

BIOGRAPHICAL SKETCH

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NAME: **Yarmush, Martin L.**

eRA COMMONS USERNAME: **mlyarmush**

POSITION TITLE: **Distinguished Professor of Biomedical Engineering**

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Yeshiva University	BA	06/1975	Biology/Chemistry
The Rockefeller University	PhD	06/1978	Physical Biochemistry
National Institutes of Health	Postdoctoral	08/1979	Immunology
Yale University School of Medicine	MD	06/1982	Medicine
Massachusetts Institute of Technology	PhD studies	08/1984	Chemical Engineering

A. Personal Statement

Over the past 38 years, I have published extensively in several fields including burn injury and inflammation, biomaterials and tissue engineering, cancer, spinal cord injury and traumatic brain injury, metabolic engineering, regenerative medicine, applied immunology, and BioMEMS & nanotechnology. My laboratory features expertise in molecular and cellular biology, biochemistry, immunology, nanotechnology, microfabrication, theoretical modeling, organ perfusion, and animal studies.

As a mentor, I have supervised >60 graduate students and >120 postdoctoral fellows over a 38-year period, with >80 of my former fellows going on to successful careers in academia both here and abroad, and many others becoming leaders in the biotechnology, pharmaceutical, and medical device industries. I have also been PI or co-PI on several predoctoral training grants including: 1 NIH T32 in Biotechnology (which is in its 33rd year of continuous funding); 2 NSF IGERT grants; and 4 DoEd GAANN grants. My other academic leadership experiences include Senior Associate Dean for Research, Department Chair, Deputy Chair, Graduate Program Director. Finally, I also have extensive experience leading large research teams (1 UH2/UH3 grant, 3 NIH BRP grants, 2 Whitaker Foundation Development Awards, 1 NIH P41), and serving as mentor on NIH F and K awards (2 NIH F31s, 9 NIH F32s, and 9 NIH K-level awards). Finally, I have taught a spectrum of courses over the years from *Molecular Genetics, Biochemistry, and Immunology to Thermodynamics and Transport Phenomena to Industrial Biotechnology and Innovation & Entrepreneurship in Science and Technology.*

Ongoing projects that I would like to highlight include:

Shriners Hospitals for Children 85110

Yarmush (PI)

01/01/2022 – 12/31/2024

“Metabolomic and proteomic analysis of neutrophil migration in burn injury”

NJCSCR CSCR19ERG004

Yarmush (PI)

05/01/19-04/30/23

“Autonomous early detection and treatment of pressure wound after SCI using galvanic skin response”

NSF ERC 1941543

Bischof, Toner (PIs), Yarmush Role: Research Thrust Leader, “Biological Engineering”

09/01/20-08/31/25

“Advanced Technologies for Preservation of Biological Systems (ATP-Bio)”

Citations:

- a. Bohr S, Patel SJ, Shen K, Brines M, Cerami A, Berthiaume F, **Yarmush ML**. Alternative erythropoietin-mediated signaling prevents secondary microvascular thrombosis and inflammation within cutaneous burns. **Proc Nat'l Acad Sci**. 2013; 110: 3513-8. PMID: PMC3587271.
- b. Sridharan GV, D'Alessandro M, Bale SS, Bhagat V, Gagnon H, Asara JM, Uygun K, **Yarmush ML**, Saeidi N. Multi-omic network-based interrogation of rat liver metabolism following gastric bypass surgery featuring SWATH proteomics. **Technology**. 2017; 5: 139-184. PMID: PMC5956888
- c. Raigani S, Karimian N, Huang V, Zhang AM, Beijert I, Geerts S, Nagpal S, Hafiz EOA, Fontan FM, Aburawi MM, Mahboub P, Markmann JF, Porte RJ, Uygun K, **Yarmush ML**, Yeh H. Metabolic and lipidomic profiling of steatotic human livers during ex situ normothermic machine perfusion guides resuscitation strategies. **PLoS One**. 2020; 15: e0228011. PMID: PMC6980574.
- d. Mert S, Bulutoglu B, Chu C, Dylewski M, Lin FM, Yu YM, **Yarmush ML**, Uygun K. Multi-organ metabolomics and lipidomics provide new insights into fat infiltration in the liver, muscle wasting and liver- muscle crosstalk following burn injury. **J Burn Care Res**. 2021; 42: 269-287.

