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Richard Ribón Fletcher

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***Lab*: http://www.mobiletechnologylab.org/portfolio**

Technologies:

- Wearable devices, embedded systems, and Internet of Things
- Non-contact sensing (thermal, electromagnetic, optical, acoustic)
- Design of antennas, passive microwave devices, and basic RF circuits
- Smart phone software platforms
- Machine Learning / AI algorithms

Current Application Areas:

- Precision medicine and diagnostics
- Global health and public health
- Behavioral medicine and mHealth
- Mental health and psychophysiology

Education:

Ph.D., Information Technology, Physics and Media Group
(now called Center for Bits and Atoms, Neil Gershenfeld),
Massachusetts Institute of Technology (MIT) **2002**
Dissertation Title: *Low-Cost Electromagnetic Tagging: Design and Implementation*

Master of Science, Information Technology, **1996**
Massachusetts Institute of Technology (MIT)
Dissertation Title: *Chipless Electromagnetic Tagging*

Grad student, Department of Physics, UC Santa Barbara **1988 - 1989**
(while awaiting start of military duty)

Bachelor of Science, Electrical Engineering, MIT **1988**
Bachelor of Science, Physics, MIT **1988**
Minor: Visual Art and Design, Muriel Cooper MIT Media Lab
Thesis work done at MIT Bates Linear Particle Accelerator
Dissertation Title: *Electromagnetic Simulation and Alignment Tolerances for MIT Bates Linear Accelerator Particle Storage Ring*

Academic Positions and Appointments:

Research Scientist, MIT **2008 – present**
Assistant Professor, University of Massachusetts Med School **2011 – present**
Research Scientist, Massachusetts General Hospital, Psychiatry **2022 - present**
Instructor, Harvard Medical School **2011 – 2013, 2022 – present**
Research Scientist, VA Hospital, Bedford, MA **2010 – 2012**
Research Scientist, Massachusetts General Hospital, Global Health **2011 – 2013**

Academic Duties:

- Founder and Head of Mobile Technology Group, Mechanical Engineering (**htttp://www.mobiletechnologylab.org**)
- Responsible for managing research, students, budget, and fundraising
- Directly supervised over 25 MIT EECS and Media Lab graduate theses (PhD and Masters) as well as supervised over 250 undergraduate student researchers (UROP).
- Co-Investigator on a variety of clinical research studies with institutions and hospitals around the world, including Harvard, Mass. General Hospital, UMass, New York University, AIIMS (New Delhi, India), Public Health Foundation of India
- Led major hardware development efforts within several groups at the MIT Media Lab, including the laboratories of Rosalind Picard, Hiroshi Ishii, Neil Gershenfeld, and Kent Larson.
- Successfully raised grant funding from Gates Foundation, NIH, USAID, Vodafone, DoD, and other private foundations.
- Successfully licensed 3 patented inventions to commercial companies with patent revenue

Visiting Scientist, MIT Media Lab **2002 – 2008**

- Technology Advisor, Things That Think Consortium with 30+ industry sponsors
- Directing several student research/thesis projects including:
  - Dielectric spectroscopy sensor for analyzing food and human tissues
  - Chlorophyll fluorescence sensor for plants as a tool for environmental monitoring
  - Integrated microwave antenna and oscillator for automotive collision sensor
  - Wearable electro-optic pulse and blood oxygen sensor
  - Miniature body-fat monitor and muscle glycogen sensor

Research Scientist, MIT AutoID Lab **2004 – 2005**
Head, RFID and Packaging Special Interest Group

- Director, RFID Packaging Consortium, with 13+ industry sponsors, raised $ 650K
- Directed and supervised several Masters thesis including:
  - Electromagnetic simulation of RFID systems and materials
  - Development of sensors and hardware measurement tools for RFID systems
  - Antenna design and electromagnetic wave propagation through various media

