP, Mishra MK, Mastorakosa P, Oha Y, Luttya GA, **Kannan RM***, Intracellular delivery of dendrimer triamcinolone acetate conjugates into microglial and human retinal pigment epithelial cells. *Eur J Pharm Biopharm*. 2015 Feb 19. pii: S0939-6411(15)00095-8. doi: 10.1016/j.ejpb.2015.02.013.
 73. Zhang F, Mastorakos P, Mishra M, Mangraviti A, Hwang L, Zhou J, Hanes J, Brem H, Olivi A, Tyler B, **Kannan RM***, Uniform brain tumor distribution and tumor associated macrophage targeting of systemically administered dendrimers. *Biomaterials*. 2015 Jun;52:507-16. doi: 10.1016/j.biomaterials.2015.02.053.

Invited Reviews (peer reviewed)

1. Menjoge AR, **Kannan RM***, Tomalia DA*. Dendrimer-based drug and imaging conjugates: design considerations for nanomedical applications. *Invited Founders Review, Drug Discov. Today*. 2010;15(5-6):171-85.
2. Kambhampati SP, **Kannan RM***. Dendrimer nanoparticles for ocular drug delivery. *J Ocul Pharmacol Ther*. 2013;29(2):151-65.
3. Xu Q, Kambhampati SP, **Kannan RM***. Nanotechnology approaches for ocular drug delivery. *Middle East Afr J Ophthalmol*. 2013;20(1):26-37.
4. **Kannan RM**, Nance E, Kannan S, Tomalia DA*. Emerging concepts in dendrimer-based nanomedicine: from design principles to clinical applications, *Invited Founders Review, J. Internal Medicine*. 2014: DOI: 10.1111/joim.12280.

Inventions/ Patents

- 1994 Method for aligning side-group liquid-crystalline polymers,” Kornfield JA, **Kannan RM**, Schwenk N, US patent, 5,313,320
- 2007 Supercritical Fluid based process for preparing highly exfoliated nanocomposites, Gulari E, Serhatkulu GK, **Kannan RM**, US patent, 7,387,749 (spinoff company - nanoSEC)
- 10/5/07 Dendrimer-containing particles for sustained release of compounds, **Kannan RM**, Iezzi R, Kannan S, US provisional patent filed 10/5/07 (Application #60/997987)/International patent filed Oct 2008 (application #, PCT/US2008/078988). Regular patents filed in US (#12/681,516), Canada (#2,701,291), European Union (#08835693.6), Japan (#2010-528216) and India (1247/ELNP/2010) (Apr. 2010). *Japanese Patent Awarded. Describes inventions on ocular and neuroinflammation applications of dendrimer-based delivery systems.*
- 5/09 Dendrimer-based therapeutic nanodevices for therapeutic and imaging applications, **Kannan R**, Kannan S, Romero R, Navath R, Dai H, Kurtoglu Y, Wang B, Menjoge A, Provisional patent filed # 61/187263, 5/09, and additional provisional patent filed, #61/319285, 3/10, US patent (#12/797,657) and international PCT (PCT/US10/38068), filed 6/10. US Patent Awarded, 2014. *Describes inventions on dendrimer-based formulations for cerebral palsy and other neurodegenerative diseases, and for maternal-fetal infections and inflammation.*
- 1/10 Supercritical Carbon-Dioxide Processed Biodegradable Polymer Nanocomposites, **Kannan RM**, Baker K, Manitiu M, Bellair R, provisional patent filed, 1/10, *Regular US patent filed (1/11, application # 1301052). Describes biodegradable, supercritical CO₂-processed polylactic acid-clay nanocomposite foams for bone graft and tissue engineering constructs. Awarded, 5/14, US 8,729,171B2*
- 1/10 Supercritical Carbon-Dioxide Processed Biodegradable Polymer Nanocomposites, **Kannan RM**, Baker K, Manitiu M, Bellair R, provisional patent filed, 1/10, *Regular US patent filed (1/11, application # 13010513). Describes biodegradable, supercritical CO₂-processed nanocomposite materials for packaging film application.*
- 3/10 Injectable dendrimer hydrogel nanoparticles, **Kannan RM**, Kannan S, Romero R, Navath R, Menjoge A, provisional patent filed, 3/10, #61/319289; International PCT filed (4/11)
- 3/10 Injectable dendrimer hydrogel nanoparticles, **R.M. Kannan**, S.Kannan, R.Romero, R. Navath, A.Menjoge, provisional patent filed, 3/10, #61/319289, PCT application under preparation. *Describes injectible, biodegradable, hybrid nanoparticles containing dendrimer nanodevices for targeted therapy.*

