BIOGRAPHICAL SKETCH

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NAME: **Moghe, Prabhas V.**

eRA COMMONS USER NAME: pmoghe

POSITION TITLE: Distinguished Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of Bombay (UDCT), India	B.S.	1988	Chemical Engineering
University of Minnesota, Minneapolis	Ph.D.	1993	Chemical Engineering (Bioengineering)
Harvard Medical School (MGH), Boston, MA	PostDoc	1995	Bioengineering

A. Personal Statement

As a research-active investigator, I have conducted research in biomedical engineering, spanning the areas of cell therapeutics, stem cell engineering, nanomedicine, and biomedical imaging. The Moghe laboratory has produced over 27 PhD degrees, and generated over 125 peer-reviewed journal publications (with ~7000 citations), 250 conference presentations and 100 invited podium/plenary talks. Five of our most cited publications include: Surveillance Technologies for Cancers -- *Nature Biomedical Engine*ering (2017), Reprogrammed Neurons for Brain Transplantation-- *Nature Communications* (2016), Macromolecules for Heart Disease-- *Proceedings of the National Academy of Sciences* (2015), Infrared Reporters for Biomedical Imaging-- *Nature Communications* (2013), and High Content Forecasting of Stem Cell Mechanobiology--*Proceedings of the National Academy of Sciences* (2010).

Since 2018, I was appointed as the Vice Chancellor for Research and Innovation at Rutgers New Brunswick, and most recently as EVP for Academic Affairs, while keeping my research as a priority. By 2020, I was relieved of classroom teaching obligations and given “restricted administrative duties”, which enables me to continue to advise my research group and free up administrative time and *lead strategic research projects with up to 25% effort level.* I am passionate about innovating new research that can have impacts on complex neurodegenerative diseases, and given our very active collaborative synergies, this R21 submission exemplifies a very important focal project in my scientific career trajectory.

NIH NIBIB R01 EB018378 9/1/2018 – 5/31/2024
Title: **Rare earth nanoprobes for optical imaging and disease tracking**
Role: PI
Goals: This R01 project focuses on the design of short wave infrared emitting nanoscale contrast agents that can be used to detect small diseased lesions *in vivo*.

NIH NIBIB 2T32EB005583 - 11A1 6/1/2018 – 5/31/2022
Title: **Translational Research in Regenerative Medicine**
Role: Co-investigator (with J. Kohn, Rutgers)
Goals: This is a postdoctoral training program on biomaterials science and regenerative medicine.

NIH NIA 1R21AG060024-01 8/15/2018 – 4/30/2021
Title: **Microglial-Targeted Nanotherapeutics for Inhibition of Alpha-Synuclein Aggregation and Inflammation in Neurodegenerative Diseases**
Role: PI
Goals: This project is focused on modulating alpha-synuclein dynamics within inflammatory microglia through the design of therapeutic nanoparticles. The proposed R01 focuses on new hypotheses and an expanded scope but will build further on the foundations of this R21 project.

NSF 1803675 9/1/2018 – 8/31/2021

Nanotechnology for Inhibition of Neurodegenerative Brain Plaques
Role: PI
Goals: To elucidate and develop a systems-level engineering approach to design macromolecules for modulation of immune cell dynamics leading to neurotoxicity. This project seeks to design AMs with composite affinity for scavenger receptor (SRA1) binding and intracellular sorting.

Citations

1. Kantamneni H, Zevon M, Donzanti MJ, Higgins LM, Zhao X, Sheng Y, Barkund SR, McCabe LH, Banach-Petrovsky W, Ganesan S, Riman RE, Roth CM, Tan MC, Pierce MC, Ganapathy V, and **Moghe PV.** Engineering Precision Surveillance Nanotechnology for Multi-Organ Cancer Metastases In-Vivo. *Nature Biomedical Engineering* 1, 993-1003 (2017).
2. Naczynski D, Tan MC, Zevon M, Wall B, Kulesa A, Chen S, Roth CM, Riman RE, and **Moghe PV.** Rare earth doped biologic composites as shortwave infrared reporters in vivo. *Nature Communications (*2013) July 19; 4: 2199. doi: 10.1038/ncomms3199 PMCID: PMC3736359
3. Lewis DR, Petersen LK, York AW, Zablocki KR, Joseph LB, Kholodovych V, Prud'homme RK, Uhrich KE, **Moghe PV.** Sugar-based amphiphilic nanoparticles arrest atherosclerosis in vivo. *Proc Natl Acad Sci U S A.* 2015 Mar 3;112(9):2693-8.
4. Carlson AL, Bennett NK, Francis N, Halikere A, Clarke S, Moore JC, Hart RP, Paradiso K, Wernig M, Kohn J, Pang Z, and **Moghe PV**. Generation and Brain–Transplantation of 3-D Microscale Networks of Reprogrammed Human Neurons. *Nature Communications* 2016 Mar 17;7:10862. doi: 10.1038/ncomms10862.