Research Assistant, Physics and Media Group, MIT Media Lab. **1994 - 2002**

- Developed passive material structures for wireless battery-less tagging devices and remote sensors – numerous patents and published papers
- Designed and built of low-cost, frequency-agile radio-frequency hardware for interrogating material structures and tags
- Built the first working table-top NMR system at the Media Lab
- Three royalty-bearing inventions commercially licensed to industry
- Awarded Motorola Fellowship (full tuition) throughout graduate school

Awarded Grant Funding:

"mHealth-Community Health Worker Tool for Comprehensive Post-Cesarean Follow-up in Rural Rwanda", 2021.
Co-Investigator, National Institutes of Health, with Harvard Medical School

"Bringing Realtime Stress Detection To Scale: Development Of A Biosensor Driven, Stress Detection Classifier For Smartwatches", 2020.
Consultant/mentor team, National Institutes of Health, Harvard Medical School

"Field Testing and Development of Mobile Health Screening Tools", 2019.
Principal Investigator, Smart Innovations, Bangladesh

"Mobile App and Algorithm for Prediction of Infection in Surgical Wounds", 2019.
Investigator, National Institutes of Health, with Harvard Medical School

"Non-invasive Screening and Bayesian Prediction for Diebetes", 2018.
Principal Investigator, Source: TATA Trust, India

"Mobile Kit for Assessing Cardiovascular Risk", 2017.
Principal Investigator, Source: TATA Trust, India

"*Low-Cost Mobile Platform for Pulmonary Disease Screening"*, 2016.
Principal Investigator, Source: National Institutes of Health, R21

"ASHA Kit: Mobile Tools for Community Health Workers", 2016.
Principal Investigator, Source: TATA Trust, India

"*An Integrated Closed-loop Feedback System for Pediatric Cardiometabolic Disease"*, 2015.
MIT PI, Source: US Department of HHS/AHRQ, (R21HS024001)

"Mobile Platform for Diagnosis of Pulmonary Disease", 2015.
Principal Investigator, Source: Vodafone Americas Foundation

"Mobile Doppler Device for Assessing Cardiac Function", 2015.
Principal Investigator, Source: TATA Trust, India

"Mobile Tool for Diagnosis of Pulmonary Disease", 2014.
Principal Investigator, Source: TATA Trust, India

"Rapid,Diagnosis of Frail and Sick Newborns Using a Handheld Vital Sign Monitor", 2013.
Co-Principal Investigator, Source: USAID, Saving Lives at Birth program

"Rapid, Low-Cost, Point-of-care Diagnosis of Loa Loa Microfilaremia by Handheld Fluorescence Photodetection", 2013.
Co-Investigator, Source: Gates Foundation Challenge Grant

"Atypical Effects in Reinforcement Procedures In Autism Spectrum Disorder", 2013.
Co-Investigator, Source: National Institutes of Health, R21.

"Integrating Behavioral Skills with a Mobile Biosensor for At-Risk Teen Mothers", 2013.
Co-Investigator, Source: National Institutes of Health, R34.

"Anemia Measurement Using a Mobile Phone", 2012.

Principal Investigator, Source: MIT-India Program

"Low-Cost methods for Automatic Vaccination Records, Patient Identification, and Vaccine Assessment", 2011.
Principal Investigator, Source: Gates Foundation

"Environmental Sensors for Monitoring Pollution and Health in Cuddalore, India", 2011.
Principal Investigator, Source: MIT-India Program

"Non-Contact Measurement of Electrodermal Activity for Psychophysiological Assessment", 2010.
Principal Investigator, Source: Draper Labs, DoD

"A Mobile Enhancing Technology to Promote Adherence to Behavioral Therapy", 2009.
Co-Principal Investigator, Source: National Institutes of Health, R01.