Preliminary Patents Filed at Johns Hopkins

- 4/14 filed Dendrimer compositions and their uses in the treatment of diseases of the eye, **Kannan RM**, Luty G, Kambhampati S, Mishra M, Bhutto I, US Provisional Patent, # 61986495.
- 8/14 filed Dendrimer compositions and their uses in the treatment of Rhatt syndrome and related disorders, Kannan S, Blue M, **Kannan RM**, Nance E, Johnston M, US Provisional Patent, # 62036839.
- 10/14 filed Approaches for systemic targeting of tumor macrophages in brain tumors, **Kannan RM**, Tyler B, Zhang F, Mastorakos P, Mishra M, Mangraviti A. US Provisional Patent, # 62059240.

Extramural Funding (current, pending, previous)

ACTIVE GRANTS

- 5/1/15 – 4/30/19 *Systemic nanotherapies for ocular inflammation and choroidal neovascularization*
NIH/NEI
1R01EY025304-01
Role: PI; The primary objective of this application is to develop dendrimer-drug nanotherapies for early and late AMD in a rat model, using systemic administration of dendrimer-drug conjugates. Response to dendrimer-drug therapy will be assessed in the choroid and retina, based on inflammation, neovascularization, and functional measures.
- 4/1/14-3/30/18 *Nanotherapies for the treatment of neurodevelopmental disorders*

NIH/NIBIB

1R01EB018306-01

Role: PI, 20% effort; The objectives of this application are to: (1) understand the mechanisms by which dendrimer-drug conjugates target activated microglia upon systemic administration; (2) evaluate the toxicity of the 'optimized dendrimer vehicle' will be evaluated in the rabbit model; and (3) evaluate the sustained efficacy of systemically administered 'hybrid-release' D-NAC-NAC with the 'optimized' dendrimer will be evaluated.

5/1/14-3/30/19

Postnatal combination therapy in cerebral palsy

NIH/NICHHD

1R01HD076901-01A1

Role: PI; The objective of this application is to develop pediatric formulations for combination therapy in cerebral palsy. Two therapeutics minocycline and n-acetyl cysteine, will be formulated alone and with dendrimers, and evaluated for their combined ability to attenuate brain injury in a rabbit model. Specific aims focus on dose-related toxicity in healthy animals, pharmacokinetics of the formulations, and efficacy of the combination therapy.

9/1/14-6/30/18

Excitotoxicity in circulatory arrest-brain injury

NIH/NHLBI

2R01HL091541-20

PI: Baumgartner W

Role: co-I; The objective of this application is to develop dendrimer-based systemic combination therapy for the treatment brain injury associated with excitotoxicity and neuroinflammation in a canine model of hypothermic circulatory arrest. Free valproic acid and n-acetyl cysteine and dendrimer-conjugated valproic acid and n-acetyl cysteine will be explored. Therapy at 1 hr and 2hr after HCA will be assessed, based on neurobehavioral, histological, and hemodynamic support, and inflammatory response.

