

Professor Samir Mitragotri
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HARVARD
John A. Paulson
School of Engineering
and Applied Sciences

Positions Held

7/17-present Hiller Professor of Bioengineering, Wyss Professor, Harvard University,
7/17-present Core faculty member, Wyss Institute
01/00-6/17 Department of Chemical Eng., University of California, Santa Barbara

Education

Ph.D., Chemical Engineering, Massachusetts Institute of Technology, 1996
B.S., Chemical Engineering, Institute of Chemical Technology, Mumbai, 1992

Research Field: Drug Delivery

Prof. Mitragotri's research is focused on drug delivery. His research has developed fundamental understanding of biological barriers of skin, gut, blood brain barrier, and macrophage clearance, and has led to the development of new materials as well as technologies for diagnosis and treatment of various diseases including diabetes, cancer, traumatic brain injury, ARDS and infections, among others. Many of his technologies have advanced to human clinical studies and products. Two of his recent key technological contributions are highlighted below:

Macrophage and Red Blood Cell Therapies: Prof. Mitragotri pioneered the field of non-genetic modifications of macrophages and red blood cells (RBCs) through engineered nanoparticles. He demonstrated that nanoparticles attached to red blood cells (cellular hitchhiking) can be delivered to specific organs including lungs, kidney and brain for targeted intervention. He also designed shape-engineered nanoparticles (cellular backpacks) that attach to macrophages and can control their phenotype for various applications including cancer, ARDS and traumatic brain injury. His non-genetic cellular modifications offer an alternative to genome-engineered approaches.

Ionic Liquids for Therapeutic Applications: Prof. Mitragotri pioneered the use of designer ionic liquids for drug delivery applications. Using biocompatible ions, he created a new family of ionic liquids and demonstrated their applications for transdermal delivery proteins such as insulin and siRNA, oral delivery of proteins including antibodies, sustained release vaccine adjuvants, depot injections, and ocular antiseptics. His lead ionic liquid, CAGE, has already advanced to human clinical trials for transdermal delivery. Two companies have been started to advance these ionic liquids for transdermal and oral delivery products.

Prof. Mitragotri's laboratory also has a strong record of training graduate students and postdocs. He has trained over 100 graduate students/postdocs in his and lab and trainees from his lab have been successful in launching independent careers in industry and academia.

Publications and Patents

- Over 325 publications in scientific journals including *Science*, *Nature Medicine*, *Nature Biotechnology*, *Nature Materials*, *Nature Nanotechnology*, *Nature Chemistry*, *Science Advances*, *PNAS*, *ACS Nano* and

Advanced Materials.

- Over 500 invited and contributed lectures in various conferences and universities around the world.
- Inventor on over 190 pending or issued patents.
- More than 40,000 citations (h-index of 101).
- Inventions translated into clinical technologies through several start-ups (Sontra, fqubed, Nuvo, Tioga, Stratagent, Liqueon, Seventh Sense, Skincential, Entrega, Sebacia, CAGE Bio, Fount Bio, i2O Therapeutics) and large companies.

Select Awards

2020	AIChE Food, Pharmaceutical and Bioengineering Division award
2020	CRS Kydonius Transdermal Research award
2019	Thomson Reuters Highly Cited Researcher
2018	Elected member, Indian National Academy of Engineering (INAE)
2016	Elected Member, National Academy of Medicine (NAM)
2015	Elected Fellow, American Association of Pharmaceutical Scientists (AAPS)
2015	Elected Fellow, Biomedical Engineering Society (BMES)
2015	Elected Fellow, Controlled Release Society (CRS)
2015	Member, National Academy of Engineering (NAE)
2014	Elected Fellow, National Academy of Inventors (NAI)
2012	Elected Fellow, American Association of Advancement of Science (AAAS)

Select Service

- Chair, Bioengineering, John A Paulson Scholl of Engineering & Applied Sciences, Harvard University
- Founding Editor-in-Chief, Bioengineering & Translational Medicine
- Member, National Academies' committee on Chemical Engineering: Challenges and Opportunities in the 21st Century (NAS)
- National Research Council Liaison, National Academy of Engineering (NAE)

Select 5 Publications from recent years

1. Shields, CW, Evans, MA, Wang, L. L-W., Baugh, N., Iyer, S., Wu, D., Zhao, Z., Pusuluri, A., Ukidve, A., Pan, DC., Mitragotri, S., Cellular backpacks for macrophage immunotherapy, *Science Advances* 6 (18), eaaz6579, 2020.
2. Zhao, Z., Ukidve, A., Gao, Y., Kim, J., and Mitragotri, S., Erythrocyte leveraged chemotherapy (ELeCt): Nanoparticle assembly on erythrocyte surface to combat lung metastasis, *Science Advances* 5 (11), eaax9250, 2019.
3. Ukidve, A., Zhao, Z., Fehnel, A., Krishnan, V., Pan, DC, Gai, Y., Mandal, A., Muzykantov, V., and Mitragotri, S., Erythrocyte-Driven Immunization via Biomimicry of their Natural Antigen Presenting Function, *PNAS*, 117 (30) 17727-17736, 2020.
4. Banerjee A., Ibsen, K., Brown T., Chen R., Agatemor C., and Mitragotri, S., "Ionic liquids for oral insulin delivery, *PNAS*, 115(28):7296-7301, 2018.
5. Zakrewsky M, Lovejoy K, Kern T, Miller T, Le V, Nagy A, Goumas A, Iyer R, Del Desto R, Koppisch A, Fox D, Mitragotri S., Ionic liquids as a class of materials for transdermal delivery and pathogen neutralization, *PNAS*, 111(37):13313-8, 2014.