"Wearable Wireless Tool Kit for Measurement and Communication of Autonomic Nervous System Activity in Autism", 2008.
Co-Principal Investigator, Source: Nancy Lurie Marks Foundation

"Wireless Technologies for Monitoring of Autonomic Nervous System in Primates", 2010.
Co-Principle Investigator, Source: Johnson Foundation

"Technologies for Early Diagnosis of Autism in Infants", 2008.
Massachusetts General Hospital
Co-Investigator, Source: US Army

"Chipless, Wireless Sensors for Remote Monitoring or Pressure and Temperature", 2004.
SBIR Grant, Phase I: NASA, Kennedy Space Center

Military Duty and Government Experience:

Engineer, US Air Force, Rome Lab, Hanscom AFB **1995-1996**

- Design of microwave patch antennas
- Near- and far-field radiation pattern measurements of patch antenna arrays.

Engineer, US Air Force, Armstrong Lab, Wright-Patterson AFB **Summer '94,'95**
Virtual Reality Lab, headed by Dr. Gene Eggleston

- Development of capacitive sensors for virtual reality interfaces
- Development of new scrolling map display for airplane cockpit controls

Research Scientist, US Air Force Wright Laboratory, Wright-Patterson AFB **1989-1994**
Active-duty military officer, (military rank = Captain)
Security Clearance = Secret and Top Secret

- Independent researcher in lab with 90% PhD scientist population
- Responsible for thin-film superconductor deposition using pulsed laser deposition (1989).
- Clean-room photolithography of thin-film structures for device fabrication and characterization
- Designed and built automated system for characterizing thin-film superconducting microwave structures operating at 20 GHz and over temperature range of 8 degrees Kelvin to room temperature under vacuum. (published in journal, *Review of Scientific Instruments*)
- Development of novel electromagnetic sensors and microwave devices using superconducting thin-films

- Atomic Force Microscopy and X-Ray diffraction studies of superconducting thin films and semiconductor devices

Contract Manager:

- Managed several SBIR (Small Business Innovative Research) contracts: responsible for proposal evaluation, writing Statements of Work, and conducting program reviews.
- Trained and Certified as Level II System Acquisition and Contract Management

Industry Experience:

Engineer, Motorola Corp., San Jose, CA. **Jan '96, Summer '97, Summer '98**

- Modelling, design, and development of capacitively-coupled RFID tag systems
- Co-inventor on several patents (not usually granted to summer interns)

Research Engineer, Superconductor Technologies, Inc. **Summer 1989**

- Clean room photolithography of high-Tc Thallium-based superconductor devices for microwave and digital electronics
- Successfully patterned SQUID device with 200 Angstrom features using Focused Ion Beam lithography using one of the world's first Focused Ion Beam (FIB) machines ever created.

Entrepreneurship:

Founder, President, TagSense, Inc. (http://www.tagsense.com) **2000 - 2011**

- Consulting: Development of custom RFID and wireless sensors for Fortune 100 clients
- Designed over 20 commercial RFID products (networked readers, active tags, sensors) that were sold online 2005-2018
- Developed several white-hat hacker demonstrations for MasterCard for wireless payment cards to improve credit card security
- Designed mailbox security system prototype for US Post Office
- Designed and developed many chipless sensor prototypes for a variety of clients, including SBIR Phase I award to NASA Kennedy Space Center Shuttle program
- Created world's smallest UHF RFID reader in 2006
- Designed radio module for world's first UHF RFID mobile phone, in collaboration with Nokia – at the time was the largest cell phone company in the world
- Created active and passive RFID sensor platform used by many schools and research labs including MIT, UCLA, Purdue, Virginia Tech, NASA, Oak Ridge National Lab, Intel Research Seattle, Kaiser Permanente, Xerox PARC, Kodak, 3M, Johnson & Johnson.