5/1/12-4/30/17

Mechanisms and therapy in maternal intrauterine inflammation induced brain injury

NIH/NICHHD

1 R01 HD069562-01A1

PI: Kannan S

Role: co-I; The primary objective of this application is to define the role of intrauterine inflammation induced alterations in tryptophan metabolism and serotonin depletion, due to activation of the kynurenine pathway in the placenta and fetal/newborn brain resulting in brain injury in the fetus and neonate. Maternal therapy with Ro-61-8048, an inhibitor of kynurenine mono-oxygenase, will be evaluated to determine the effects of inhibiting the kynurenine pathway in the placenta on fetal and newborn brain injury. Inhibition of the kynurenine pathway in the neonatal brain will be evaluated by postnatal treatment with Ro-61-8048, and nanoparticle conjugated Ro-61-8048. Rangaramanujam's group will measure tryptophan metabolites with and without therapy, and prepare nanoparticle-Ro-61-8048 conjugate.

1/12/13 - 11/30/14

Intra-amniotic biodistribution of dendrimers: applications in maternal-fetal medicine

Wayne State Univ.-NICHHD Perinatology Research Branch Subcontract

Role: PI; Evaluation of the bio-distribution of intra-amniotically administered Cy5-labeled dendrimers in the fetal brain and other fetal organs, to evaluate whether dendrimers go to the fetal brain and localize in microglia, so that fetal therapies may be developed in the long term.

7/1/13 – 6/30/15

Preparation and characterization of dendrimer-hyaluronic acid nanogel for sutureless corneal surgeries

King Khalid Eye Specialist Hospital (Saudi Arabia)

KKESHJHU 02-09

Role: PI; Development and characterization of dendrimer-hyaluronic acid nanogels for replacing sutures, following corneal surgeries.

7/1/13 – 6/30/15

In vivo evaluation of dendrimer-hyaluronic acid nanoglue for sutureless corneal surgeries
King Khalid Eye Specialist Hospital (Saudi Arabia)

KKESHJHU 02-25

Role: PI; Assessment of the in vivo effectiveness of the dendrimer nanoglue in appropriate animal models in (a) sealing a corneal laceration; (b) replacing sutures; (c) preventing corneal transplant failures.

12/1/13 – 11/30/14

Dendrimer-based therapies targeted to tumor-associated macrophages in Glioma

Astra Zeneca Corporation

AstraZeneca116601

Role: PI; The goal of this project is to develop dendrimer-PD98059 drug conjugates to target tumor associated macrophages, and evaluate the efficacy of these compounds in reducing brain tumor growth, in a 9L rat glioma model.

7/1/14-6/30/17

KKI-JHU Medicine inter-disciplinary center for research excellence: nanomedicine-based therapy in perinatal white matter injury

Cerebral Palsy International Research Foundation (CPIRF) – subcontract from Kennedy Krieger Institute

PI: Johnston MV

Role: co-investigator; The purpose of this project is to develop and translate a novel dendrimer nanodevice-based therapy that can attenuate neuroinflammation in PWMI, and associated Cerebral Palsy (CP) when administered in the postnatal period in a mouse model of hypoxic-ischemic injury. The associated clinical studies will involve PET and MRI imaging of patients with CP.

9/1/14 – 8/31/19

Multi-modal treatment for neonatal HIE: hypothermia and dendrimer nanotherapy

NIH – 1U54HD079123-01A1

Intellectual and developmental disorders center – subcontract from the Kennedy-Krieger Institute

Co-PIs: Wilson M, and S. Kannan

Role: co-I; The objective of this research project, as part of the IDDRC center, is to develop dendrimer-N-acetyl cysteine nanodevices as monotherapy, and in combination with hypothermia in a neonatal HIE model.

PENDING GRANTS

4/1/15 – 3/31/2020

Targeting glutamate carboxypeptidase in perinatal brain injury

NIH/NINDS

1R01NS093416-01

PI: Kannan S, PD/PI; Slusher B co-PI

Role: co-PI; we will evaluate the role of glutamate carboxypeptidase II (GCPII), a membrane bound enzyme expressed on activated astrocytes, in a rabbit model of perinatal brain injury using the potent, selective GCPII inhibitor 2-(3-mercaptopropyl) pentanedioic acid (2-MPPA). We use a nanotechnology based approach that delivers 2-MPPA selectively to the extracellular GCPII on activated astrocytes, to improve efficacy and reduce side effects.