B. Positions and Honors

Positions and Employment

1995-00 Assistant Professor, Department of Chemical and Biochemical Engineering, Rutgers University, Piscataway, NJ.
1998- Graduate Faculty Member, Cell and Developmental Biology, Rutgers University, NJ.
2001-06 Associate Professor (with tenure), Department of Chemical and Biochemical Engineering, Department of Biomedical Engineering, Rutgers University, NJ.
2002-03 Undergraduate Program Director, Department of Biomedical Engineering, Rutgers University.
2003-15 Director and Principal Investigator, NSF-Rutgers Integrative Graduate Education and Research Traineeship (IGERT) on Integratively Engineered Biointerfaces
2007-13 Professor, Department of Biomedical Engineering; Department of Chemical and Biochemical Engineering, Rutgers University, NJ.
2007-11 Director, Rutgers-UMDNJ Graduate Program in Biomedical Engineering
2012-14 Vice-Chair, Department of Biomedical Engineering, Rutgers University-New Brunswick, NJ.
2013- Distinguished Professorship, Rutgers University, NJ.
2014-18 *Research Director*, Rutgers Engineering-Biomedical and Health Sciences Alliances & Partnerships
2018-19 Vice Chancellor for Research and Innovation, Rutgers University-New Brunswick.
2019-20 Provost and Executive Vice Chancellor for Research & Academic Affairs, Rutgers-New Brunswick.
2020- Executive Vice President, Academic Affairs, Rutgers University.

Professional Memberships & Service

Editorial Board, *Journal of Functional Biomaterials* (2010)
Editorial Board, *Acta Biomaterialia* (2004)

Reviewer, NIH T-RO1, Challenge, BRG Special Emphasis Panels, SBIR Grants (2004-2010)
Member, National Science Foundation Advisory Panel to President, Rutgers University (2003-6)
Member, Engineering Research Center (ERC) Review Committee, National Science Foundation
Member, Nanoscale Science and Engineering Center (NSEC) Site Visit Review, NSF
Member, National Science Foundation CAREER Review Panel
Member, National Science Foundation MRSEC Review Panel

Member, Dean Search Committee for School of Engineering, Rutgers, 2008-9
Member, Dean Search Committee for Ernest Mario School of Pharmacy, Rutgers, 2006-7
Member, Executive Committee for Graduate School of Biomedical Sciences, UMDNJ
Member, Admissions Committee for Rutgers/UMDNJ/Princeton MD/PhD Program

Honors

National Science Foundation CAREER Award (1998)
Johnson & Johnson Discovery Award (1998)
Rutgers FASIP Award for Teaching, Research, and Service *(Ranked First in Department) (2001)*
American Heart Association Grant-in-Aid Award (1999, 2004, 2007)
Teaching Excellence Award - Dept. of Chemical & Biochemical Eng, Rutgers (2002)
National Science Foundation IGERT Award on Biointerfaces (2003)
Elected Fellow – *American Institute of Medical and Biological Engineering* (AIMBE) (2004)
Leader in Diversity Award, Rutgers University (2006)
Excellence in Teaching Award, Engineering Governing Council (2008)
National Science Foundation IGERT Award on Stem Cell Science & Engineering (2008)
Teacher of the Year Award, Engineering Governing Council, 2011
First Faculty of the Year Award, School of Engineering, Rutgers University (2012).
Inducted As: *International Fellow of Biomaterials Science and Engineering* (2012).
Fellow of Biomedical Engineering Society (BMES) (2015).

C. Contribution to Science

As a bioengineering faculty, I received graduate and postdoctoral training at Minnesota and Harvard, respectively, to elucidate cell-biomaterial interactions across a broad range of cellular and tissue systems. At Rutgers, I have focused on the design of nanomaterials for diagnostic and therapeutic applications to medicine. Since 2010, the Moghe laboratory pioneered the concept of sugar-derived amphiphilic macromolecules that have high scavenger receptor binding affinity. We published over twenty papers on the structure-activity relations, in vitro efficacy, and in vivo efficacy of NLBs. New designs of nanoparticles based on these macromolecules are also the basis for the microglial therapeutics envisioned in the proposed NIH R21 application.