B. Positions, Scientific Appointments, and Honors

2008- Paul & Mary Monroe Chair & Distinguished Professor, Biomedical Engineering, Rutgers U
1998- Editor-in-Chief, "Annual Review of Biomedical Engineering"
1995- Director, Center for Engineering in Medicine and Surgery, Massachusetts General Hospital
1995- Senior Scientific Staff, Shriners Hospital, Boston, MA
1995-2008 Helen Andrus Benedict Professor of Surgery and Bioengineering, Harvard Medical School
1992-1995 Graduate Program Director, Chemical and Biochemical Engineering, Rutgers U
1991-1995 Director, NJ Center for Biomaterials and Medical Devices, UMDNJ and Rutgers U
1988-1997 Director, Rutgers-UMDNJ PhD Training Program in Biotechnology
1988-1995 Professor, Professor II (1994-), Department of Chemical and Biochemical Eng, Rutgers U
1985-1990 Operating Committee Member, NSF ERC in Bioprocess Engineering, MIT
1984-1988 Principal Research Associate (Associate Research Professor), Chemical Engineering, MIT

Honors

2021 The Sackler Scholar, Sackler Institute of Advanced Studies, Tel Aviv University, Israel ♦ 2020 Daniel Gorenstein Memorial Award ♦ 2018 Lady Davis Professorship, Hebrew University, Israel ♦ 2017 Fellow, US National Academy of Engineering ♦ 2017 Fellow, Biomedical Engineering Society ♦ 2015 Fellow, US National Academy of Inventors ♦ 2015 Robert A. Pritzker Distinguished Lecture Award, BMES ♦ 2013 Top 20 Translational Researchers, *Nature Biotechnology* ♦ 2011 Food Pharmaceutical and Bioengineering Division Award, AIChE ♦ 2009 Visiting Distinguished University Professor, Michigan State University ♦ 2007 NIH Career Enhancement Award for Stem Cell Research ♦ 2006 Inducted into New Jersey High Tech Hall of Fame ♦ 2004 Award for Excellence in Undergraduate Education, Rutgers U ♦ 1999, 2001, 2005 AIChE Bioengineering Division Plenary Speaker ♦ 1996 “Martin L. Yarmush Student Award in Biotechnology” established, Rutgers U ♦ 1996 Bernard Revel Memorial Award in Arts & Sciences, Yeshiva U ♦ 1994 Hoechst Celanese Innovative Research Award ♦ 1993 Founding Fellow - American Institute of Medical and Biological Engineering ♦ 1992 Board of Trustees Award for Excellence in Research ♦ 1989-1994 NIH Research Career Development Award ♦ 1988-1993 NSF Presidential Young Investigator Award ♦ 1985-1993 Lucille P. Markey Scholar Award in Biomedical Science ♦ 1984-1987 National Research Service Award, NCI ♦ 1984 Cum Laude, Yale Medical School ♦ 1983-1984 Bert K. Kusserow Fellowship Award, ASAIO ♦ 1982-1983 Edwin R. Gilliland Fellowship, MIT ♦ 1975-1978 Rockefeller U Fellow ♦ 1975 Meyers Atlas Award in Biological Science, Yeshiva U ♦ 1975 Summa Cum Laude, Yeshiva U

C. Contributions to Science (>550 peer review journal publications)

1. **Wound Healing, Inflammation, and Infection Control:** We have developed nanoparticle-based techniques using ELP- growth factor fusion peptides for enhanced wound healing, as well as scarless wound healing techniques and disinfection protocols using pulsed electric field technology.