PREVIOUS GRANTS (over the last 4 years)

- 9/07— 10/12 *Dendrimer-based functionally-optimized nanodevices for diagnosis and treatment of chorioamnionitis*
 NICHD-Perinatology Research Branch (sub contract)
 Role: PI; S. Kannan (co-PI); Program goals: (1) Preparation, in vitro and in vivo characterization of PAMAM dendrimer-based therapeutic, imaging and targeting nanodevices. (2) Animal evaluation of efficacy in pregnant rabbit models (cerebral palsy in the newborn, maternal inflammation, and fetal inflammation) and guinea pig models (sustained release topical antibiotics delivery systems for preventing preterm birth).
- 1/08—3/11 *In vivo evaluation of dendrimer nanodevices for neuroinflammation*
 Ralph C. Wilson Foundation for Biomedical Engg.
 Role: PI; Development dendrimer-minocycline nanodevices for in vivo testing in rat model of retinal degeneration and rabbit model of cerebral palsy
- 7/10-12/13 *Supercritical CO₂-processed PET-clay nanocomposite barrier materials*
 Coca-Cola R & D
 Role: PI; Development of dispersed poly(ethylene terephthalate)-clay nanocomposites with improved barrier properties for bottle applications

Research Program Building/Leadership

- 3/04-5/11 Co-founder, Research Director & Chief Technology Officer, nanoScience Engineering Co., Detroit, MI. I played a key role in setting the technological direction, and helped with federal and private funding for this company.
- 8/07-7/11 Co-director, Nanotechnology Lab, NICHD Perinatology Research Branch, Detroit, MI; I created, set goals, hired 8-10 people for the lab, which was the first of its kind in the field of perinatology research. The center played a key role in the renewal of the large NICHD center located at Wayne State University.
- 8/10 – 8/11 Co-director, Center for Adaptive Nanostructures at Wayne State. I developed the nanomedicine effort from the ground, with collaborators from the colleges of science, engineering, school of medicine, Kresge Eye Institute, Children's Hospital of Michigan, NICHD Perinatology Research Branch, Karmanos Cancer Institute, OB & Gyn, Immunology & Microbiology, Anatomy, and Orthopedic surgery, constituting more than 25 basic science, engineering, clinical and medical researchers.
- 1/12 -present Co-director, Center for Nanomedicine, Wilmer Eye Institute, Johns Hopkins School of Medicine, Baltimore, MD. I played a key role in expanding the footprint of the center through Wilmer/The Brain Science Institute/Kennedy-Krieger Institute, and other collaborators. I led the assistant professor search committee (led to the hiring of Dr. Laura Ensign), helped creating the website, and help manage several other aspects of the center.
- 9/14 - present Co-director, KKI-JHU Interdisciplinary CP center of research excellence

EDUCATIONAL ACTIVITIES

Educational Publications

Book Chapters

1. **Kannan RM**, Pillai O, Kannan S. Cellular interactions of nano drug delivery systems. In: Force microscopy in biology and medicine. Jena BP (ed), John Wiley Co, 6/07
2. **Kannan RM**, Pillai, O, Kannan S. Dendrimers and hyperbranched polymers for drug delivery. In: Biomedical applications of nanotechnology, Labhasetwar V, Leslie-Pelecky DL (eds). John Wiley Co, 8/07.
3. Kurtoglu YE, **Kannan RM**. Cellular trafficking of dendrimers. In: Organelle-specific pharmaceutical nanotechnology. Weissig V, D'Souza GGGM (eds). Wiley Co, 2010

Teaching

1997-2011 Courses Taught at Wayne State University

<u>Course Name</u>	<u>Number</u>
Polymer Science	CHE/MSE 535
Polymer Solutions	CHE/MSE 735
Advanced Kinetics	CHE 7400
Measurements Laboratory	CHE3220
Fluid Flow & Heat Transfer	CHE 3200
Adv Transport Phenomena	CHE 7200
Polymer Rheology	CHE 7330
Drug Delivery	CHE 7995
Intro to NanoBioScience	PSL 7210 (team taught)

Mentoring (pre- and post-doctoral)