FreshTemp (www.freshtemp.com) (co-founder) 2011-2015

- Spin-off from TagSense
- IoT temperature monitoring solutions for restaurants and industry
- Successfully sold in 2016 to Internet of Things company Digi International (https://www.digi.com/)
- Now called SmartSense

Co-Founder, **and former CTO**, First-Mile Solutions, LLC. **2002-2004**

- Provided wireless network infrastructure for villages in developing countries
- One of the first sustainable for-profit companies in this domain
- Semi-finalist in MIT Sloan Business School Annual Business Plan Competition
- Products successfully deployed since 2002 and used in over 80 schools in rural Cambodia
- Enabled telemedicine services for rural health clinics, e-business services for local businesses, and over 30,000 community users in Cambodia.
- Other deployment sites include: Rawanda (Africa), India, and Costa Rica.
- Featured as exemplary case study of "What Works" by the World Resources Institute and USAID, published Oct 2005: http://www.firstmilesolutions.com/documents/FMS_Case_Study.pdf
- Company restructured as United Villages in 2004

Co-Founder, **and Advisory Board**, United Villages, LLC. **2004 - 2012**

- Providing information services for developing countries, including: web search service, e-mail, voice mail, video, community advertising.
- Named by Investors Circle (investorcircle.net) as one of Top 20 Emerging Companies of the past 18 years, that have had an impact on the world since the organization was founded.
- Patented IP-based telephony service for rural villages
- Successfully Raised First-Round Venture Capital Funding
- Acquired by Oxigen Services, Pvt. (http://www.myoxigen.com/), largest e-payment company in India, in 2012.

Ashametrics (www.ashametrics.com) **2010-2020**

- Provides mobile health sensors and mobile phone apps

Other Company Spin-offs and Organizations:

In addition to the companies listed above, I'm on the advisory board of the following organizations:

KeegoTech (www.keegotech.com) **2010-present**

- Manufactures and sells microbial fuel cell kits for schools and researchers.
- Emerging technology as power source and natural sensor

Academic Mentoring and Teaching

I am an official thesis advisor for MIT grad students in **Electrical Engineering and Computer Science**, but occasionally I also advise student theses from other departments, including Media Arts and Sciences (**Media Lab**), Technology Policy Program (**TPP**), and Integrated Design and Management (**iDM**). As of 2022, I have directly supervised over 250 undergraduate student researchers and over 25 graduate student theses in my group at MIT.

Graduate Student Theses:

- **Jemutai "Christa" Sitienei, EECS, Masters Thesis, 2021: "***Applying Artificial Intelligence to Enable Practical Screening for Diabetic Retinopathy and Diabetes***"**
- **Vedaant Kukadia, EECS, Masters Thesis, 2021: "***The Development and Deployment of Mobile Apps and Server Platform for Real-World Screening of Pulmonary and Cardiovascular Disease in Low-Resource Areas***"**
- **Saadiyah Husnoo, EECS, Masters Thesis, 2021: "***A Scalable Server Platform and API Design for Real-Time Health Monitoring and Diagnostics***"**
- **Gabriel Schneider, EECS, Masters Thesis, 2021: "***Machine Learning Techniques for Wound Infection Detection***"**
- **Ellie Simonson, EECS, Masters Thesis, 2020: "**Semi-Supervised Classification of Social Media Posts: Identifying Sex-Industry Posts to Enable Better Support for Those Experiencing Sex-Trafficking**"**
- **Victoria Ouyang, EECS, Masters Thesis, 2020: "**Mobile Platform and Prediction Algorithms for Cardiovascular Disease**"**
- **Olusubomi Olubeko, EECS, Masters Thesis, 2019: "**Machine Learning Models for Screening and Diagnosis of Infections**"**
- **Shivani Chauhans, EECS, Masters Thesis, 2019: "**A Mobile Platform for Non-invasive Diabetes Screening**"**
- **John Mofor, EECS, Masters Thesis, 2019: "**PyMedServer: A Server Framework for Mobile Data Collection and Machine Learning**"**
- **Botong Ma, EECS, Masters Thesis, 2019: "**Developing a Low-Cost Cardiovascular Mobile Screening Kit**"**
- **Aneesh Anand, EECS, Masters Thesis, 2018: "**Bayesian Models for Screening and Diagnosis of Pulmonary Disease**"**
- **Tania Yu, EECS, Masters Thesis, 2018: "**Iris Imaging for Heath Diagnostics"
- **Christian Infante, EECS, Masters Thesis, 2017: "**Development of Machine Learning Algorithms forScreening of Pulmonary Disease**"**
- **Honey Bajaj, iDM, Masters Thesis, 2017: "**Design of Mobile Health Tools for Assessment of Health and Nutritional Status in Children**"**