- a. Koria P, Yagi H, Megeed Z, Nahmias Y, Sheridan R, **Yarmush ML**. Self-assembling elastin-growth factor chimeric nanoparticles for the treatment of chronic wounds. **Proc Nat'l Acad Sci**, 2011; 108: 1034-9 PMID: PMC3024670.
 - b. Golberg A, Khan S, Belov V, Quinn KP, Albadawi H, Broelsch GF, Watkins MT, Georgakoudi I, Papisov M, Mihm MC Jr, Austen WG Jr, **Yarmush ML**. Skin rejuvenation with non-invasive pulsed electric fields. **Nature Sci Rep**, 2015; 5: 10187 PMID: PMC442807
 - c. Yeboah A, Maguire T, Schloss R, Berthiaume F, **Yarmush ML**. SDF1 α -elastin-like-peptide fusion protein promotes cell migration and revascularization of experimental wounds in diabetic mice. **Advances in Wound Care** 2017; 6: 10-22.
 - d. Bulutoglu B, Devalliere J, Deng SL, Acun A, Kelangi SS, Uygun BE, **Yarmush ML**. Tissue scaffolds functionalized with therapeutic elastin-like biopolymer particles. **Biotechnol Bioeng**. 2020; 117: 1575-1583. PMID: PMC148187.
- 2. Neurotechnology and Spinal Cord Injury:** We have developed techniques to reduce inflammation following spinal cord injury using microencapsulated MSCs. Our lab has also developed brain-on-a-chip microsystems to study traumatic brain injury.
- a. Berdichevsky Y, Staley KJ, **Yarmush ML**. Building and manipulating neural pathways with microfluidics. **Lab on a Chip** 2010; 10: 999-1004. PMID: PMC3137909.
 - b. Barminko J, Kim JH, Gray A, Schloss R, Grumet M, **Yarmush ML**. Encapsulated mesenchymal stromal cells for in vivo transplantation in spinal cord injury. **Biotechnol Bioeng** 2011; 108: 2747-58. PMID: PMC 3178737.
 - c. Dollé JP, Morrison B, III, Schloss RS, **Yarmush ML**. Brain-on-a-chip microsystem for investigating traumatic brain injury. **Technology** 2014; 2: 106-117. PMID: PMC4120884.
 - d. Kumar S, Babiarz J, Basak S, Kim JH, Barminko J, Gray A, Mendapara P, Schloss R, **Yarmush ML**, Grumet M. Sizes and sufficient quantities of MSC microspheres for intrathecal injection to modulate inflammation in spinal cord injury. **Nano LIFE** 2015; 5: 1550004.
- 3. Automated Robotic Venipuncture Device and Downstream Analysis Unit:** We have developed a fully automated robotic venipuncture device that accurately performs blood draws and can transfer the blood to a downstream processing unit for cell and plasma analysis. Recent enhancements include force feedback sensing and deep learning models which enable significantly superior results to manual blood drawing.
- a. Balter ML, Chen AI, Maguire TJ, **Yarmush ML**. The system design and evaluation of a 7-DOF image-guided venipuncture robot. **IEEE Transactions on Robotics** 2015; 31: 1044-1053.
 - b. Balter ML, Leipheimer JM, Chen AI, Shrirao A, Maguire TJ, **Yarmush ML**. Automated end-to-end blood testing at the point-of-care: Integration of robotic phlebotomy with downstream sample processing. **Technology** 2018; 6: 59-66. PMID: PMC6058193
 - c. Chen AI, Balter ML, Maguire TJ, and **Yarmush, ML**. Deep Learning Robotic Guidance for Autonomous Vascular Access. February 2020. **Nature Machine Intelligence** 2020; 2: 104–115.
 - d. Leipheimer JM, Balter ML, Chen AI, **Yarmush ML**. Design and Evaluation of a Handheld Robotic Device for Peripheral Catheterization. October 2021. **J Med Device** 2022; 16: 021015.
- 4. Mesenchymal Stromal Cell Therapeutics:** Our labs main contribution to this area was to demonstrate that it was unnecessary to inject MSC for therapeutic effect, and that molecules liberated by the cells (seeded in bioreactors) were sufficient to provide survival benefits in several models of organ failure. We also pioneered the use of microencapsulation to prolong MSC life and function in vivo and demonstrated their utility in spinal cord injury, traumatic brain injury, arthritis, and viral hemorrhagic type disorders.
- a. Parekkadan B, van Poll D, Sukanuma K, Carter EA, Berthiaume F, Tilles AW, **Yarmush ML**. Mesenchymal stem cell-derived molecules reverse fulminant hepatic failure. **PLoS One**, 2007; 2: e941. PMID: PMC1978513.
 - b. Barminko J, Kim JH, Otsuka S, Gray A, Schloss R, Grumet M, **Yarmush ML**. Encapsulated mesenchymal stromal cells for in vivo transplantation in spinal cord injury. **Biotechnol Bioeng**, 2011; 108: 2747-58. PMID: PMC 3178737.
 - c. Milwid JM, Ichimura T, Li M, Jiao Y, Lee J, Yarmush J, Parekkadan B, Tilles A, Bonventre JV, **Yarmush ML**. Secreted factors from bone marrow stromal cells upregulate IL-10 and reverse acute kidney injury. **Stem Cells International**, 2012; Article ID 392050, 12 pages, PMID: PMC3539665.

- d. Stucky EC, Schloss RS, **Yarmush ML**, Shreiber DI. Alginate microencapsulated mesenchymal stromal cells modulate the neuro-inflammatory response. **Cytotherapy**, 2015; 17: 1353-64.
- 5. Drug Metabolism and Toxicity:** We have developed several in vitro systems to study drug metabolism and toxicity, and discovered the importance of gap junctions in propagating hepatotoxicity
- a. Patel S, King KR, **Yarmush ML**. DNA-triggered innate immune responses are propagated by hepatocyte gap junction communication. **Proc Nat'l Acad Sci** 2009; 106: 12867-72. PMC2722330
 - b. Kidambi S, Chao P, **Yarmush ML**, Nahmias Y. Oxygen-mediated enhancement of primary hepatocyte metabolism gene expression and drug clearance. **Proc Nat'l Acad Sci** 2009; 106: 15714-15719. PMID: PMC2747185
 - c. Patel SJ, Milwid JM, King KR, Iracheta A, Parekkadan B, **Yarmush ML**. Engineering a hepatoprotective strategy for preventing drug-induced liver toxicity. **Nature Biotechnology** 2012; 30: 179–183.
 - d. Prodanov L, Jindal R, Bale SS, McCarty WJ, Golberg I, Bhushan A, **Yarmush ML**, Usta OB. Long-term maintenance of a microfluidic 3D human liver sinusoid. **Biotechnol Bioeng**. 2016; 113: 241-6. PMID: PMC4967935.

A mostly complete list of papers can be found at <http://www.ncbi.nlm.nih.gov/pubmed/?term=yarmush+m>