Pre-doctoral Students

Graduate Student Advised: 14 PhDs (13 at Wayne State and 1 at JHU; and 3 MS at WSU)

10/01	Semen Kharchenko (Ph.D. in Chemical Engineering) (Masco R & D)
9/01	Vivek Maheshwari [M. S. Chemical Engineering (Thesis)](Assistant Professor, U Waterloo)
8/01	Gautam Parthasarthy [M. S. Materials Science and Engg. (Thesis)]
7/01	Ekta Misra [M. S. Materials Science and Engg. (Thesis)](Intel R & D)
4/04	Parag Kolhe (Ph.D. Materials Science and Engg.) (Pfizer R & D)
4/04	Michael Sevegney (Ph.D. Chemical Engineering)(Pall Corp. R & D)
5/05	Sezen Gurdag (Ph.D. Chemical Engineering)(R & D, Turkey)
5/06	Ajay Kulkarni (Ph.D.) (Packaging R & D)
12/06	Rajyalakshmi Inapagolla (Ph.D.)
6/06	Steve Horsch { Ph.D. (with E. Gulari)}(Dow Chemical R & D)
12/08	Bharath Raja Guru (Ph.D.)(Associate Professor & Chair, Department of Biotechnology, Manipal University, India)
8/09	Yunus Emre Kurtoglu (Ph.D.)(BASF R & D)
11/09	Robert Bellair (Ph.D.)(Dow Chemical R & D)
5/10	Mihai Manitiu (Ph.D.)(BASF R & D)
5/12	Admira Bosnjakovic (Ph.D.)(U Detroit)
7/12	Kevin Baker (Ph.D.)(Associate Professor, Oakland U/Beaumont Hospital)
5/12	Fengyuan Yang ((Ph.D.)(Merck R & D)

A. Postdoctoral Researchers Advised (11 at WSU, 4 at JHU):

1999-2000	Gerald Hoffman (3M R & D)
05-06	Jayant Khandare (Associate Professor, Maharashtra Institute of Pharmacy, Pune, India)
07-08	Hrushikesh Agashe (currently at Aveva Drug Delivery Systems, USA)
08-10	Raghavendra Navath (currently at Endo Pharmaceuticals, USA)
08-10	Hye Jung Han (currently at Sloane-Kettering Cancer Center, NY)
09-10	Anupa Menjoge (currently at Amneal Pharmaceuticals, USA)
10/07-12/09	Bing Wang, MDPhD (Wayne State/Perinatology Research Branch, joint with S.Kannan)
10/07-5/12	Hui Dai, MDPhD (joint with S. Kannan)
1/10-1/13	Amar Jyoti (jointly with S.Kannan)
1/11 – 5/12	Ugir Hussain Sk (CSIR-Institute of Himalayan Bioresource Technology, India)
8/10-2/14	Wojciech Lesniak (Research Associate, Radiology, JHH SOM)

B. Graduate Students - Current

9/10 - current	Siva Kambhampati (Ph.D – biomedical engineering, Wayne State University)
9/10 - current	Fan Zhang (Ph.D. student-Materials Science, Johns Hopkins University)

C. Current Post-doctoral Associates:

10/07 - current	Manoj Mishra (Research Associate)
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9/14 – current Rajasekhar Reddy Rami Reddy (Postdoctoral Fellow)

11/14 - current Yi-an Lin (Postdoctoral Fellow)

SYSTEM INNOVATION AND QUALITY IMPROVEMENT ACTIVITIES

Not Applicable

ORGANIZATIONAL ACTIVITIES

Institutional Administrative Appointments

1998 Curriculum Planning: Design, Ethics, and Professionalism, Engineering, WSU

2000-2011 Director, Materials Science and Engineering, Wayne State University

2003-2011 Tenure and Promotion Committee-ChE department, Wayne State University [2003-04, 2006-11]

2004-2006 College of Engineering Representative on the Advisory Board for the Office of Teaching and Learning (OTL) at WSU.