- **Niccolo Pignatelli, TPP, Masters Thesis, 2017: "**Design of a Mobile Kit for Cardiovascular Disease Screening in Resource Constrained Environments**"**
- **Daniel Chamberlain, EECS, TPP, Masters Thesis, 2017: "**Design and Validation of Mobile Kit and Machine Learning Algorithms for Pulmonary Disease Screening and Diagnosis**"**
- **Daniel Weber, TPP, Masters Thesis, 2015: "**Design of a Battery-Powered Induction Stove**"**
- **Selene Mota, Media Lab, PhD Thesis, 2014: "**Scalable Recognition Of Human Activities For Pervasive Applications In Natural Environments**"**
- **Jennifer Broutin Farah, Media Lab, Masters Thesis, 2013: "**Sprouts IO Urban Microfarm: Interactive Indoor Farming System for Urban Use**"**
- **Yuta Kuboyama, EECS, Masters Thesis, 2010: "**Motion Artifact Cancellation For Wearable Photoplethysmographic Sensor**"**
- **Jonathan Wolk, EECS, Masters Thesis, 2005: "**Graphical Real-Time Simulation Tool For Passive UHF RFID Environments**"**
- **Uttara Marti, EECS, Masters Thesis, 2005: "**Electromagnetic Analysis for RFID Packaging Applications**"**
- **Richard Redemske, EECS, Masters Thesis, 2005: "**An Electromagnetic Measurement Tool for UHF RFID Diagnostics**"**

Teaching Experience:

MIT Course Instructor
Technologies for Mental Health and Wellness **2019 - present**
Project oriented course that introduces the field of Computational Psychology and Applies mobile technologies, Internet of Things, and Artificial Intelligence to the most important problems in mental health and also addresses approaches for prevention.
One of the top-rated classes of fall semester

Course Instructor
D-Lab: Information and Communication Technologies for Development **2008 – 2011**
Laboratory course dedicated to creating engineering and science technologies to address specific needs in developing countries, specifically in the areas of global health, environmental monitoring, agriculture, and water/food testing.

Course Instructor
Next Lab: Design of Mobile Technologies for Development **2008**
Class dedicated to using mobile phone platforms for addressing specific needs in developing countries, including health, disaster relief, and e-commerce.

Teaching Assistant: ***Physics of Information Technology*** **1997 - 1998**
Prof. Neil Gershenfeld
Organized and conducted weekly tutorials and homework review sessions

Teaching Asistant, Lecturer: ***Tangible Interfaces*** **1999 - 2004**
Prof. Hiroshi Ishii
Design of sensors for human computer interfaces

Diversity and Volunteer Service:

MITES (Minority Introduction to Engineering and Science), MIT **1995-2000**
Mentor and annual tour guide at Media Lab for minority student program

Evening Class Instructor, International Red Cross **1990-1994**
ESL (English as a Second Language) instructor
Responsible for weekly lesson plans and exercises for class of 10+ students
Also worked as part-time van driver to pick-up/drop-off students to the school

State and Local Science Fair Judge, (Ohio) **1990-1994**

Professional Affiliations (Engineering and Medicine):

IEEE, Engineering in Medicine and Biology Society **2009-present**
IEEE, Microwave Theory and Techniques **1995, 1996, 2000-present**
IEEE, Magnetics Society **2000-present**
IEEE, Antenna and Propagation Society **2001-present**
IEEE, Sensors Council **2002-present**

European Respiratory Society (ERS) **2016 - 2021**
Society for Behavior Medicine (SBM) **2011 - present**
Materials Research Society (MRS) **1988-2000, 2002-2005**

Academic Journal Editorial Boards:

- *Frontiers: Special Issue on Artificial Intelligence Applied to Global Health*, 2019-2020
- *Frontiers: Special Issue on Wearables and AI*, 2020-2021.

