BIOGRAPHICAL SKETCH

NAME:	**Maribel Vazquez**
eRA COMMONS USERNAME:	VAZQUEZ
POSITION TITLE:	Professor of Biomedical Engineering

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	Completion Date	FIELD OF STUDY
Cornell University (Ithaca, NY)	B.S.	06/1992	Mechanical Engineering
Massachusetts Institute of Technology (Cambridge, MA)	M.S.	06/1996	Mechanical Engineering
Massachusetts Institute of Technology (Cambridge, MA)	Sc.D.	08/2001	Mechanical Engineering

A. PERSONAL STATEMENT:

My research integrates design of Biomedical Engineering (BME) systems with mechanistic biology and clinical application. My laboratory has developed microfluidic systems to correlate extracellular environments with activated signaling pathways across a wide range of bio-applications, including repair of the central, visual, and peripheral nervous system (NS). My current projects focus on retinal neurons, glia, and the inner blood retinal barrier (iBRB) for applications in cell-based therapies to reduce vision loss. My biomedical contributions have demonstrated that collective response is finely regulated by cell sensitivity to chemical and electrical gradients. My technological contributions have developed static and Multi-physiological systems that support clinical observations in degenerative retinal disorders. In this proposal, my laboratory will collaborate to develop barrier model of iBRB cells that help examine the role of hyperglycemia on the cell-cell communication, barrier formation, and resistivity to biomolecular transport. Experiments will apply our system to examine the effects of semaglutide on barrier integrity and its compounded effects with estradiol. The research team will meet weekly to guide and interpret experimental data needed for project aims.

PUBLICATIONS MOST SIGNIFICANT TO THIS PROPOSAL:

a. Castro N.; Pena, J.S.; Cliver, R.; Berthiaume, F.; and **Vazquez, M**., 'Estradiol impacts Müller glia and endothelial cell responses in hyperglycemic microenvironments with advanced glycation end products,' Exp. Eye. Res. 2024 Nov 29:251:110185.
b. Pena, J.S.; Berthiaume, F.; and **Vazquez, M**., 'Muller glia co-regulate barrier permeability with endothelial cells in an in vitro model of hyperglycemia,' Int. J. Mol. Sci. 2024, 25(22), 12271.
c. Bello, N.T.; Firestein, B.L.; **Vazquez, M**., Retinal Focus on Relationships between Diet-Induced, Advanced Glycation End Products and Supplemental Estradiol,' BIOCELL (Accepted 02/2025)

ONGOING FUNDING AWARDS THAT HIGHLIGHT RESEARCH AREAS:

1. A glial-endothelial model to examine collective regulation of transport across the retina
Principal Investigator (PI)**: Maribel Vazquez, Sc.D.**
National Science Foundation (**CBET 2243644)**; Period: 06/2023-6/2026
Supports development of microfluidic modeling to examine the role of Muller glia in regulating bloodborne factors and advanced glycation end products across the inner blood-retinal barrier.

2. Impacts of Advanced Glycation End Products (AGEs) on Retinal Thrombosis and Transport
Principal Investigator (PI): **Maribel Vazquez, Sc.D.**
New Jersey Health Foundation (PC 140-24); Period: 03.2024-03.2026
Supports study of AGEs on clotting and resultant transport across blood retinal barriers

B. POSITIONS, SCIENTIFIC APPOINTMENTS, AND HONORS

Academic Appointments and Employment

2020-	Professor (Tenured), Dept. of Biomedical Engineering, Rutgers University (NJ)
2019- 2020	Associate Professor (Tenured), Dept. of Biomedical Engineering, Rutgers University (NJ)
2018- 2006	Associate Professor (Tenured), Dept. of Biomedical Engineering, City College of New York
2005- 2002	Assistant Professor and Dept. Co-Founder, Biomedical Engineering, CCNY
2002- 2001	Assistant Professor, Dept. of Mechanical Engineering, City College of New York (CCNY)
2001- 1999	Research Assistant, MIT Whitehead Institute for Biomedical Research (Cambridge, MA)
1999- 1997	Teaching Fellow, MIT Dept. of Mechanical Engineering (Cambridge, MA)
1996- 1994	Mechanical Engineer, Cleanroom Micro-contamination, Intel Corp. (Santa Clara, CA)
1994- 1992	Mechanical Engineer, Cleanroom Process, Intel Corporation (Beaverton, OR)

Selected Honors:

2024	Invited Plenary: Biomedical Engineering Society Council of Department Chairs (NJ)
2023	International Keynote: Gordon Research Seminar (Microscale Fluidic Phenomena)
2023	AIMBE Professional Impact Award in Education (Health Disparities)
2022	Elected Fellow of the Biomedical Engineering Society (BMES)
2020	Elected Fellow of the American Institute of Medical and Biological Engineers (AIMBE)
2018	President's Award for Excellence in Mentoring, Research and Teaching, CCNY
2017	Invited International Lecture: Gordon Conference (Physics and Chemistry of Microfluidics)
2015	Department Diversity Award, Biomedical Engineering Society (BMES)
2014	Coulter College Winner for Translation of BME Innovation (Faculty Design Advisor)
2013	Univision TV New York (Ch41) Technical Feature, '*STEM and the Elusive Role Model*'
2010	Best Conference Paper, Cellular and Molecular Bioengineering (National BMES)
2007	Mentoring Award, Alfred P. Sloan Foundation for Graduate Education
2005	Harold Shames Junior BME Faculty Chair, City College of New York (CCNY)
2004	Honoree, American Association for the Advancement of Science (AAAS): Latin American Lecture Series for Women in Science and Engineering (Brazil, Panama, Uruguay)
1996	GEM Cooperative Education Fellowship (Intel Corporation--MIT)

Service to the Profession:

2022-2024	AIMBE Board of Directors, Vice President-at-Large
2021-2025	Executive Committee, Rutgers Connection Network for Mentoring, Rutgers University
2020-2024	AIMBE Review Committees: Fellows Nominations, Board Operations, Society Awards
2016-2008	Undergraduate Curriculum and Accreditation Chair (ABET), City College of New York
2010-2028	BMES: Session Co-Chair, Track Co-Chair, Special Session Co-Chair, Awards Committee
2002-2005	Co-founding Faculty Member, Dept. of Biomedical Engineering, City College of New York

External Advisory Committees and Reviewer Service:

2016-2019	NIH U54 Partnership Advisory Council
2008-2013	Sloan Awards for Excellence in K-12 Teaching Science and Math, NYC Selections Panel
2002-2008	MIT Mechanical Engineering Review Committee, Alumna Member

NIH Study Section Ad-hoc Reviewer: Bioengineering of Neuroscience, Vision, and Low Vision Technologies [BNVT, 2023]; Interdisciplinary Molecular Sciences and Training [IMST, 2021-2019]; NEI Audacious Initiatives Panel [ZRG1, 2016]; NIBIB Special Emphasis Panel [ZRG1, 2013, 2011]; NIGMS Special Emphasis Panel [ZRG1, 2012-2010]; Instrumentation and Systems Development [ISD, 2009-2006]; NCI Special Emphasis Panel [ZRG1, 2008-2007].

NSF Proposal Reviewer: Chemical, Bioengineering, Environmental, and Transport Systems (CBET, 2021-2019; 2011-2009;); Planning Grants for Engineering Research Centers (ERC 2020-2019); Major Research Instrumentation (MRI, 2015-2013); Electrical, Communications Cyber Systems (EECS, 2008-2005); Nano-Biosensing (NER, 2006-2003).

C. CONTRIBUTIONS TO SCIENCE:

1. Collective Cell Behavior and Communication:
Modern advances in neuroscience have focused on the development, function, and plasticity of specialized neuronal cell groups. A relatively small subset of projects has also examined neuronal interactions with cognate glial partners, and even fewer have done so for retinal tissue. My laboratory has developed platforms to examine cell connectivity and communication in tissue engineering applications of regenerative medicine. Our microfluidic technologies can uniquely model ultra-low, in vivo chemical and flow fields to facilitate study of intra- and inter-cellular responses to adult tissue cues and external stimuli.

d. Thakur A., Mishra S., Pena J., Zhou J., Redenti S., Majeska R., **Vazquez, M**., 'Collective adhesion and displacement of retinal progenitor cells upon extracellular matrix substrates of transplantable biomaterials,' J. Tissue Eng. (2018) Vol. 9: 1–14.
e. Markey, M.W.; Pena, C.; Venkatesh, T.; Cai, L.; and **Vazquez, M.,** Retinal progenitor cells exhibit cadherin-dependent chemotaxis across transplantable extracellular matrix of in vitro developmental and adult models, J Tissue Eng Regen Med 2023, Vol. 2023 | ID 1381620
f. Pena, JS.; Tutwiler, V.; **Vazquez, M**., 'Neurovascular Relationships in AGEs-Based Models of Proliferative Diabetic Retinopathy, Bioengineering 2024 Jan 8;11(1):63.
g. Oprysk, L.; **Vazquez, M.**; Shinbrot, T., "Internal Cohesion Gradient as a Novel Mechanism of Collective Cell Migration,' PLoS Comput. Biol. (Accepted 01/2025)

2. Microfluidic Models of Retinal Environments:
The significance of cell migration to neural function has been well-established by seminal works in developmental biology and tissue repair, among others. My group has developed predictive microsystems to examine neural cell migration, mechanistically, for translational applications. Our group has become a pioneer in evaluating individual and collective cell migratory responses towards chemical, electrical, and haptotactic stimuli to aid development of neural therapies. Moreover, our unique contributions have designed microfluidic systems that correlate collective behaviors of neural progenitors across invertebrates and mammals for robust genetic study.