2007-2011 Formed/led the nanomedicine research and educational effort

Editorial Board Activities

2009 – current Nanomedicine (Nanotechnology, Biology and Medicine)

Journal peer review activities: Reviewer

Biomaterials

Nanotoxicology

Proceedings of the National Academy of Sciences

Journal of the American Chemical Society

Nature Nanotechnology

Macromolecules

Molecular Pharmaceutics

Bioconjugate Chemistry

J Chemical Physics

Pharmaceutical Research

Eur J Phar Biopharmaceutics

Biomacromolecules

Nanomedicine (Nanotechnology, Biology, Medicine)

J Controlled Release,

Int J Pharmaceutics

Progress in Polymer Science

Advisory Committees, Review Groups/Study Sections

2001 NSF NIRT Biomaterials Panel

2001-2002 NSF CCLI Panel

2009 NSF DMR Review Panel

2010-2013 NCI Special Emphasis Panels

2012-2013 NIH SBIR Panels IMST W53 SBIR

2011-2013 NIH Pediatric formulations Special Emphasis Panel ETTN-B50

2012 -present Wilmer Research Day Committee

2014 DoD-CDMRP Vision Research Review Panel

2014 Wilmer Research Mentoring Program

2015 NIH Nanotechnology Study Section

2015 NIH NCI Cancer Nanotechnology Center (CCNE) Panel

Thesis Committee Service

Served on more than 25 doctoral and Master's thesis committees at Wayne State University

Served on 8 Johns Hopkins doctoral thesis committees from Chemical and Biomolecular Engineering, Biomedical Engineering.

RECOGNITION

Awards, Honors

1989-1990	Du Pont Foundation Graduate Fellowship at Caltech
1992-1994	Charles Powell Foundation Graduate Fellowship at Caltech
1995	American Chemical Society Honor symposium for Unilever award
1995	Unilever Award for outstanding Ph.D. thesis in polymer Science by ACS
1997-1999	Wayne State University Faculty Research Award
1998-2002	3M Non-tenured Faculty Award [1998-2000, 2001-2002]
1999	National Science Foundation CAREER Award
2008-2011	Director, Nanotechnology Lab, NICHD Perinatology Research Branch, 2008-2011
2014	Society of Critical Care Medicine Annual Scientific Award (for collaborative work with S. Kannan)
2015	Invited member, Beckman Institute for Macular Research, Los Angeles, CA

Invited Talks, Panels (2010 – current)

2/10	Clemson University-Bioengineering, Joint Page Morton Hunter Bioengineering Distinguished Seminar Series & NIH COBRE SCBiomat Lecture Series.
4/10	Stanford University – Chemical Engineering.
5/10	University of Akron (Polymer Science), Austen Bioinnovation Center.
5/10	Bristol Myers Squibb – NJ.
7/10	Northwestern University - Biotechnology/ChemE.
9/10	Nanobusiness Alliance conference, Chicago, IL.
8/11	Plenary Speaker, Nanotechnology conference, SASTRA University, India
3/12	University of Illinois, Chicago, Department of Pharmaceutical Science.
3/12	Plenary Speaker, Saudi Ophthalmology Society, Riyadh.
6/12	ARVO Eye Research Conference, U Colorado, Boulder.
10/12	Nanomedicine Conference, Riyadh Saudi Arabia.
11/12	Children's Hospital at Saint Justine/ U Montreal, Quebec, Canada.
11/12	University of Texas (Austin), Chemical Engineering.
6/13	National Cancer Institute Strategic Workshop, Bethesda, MD.
6/13	Plenary Speaker, University of Missouri Nanofrontiers conference
3/14	University of Utah, Nanomedicine.
5/14	ARVO National meeting, Orlando, FL, Symposium on Neuroinflammation.
6/14	International 'Biodendrimers' conference, Lugano, Switzerland.
7/14	Controlled Release Society Annual Meeting, Chicago, Symposium on drug delivery to the brain.
7/14	Ophthalmology-2014, Baltimore.
1/15	Beckman Institute for Macular Research, Los Angeles, CA.
1/15	Drug Delivery Partnerships 2015, Boca Raton, FL