1. Plourde NM, Kortagere S, Welsh W and **Moghe PV.** Structure-Activity Relations of Nanolipoblockers with Atherogenic Domain of Human Receptor Scavenger Receptor A. *Biomacromolecules* 10: 1381-91 (2009).
2. York AW, Zablocki KR, Lewis DR, Gu L, Uhrich KE, Prud'homme RK and **Moghe PV.** Kinetically Assembled Nanoparticles of Bioactive Macromolecules Exhibit Enhanced Stability and Cell-Targeted Biological Efficacy. *Advanced Materials*. 24:733-9. (2012).
3. Petersen LP, York AY, Lewis DR, Ahuja S, Uhrich KE, Prud'homme R, and **Moghe PV.** Modular Nanolipoblockers for Tunable Scavenger Receptor Inhibition: Therapeutic Biomaterials for the Management of Atherosclerosis. *Mol Pharm.* 2014 Aug 4;11(8):2815-24. doi: 10.1021/mp500188g. Epub 2014 Jul 9.
4. Lewis DR, Petersen LK, York AW, Zablocki KR, Joseph LB, Kholodovych V, Prud'homme RK, Uhrich KE, and **Moghe PV.** Sugar-based amphiphilic nanoparticles arrest atherosclerosis in vivo. *Proc Natl Acad Sci U S A.* 2015 Mar 3;112(9):2693-8.

Since 2008, the Moghe laboratory has developed expertise in "high content" biomedical imaging technologies focused on profiling cell-biomaterial interactions. One of the strategic applications of this toolbox is the metrology of cell lineage, specifically, the detection of early lineage differentiation in stem cells. A number of organizational proteins were implicated as new surrogate markers for high content imaging, and these approaches were applied to forecast stem cell differentiation, as reported in our *PNAS* paper in 2010, and our most recent paper in *Scientific Reports* in 2017.

5. Treiser MD, Yang E, Gordonov S, Cohen DM, Kohn J, Androulakis IP, Chen CS and **Moghe PV.** Cytoskeleton-Based Forecasting of Stem Cell Lineage Fates. *Proc. Natl. Acad. Sci. USA 107:* 610–615 (2010) PMCID: PMC2818905.
6. Kilian KA, **Moghe PV**. High throughput strategies for the design, discovery, and analysis of biomaterials. *Acta Biomater.* 2016 Apr 1;34:v-vi. doi: 10.1016/j.actbio.2016.03.019.
7. Vega SL, Liu E, Patel PJ, Kulesa AB, Carlson AL, Ma Y, Becker ML, **Moghe PV**. High-content imaging-based screening of microenvironment-induced changes to stem cells. *J Biomol Screen*. 2012 Oct;17(9):1151-62. Epub 2012 Jul 17.
8. Kim JJ, Devita MS, Kulesa A, Bennett NK, Chahar S, Viswanath S, Lee EA, Jung G, Shao PP, Childers EP, Liu S, Garcia BA, Becker ML, Hwang NS, Madabhushi A, Verzi MP, and **Moghe PV.** High Content Optical Nanoscopy of Stem Cell Phenotypes: Textural Fingerprinting of Epigenetic Marks. *Scientific Reports* 7, 39406 (2017) doi:10.1038/srep39406 (2017).

In the area of *regenerative tissue technologies for neuroscience applications*, we reported on the use of three-dimensional biomaterials for reprogramming and transplantation of induced pluripotent stem cells for regenerative medicine in the central nervous system space.

9. Carlson AL, Florek CA, Kim JJ, Neubauer T, Moore JC, Cohen RI, Kohn J, Grumet M, **Moghe PV.** Microfibrous substrate geometry as a critical trigger for organization, self-renewal, and differentiation of human embryonic stem cells within synthetic 3-dimensional microenvironments. *FASEB J.* 26: 3240-51 (2012) PMCID: PMC3405262.
10. Landers J, Turner JT, Heden G, Carlson AL, Bennett NK, **Moghe PV**, Neimark AV. Carbon nanotube composites as multifunctional substrates for in situ actuation of differentiation of human neural stem cells. *Adv Healthcare Mater*. 2014 Nov;3(11):1745-52. doi: 10.1002/adhm.201400042. Epub 2014 Apr 22. PMID: 24753391
11. Carlson AL, Bennett NK, Francis N, Halikere A, Clarke S, Moore JC, Hart RP, Paradiso K, Wernig M, Kohn J, Pang Z, and **Moghe PV**. Generation and Brain–Transplantation of 3-D Microscale Networks of Reprogrammed Human Neurons. *Nature Communications* 2016 Mar 17;7:10862. doi: 10.1038/ncomms10862. PMCID: PMC4800432
12. Francis N, Bennett NK, Halikere A, Pang ZP, and **Moghe PV.** Self-Assembling Peptide Nanofiber Scaffolds for 3-D Reprogramming and Transplantation of Human Pluripotent Stem Cell-Derived Neurons. *ACS Biomaterials Science and Engineering Eng* **2016**, *2* (6), pp 1030–1038

