## BIOGRAPHICAL SKETCH

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| NAME: | **Maribel Vazquez** |
| eRA COMMONS USER NAME: | 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 cell migration with altered 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 neurovascular barriers for applications in reparative, cell-based therapies that reduce adult vision loss. My biomedical contributions have demonstrated that cellular positioning and connectivity needed for collective response are finely regulated by cell sensitivity to exogenous chemical and electrical gradient fields. My technological contributions have developed quantitative, microfabricated tools to bridge tunable cell responses with clinical outcomes in degenerative retinal disorders. Further, the profound diversity of health challenges among USA adults with NS disorders has roused my educational initiatives in health disparities and in raising awareness of disparities in scientific publishing. These interests are in line with my first faculty role as co-founder of the first BME Department in a public Minority Serving Institution, City College of New York, which began awarding doctoral degrees in 2008. In this proposal, my lab will collaborate with the lab of Dr. Francois Berthiaume to develop a tunable, experimental model to examine the role of advanced glycation end products (AGEs) in the transport of VEGF ligands and anti-VEGF molecules across the inner neurovascular barrier of diabetic retina. Our team will meet weekly to guide and interpret experimental data needed to fulfill the project aims.

ONGOING AND RECENTLY COMPLETED PROJECTS THAT I WOULD LIKE TO HIGHLIGHT INCLUDE:

**1.** Cellular Bioengineering: From Biomaterials to Stem Cells (Research Experience for Undergraduate Site)
Principal Investigator (PI)**:** David Shreiber, Ph.D.; Co-PI: **Maribel Vazquez, Sc.D.**
National Science Foundation (**EEC-19-50509**); Period: 05/2021-05/2024
*Supports development of REU projects that help develop an advanced and diverse community of STEM researchers in cellular bioengineering*

**2.** Modulating electro-chemotactic stimuli and Top2b-mediated pathways for integration of cone progenitors
Principal Investigator**: Maribel Vazquez, Sc.D.**
National Eye Institute (R21 **EY031439-01**); Period: 05/2020-04/2023
*Supports examination of external stimuli to impact integration of transplanted retinal cells*

**3.** A combinatory microfluidic-in vivo modeling approach to evaluate collective migration in retinogenesis
Principal Investigator**: Maribel Vazquez, Sc.D.**
National Science Foundation (**CBET 1804411**); Period: 8/2018-8/2022
*Supports development of microfluidic systems to predict changes in the collective behavior of genetically modified retinal progenitors during in vivo development of Drosophila Melanogaster*

**4.** Emergent Behaviors of Integrated Biological Systems (EBICS II)
Principal Investigator: Roger Kamm, Ph.D.; Subcontract-PI: **Maribel Vazquez, Sc.D.**
National Science Foundation (**CBET 0939511**); Period: 07/2010-08/2023
*Supports development of microfluidics to examine glial-neuronal interactions.*

## B. POSITIONS, SCIENTIFIC APPOINTMENTS, AND HONORS

Appointments

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| 1992-1994 | Mechanical Engineer-Cleanroom Support, Intel Corporation (Portland, OR) |
| 1994-1996 | Cleanroom Development and Micro-contamination, Intel Corporation (Santa Clara, CA) |
| 1997-1999 | Teaching Assistant, MIT Dept. of Mechanical Engineering (Cambridge, MA) |
| 1999-2001 | Research Assistant, MIT Whitehead Institute for Biomedical Research (Cambridge, MA) |
| 2001-2002 | Assistant Professor, Dept. of Mechanical Engineering, City College of New York (CCNY) |
| 2002-2005 | Assistant Professor and Dept. Co-Founder, Biomedical Engineering, CCNY |
| 2006-2018 | Associate Professor (Tenured), Dept. of Biomedical Engineering, CCNY |
| 2019-2020 | Associate Professor (Tenured), Dept. of Biomedical Engineering, Rutgers University (NJ) |
| 2021-Now | Full Professor (Tenured), Dept. of Biomedical Engineering, Rutgers University (NJ) |

Selected Honors:

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| 1996-1999 | Intel Cooperative Graduate Fellowship-GEM: MIT (Cambridge, MA) |
| 2002-2005 | Harold Shames Junior BME Faculty Chair: CCNY (New York, NY) |
| 2004 | American Association for the Advancement of Science (AAAS) Honoree: Latin American Lecture Series for Women in Science and Engineering (Brazil, Panama, Uruguay) |
| 2007 | Mentoring Award: Alfred P. Sloan Foundation for Minority Education (NY) |
| 2010 | Cellular and Molecular Bioengineering: Best BMES Conference Paper (TX) |
| 2013 | Univision TV New York (Ch41) Technical Feature, 'STEM and the Elusive Role Model' |
| 2014 | Coulter College for Translation of BME Innovation: Faculty Design Advisor Winner (FL) |
| 2015 | Biomedical Engineering Society (BMES): Department Diversity Award (FL) |
| 2016 | Gordon Research Conference in Microfluidics (Italy): Invited Speaker and Panelist |
| 2017 | President's Award for Excellence in Mentoring, Research and Teaching, CCNY (NY) |
| 2020 | Induction into the American Institute of Medical and Biological Engineers (AIMBE) |
| 2022 | Elected Fellow of the Biomedical Engineering Society (BMES) |

Professional Service:

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| 2001-2006 | Co-founding member, Dept. of Biomedical Engineering, City College of New York |
| 2002-2010 | MIT Mechanical Engineering Review Committee, Alumna Member |
| 2003-Now | Society of Hispanic Professional Engineers, Academic Member |
| 2002-Now | Biomedical Engineering Society, Active Member and Session(s) Co-Chair |
| 2005-Now | NSF Proposal Reviewer (EEC, MRI, CBET Divisions) |
| 2005-Now | NIH Study Section Ad-hoc Reviewer and Special Emphasis Panelist<br>-NIGMS, NCI Special Emphasis Panels [SEP]<br>-Instrumentation and Systems Development [ISD]<br>-Interdisciplinary Molecular Sciences and Training [IMST] |
| 2008-2013 | Fund for the City of New York, Sloan Awards for Excellence in K-12 Teaching Science and Mathematics, Selections Panel |
| 2008-2016 | Undergraduate Curriculum and ABET Chair, City College of New York |
| 2014-2016 | Inaugural Graduate Officer, Master's in Translational Medicine, City College of New York |
| 2016-2019 | NIH U54 Minority Partnership Advisory Council |
| 2020-Now | AIMBE Nominations Review Committee (Tissue Engineering); Operations Committee |
| 2021-Now | Director of Faculty Development and Diverse Scholar Engagement, Rutgers University |
| 2022-Now | AIMBE Vice President-at-Large |

**C. CONTRIBUTIONS TO SCIENCE:**

**1. Microfluidic Platforms**:

Early laboratory work examined how cell connectivity and communication is altered during mechanical loading of matrix-laden suspensions in vitro. We developed microfluidic systems and nanotechnology to enable scrutiny of cell responses to finely tuned stimuli. Our projects customize microsystems to evaluate cell gradient sensitivity to extracellular factors and pharmacological compounds of therapeutic interest.

a. Dudu V.; Rotari V.; **Vazquez M**., 'Sendai Virus-based Liposomes Enable Targeted Cytosolic Delivery of Nanoparticles in Brain Tumor-Derived Cells,' J Nanobiotechnology. 2012 Feb 17;10:9 (Cover)
b. 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.
c. 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.
d. 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).

**2. Cell Migratory Processes**:

We leveraged our bioengineering designs to develop predictive microsystems able to mechanistically examine the migration of neural cells for translational applications. Our work was among the earliest to identify the finely tuned chemotactic responses of neural progenitors to highly dilute extracellular gradients.

a. Rico-Valera J.; Singh T.; McCutcheon S.; **Vazquez M**., 'EGF as a new Therapeutic Target for Metastasis,' Cell Mol Bioeng. 2015 June 1; Volume 6, Issue 1, pp 137-149.
b. 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.
c. 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.
d. Pena, J.S.; **Vazquez, M.**, 'VEGF upregulates EGFR expression to stimulate chemotactic behaviors in Müller glia,' Brain Sci 2020, 10(6), 330.

**3. Interfaces with Neuro-restorative Therapies**:

We have continued to adapt our technology to the nervous system with platforms that enhance emerging regenerative strategies. We are among the first projects to examine collective neural cell behavior within microfluidic systems for transplantation strategies. Our group is additionally a pioneer in adapting microsystems to examine the behavior of primary neural cells from invertebrates for robust genetic study.

a. Pena J.; Dulger N.; Redenti, S.; Majeska R.; **Vazquez, M**., 'Controlled microenvironments to evaluate chemotactic properties of cultured Muller glia,' Exp Eye Res. 2018 May 19; 173:129-137.
b. Pena C.; Zhang, S.; Majeska, R.; Venkatesh, T.; **Vazquez, M**., 'Invertebrate retinal progenitors as regenerative models in a microfluidic system,' Cells Oct 22;8(10).
c. Mishra, S.; **Vazquez, M**., 'A Gal-MµS device to evaluate cell migratory response to combined galvano-chemotactic fields,' Biosensors (Basel). 2017 Nov 21;7(4).
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.

**4. Regenerative Medicine in Adult Retina**

Recent projects have integrated microfluidics with retinal cell biology and ex vivo tissue to develop quantitative systems able to query novel approaches for retinal repair. We have produced whole eye explant systems for collaborative study with in vivo rodents as well as chip systems for pharmacological screening.

a. Mut, S.; Mishra, S.; **Vazquez, M**., 'A microfluidic eye facsimile system to examine the migration of stem-like cells,' Micromachines 2022 Mar 2;13(3):406.
b. Rodriguez, B.; **Vazquez, M**.; Cai, L.,' A newly anticipated role for Laptm4b in retinal outer segment development,' Eye (Lond.) 2022 Jul;36(7):1342-1343.

c. 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.
d. Castro, N.; Cohen, R.; **Vazquez, M**., 'Re: "Organ-On-A-Chip Technologies for Advanced Blood-Retinal Barrier Models,' Journal of Ocular Pharmacology and Therapeutics 2022 Jun;38(5):329-330.

**5. Disparities in Human Health and in the Scientific Community**

BME projects in neuro-repair have underscored profound health disparities among adults with neural disorders in the USA. These results inspire my continued educational research/outreach to incorporate health disparities challenges into engineering design and training. These projects have developed undergraduate curricula to include health disparities via coursework, yearly capstone design projects, and summer training programs.

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