a. Mishra S.; Thakur A.; Redenti S.; **Vazquez M**., A model microfluidics-based system for the human and mouse retina,' Biomed Microdevices. 2015 Dec;17(6):107.
b. McCutcheon S.; Majeska R.; Schaffler M.B.; **Vazquez M**., 'A multiscale fluidic device for the study of dendrite-mediated cell to cell communication.' Biomed Microdevices 2017, Aug 8;19(3):71.
c. Peña JS.; Robles D.; Zhang S.; **Vazquez M**., 'A Milled Microdevice to Advance Glia-Mediated Therapies in the Adult Nervous System,' Micromachines (Basel). 2019 Jul 31;10 (8).
d. Pena C.; Zhang, S.; Majeska, R.; Venkatesh, T.; **Vazquez, M**., 'Invertebrate retinal progenitors as regenerative models in a microfluidic system,' Cells 2020 Oct 22;8(10).

3. Muller Glia as Partners in Signaling and Repair:
Contemporary biomedicine has underscored the benefits of restorative therapies that leverage endogenous repair processes and mechanisms. One of our unique contributions is to advance the study of early-stage gliotic processes in the visual system as a viable strategy to improve outcomes of regenerative therapies.

a. Pena, J.S.; **Vazquez, M.**, 'VEGF upregulates EGFR expression to stimulate chemotactic behaviors in Müller glia,' Brain Sci 2020, 10(6), 330.
b. Cliver R.; Castro, N.; Russomano, T.; Lardieri, G.; Quarrie, L.; Van der Merwe, H.; and **Vazquez M**., 'Antioxidants derived from natural products reduce radiative damage in cultured retinal glia to prevent oxidative stress, Neuroglia 2022, 3(3), 84- 98.
c. Pena, J.S.; **Vazquez, M**., 'Harnessing the Neuroprotective Behaviors of Müller Glia for Retinal Repair,' Frontiers in Bioscience-Landmark 2022, 27(6), 169-181.
d. Leverant, A.; Oprysk, L.; Dabrowski, A.; Kyker-Snowman, K..; and **Vazquez, M**., 'Three-Dimensionally Printed Microsystems to Facilitate Flow-Based Study of Cells from Neurovascular Barriers of the Retina', Micromachines 2024, 15(9), 1103.

4. Retinal Cell Transplantation:

Cell replacement therapies show great promise to restore vision by transplanting stem cells to regain neural function. My laboratory's most recent projects have developed hybrid microfluidic systems to query new strategies for transplantation by using ex vivo ocular tissue. We have produced whole eye explant systems for collaborative study with animal models as well as chip systems for pharmacological screening.

a. Unachukwu, U.; Warren, A.; Zhou, J.; Li, Z.; Mishra, S.; Sauane, M.; Lim, H.; **Vazquez, M**.; Redenti, S.; 'Predicted molecular signaling guiding photoreceptor precursor cell migration following transplantation into damaged retina,' Nature Scientific Reports 2016 Mar 3;6:22392.
b. Mishra, S.; Pena, J.; Redenti, S.; **Vazquez, M**., 'A novel electro-chemotactic approach to impact the directional migration of transplantable retinal progenitor cells,' Exp Eye Res 2019 Aug;185:107688.
c. Mut, S.; **Vazquez, M.,**' Emerging hybrid explant systems bring promise to retinal replacement therapy,' Frontiers Neuroscience 2021 Jul 23;15:714094
d. Markey, M.W.; **Vazquez, M.**, 'Targeting collective behaviors of transplanted retinal cells as strategies to improve cellular integration,' Neuro. Regen. Res. 2022 Jun;17(6):1271-1272.

5. Disparities in Vision Loss, Human Health and in Scientific Publishing

Modern biomedical study of neural repair has underscored profound health disparities among adults with neural disorders in the United States and worldwide. These worsening public health results motivate my lab's community outreach to incorporate health disparities within biomedical training and increase visibility of the community of researchers who do so. Projects from my laboratory have developed curricula to address health disparities challenges via design projects and coursework, as well as integrated disparities within biomedical theses and scientific hypotheses.

a. **Vazquez M.**, Marte O., Barba J., Hubbard K., 'An Approach to Integrating Health Disparities within Undergraduate Biomedical Engineering Education,' Ann Biomed Eng. 2017 Nov; 45(11):2703-2715.
b. **Vazquez, M.**; 'Engaging Biomedical Engineering in Health Disparities Challenges,' J Community Med Health Educ 2018, 8:595.
c. Pena J.; **Vazquez, M.**, 'Reducing health disparities in adult vision loss via interfaces with emerging technology,' Eye (Lond). 2019 Apr;33(4):532-533.
d. Desai, T.; Omolala, E.; Stevens, K.R.; **Vazquez, M**.; Imoukhuede P., 'Perspectives on Disparities in Scientific Visibility,' Nat. Rev. Mater. (2021) Vol. 6, Issue 7, p.556-559.

Partial List of Published Work in MyBibliography:

https://www.ncbi.nlm.nih.gov/sites/myncbi/maribel.vazquez.1/bibliography/48173945/public