Since 2013, the Moghe lab has focused on the protein dynamics of the immune cells in the brain, the microglia. By redesigning the amphiphilic macromolecules, we have identified new compositions and stereochemistry of the AMs that could modulate alpha-synuclein trafficking via scavenger receptors in microglia. These phenomena could have strong implications for developing microglial therapeutics with neuroprotective activity. The paper by Bennett et al., in 2016 was the first publication on the design of such nanoparticles to inhibit ASYN aggregation. In this R21, we propose to advanced a new family of nanoparticles that leverage their multiple scavenger receptor-binding activity to attenuate the activation of microglia and astrocytes, thus ameliorating the neuroinflammatory microenvironment that contributes to neurodegeneration in Alzheimers' Disease.

13. Bennett NK, Chmielowski R, Abdelhamid DS, Faig JJ, Francis N, Baum J, Pang ZP, Uhrich KE, **Moghe PV**. Polymer brain-nanotherapeutics for multipronged inhibition of microglial α-synuclein aggregation, activation, and neurotoxicity. *Biomaterials*. 2016 Oct 4;111:179-189. doi: 10.1016/j.biomaterials.2016.10.001.
14. Kwan WL, Bennett NK, Skepper JN, Martynyuk N, Wijeyekoon R, **Moghe PV**, Williams-Gray CH, and Baker R. α-Synuclein pre-formed fibril impairs blood-brain barrier tight junction protein expression without affecting cerebral endothelial permeability. *Exp. Neurology* 2016 Nov;285(Pt A):72-81.
15. Chmielowski RA, Abdelhamid DS, Faig JJ, Petersen LK, Gardner CR, Uhrich KE, Joseph LB, **Moghe PV**. Athero-inflammatory nanotherapeutics: Ferulic acid-based poly(anhydride-ester) nanoparticles attenuate foam cell formation by regulating macrophage lipogenesis and

reactive oxygen species generation. *Acta Biomater.* 2017 May 15. pii: S1742-7061(17)30311-2. doi: 10.1016/j.actbio.2017.05.029.

16. Zhao N, Yang X, Calvelli HR, Cao Y, Francis NL, Chmielowski RA, Joseph LB, Pang ZP, Uhrich KE, Baum J, and **Moghe PV**. Antioxidant nanoparticles for concerted inhibition 1 of α-synuclein fibrilization, and attenuation of microglial intracellular aggregation and activation. *Frontiers in Bioengineering and Biotechnology*. 2020; 8: 112

Since 2010, we have advanced nanotechnologies involving short wave infrared nanoprobes based on phosphors that can detect tumors over a new spectral window of optical imaging (shortwave infrared).

17. Naczynski D, Tan MC, Zevon M, Wall B, Kulesa A, Chen S, Roth CM, Riman RE, and **Moghe PV.** Rare earth doped biologic composites as shortwave infrared reporters in vivo. *Nature Communications (*2013) July 19; 4: 2199. doi: 10.1038/ncomms3199 PMCID: PMC3736359
18. Naczynski D, Tan MC, Riman R, and **Moghe PV.** Rare Earth Nanoprobes for Functional Biomolecular Imaging and Theranostics. *J. Materials Chemistry B*. (2014). 2: 2958-73
19. Zevon M, Ganapathy V, Kantamneni H, Mingozzi M, Kim P, Adler D, Sheng Y, Tan MC, Pierce M, Riman RE, Roth CM, **Moghe PV.** CXCR-4 Targeted, Short Wave Infrared (SWIR) Emitting Nanoprobes for Enhanced Deep Tissue Imaging and Micrometastatic Cancer Lesion Detection. *Small* (2015). 11: 6347-57.
20. Kantamneni H, Zevon M, Donzanti MJ, Higgins LM, Zhao X, Sheng Y, Barkund SR, McCabe LH, Banach-Petrovsky W, Ganesan S, Riman RE, Roth CM, Tan MC, Pierce MC, Ganapathy V, and **Moghe PV.** Engineering Precision Surveillance Nanotechnology for Multi-Organ Cancer Metastases In-Vivo. *Nature Biomedical Engineering (2017)*. 1:993-1003.

Complete list of published work in NCBI MyBibliography:
http://www.ncbi.nlm.nih.gov/myncbi/browse/collection/41153747/?sort=date&direction=descending