Grant Review Service:

- Regular study section member for mHealth grants, National Institutes of Health **2018 – present**
- Grant Reviewer for military proposals:

Professional Service (Paper Reviews, Organizing Committees):

- Reviewer for IEEE EMBC **2011 - present**
- Technical Co-chair, *IEEE RFID Conference* **2011, 2014**
- Technical program committee, session chair, *IEEE RFID Conference* **2007-2014**
- Conference Committee and Session Co-Chair, *4th IEEE Conference on Automatic Identification Technologies*, **Oct. 2005**
- Invited Reviewer for various IEEE, ACM, and international journals, including *Microwave Theory and Techniques*, *Pervasive Computing* and *CHI*
- Invited reviewer for several medical journals, including: *Physiology and Behavior, Psychophysiology, JMIR, J. Biomedical Informatics, and Medical Engineering and Physics*.

Book contract:

"Electromagnetic Tagging and RFID", Cambridge University Press
in progress; 400+ pages.

Peer-Reviewed Academic Papers and Posters:

Google Scholar: H-index ranking = 33, i10-index = 68

(2021)

- **Fletcher, R.R.**, Schneider, G., Bikorimana, L., Rukundo,G., Niyigena,A., Miranda, E., Riviello, R., Kateera, F., Hedt-Gauthier, B., "*The Use of Mobile Thermal Imaging and Deep Learning for Prediction of Surgical Site Infection*," *IEEE Engineering in Medicine and Biology Society (EMBC),* 2021.

- **Fletcher, R.R.**, Schneider, G., Hedt-Gauthier, B., Nkurunziza, T., Alayande, B., Riviello, R.,Kateera, F., "*Use of Convolutional Neural Nets and Transfer Learning for Prediction of Surgical Site Infection from Color Images*," *IEEE Engineering in Medicine and Biology Society (EMBC),* 2021.

- **Fletcher, R.**, Sobier, M., Hodges, K., "*Development of a Smart Speaker Voice Assistant for Use in Parent-Child Interaction Psychotherapy and Training*," Rapid Communications, Society for Behavior Medicine annual meeting, 2021.

- Elgendi, M., **Fletcher, R.R.**, Tomar, H., Allen, J., Ward, R., Menon, C. "*The Striking Need for Age Diverse Pulse Oximeter Databases*," Frontiers in Medicine, 2021.

- Byun, S., Garcia Bulle Bueno, B., Gupta, Y., Dhadge,N., Pawar, S., Kodgule, R., **Fletcher, R.R.**, "*The Use of Thermal Imaging and Deep Learning for Pulmonary Diagnostics and Infection Detection*," *IEEE Body Sensor Networks*, 2021.

(2020)

- **Fletcher, R.R**., Nakeshimana, A., Olubeko, O., "Addressing Fairness, Bias, and Appropriate Use of Artificial Intelligence and Machine Learning in Global Health," *Frontiers in Artificial Intelligence*, 2020.

- Ouyang, V., Ma, B., Pignatelli, N., Sengupta, S., Sengupta, P., Mungulmare, K., **Fletcher, R.R.**, "The Use of Multi-Site Photoplethysmography (PPG) as a Screening Tool for Coronary Arterial Disease and Atherosclerosis," *Physiological Measurement*, 2020.

- Hosanee, M., Chan, G., Welykholowa, K., Cooper, R., Kyriacou, P.A., Zheng, D., Allen, J., Abbott, D., Menon, C., Lovell, N.H. and Howard, N., **Fletcher, R.,** Ward R., Elgendi, M., "Cuffless Single-Site Photoplethysmography for Blood Pressure Monitoring," *Journal of Clinical Medicine*, 2020, *9*(3), p.723.

- Welykholowa, K., Hosanee, M., Chan, G., Cooper, R., Kyriacou, P.A., Zheng, D., Allen, J., Abbott, D., Menon, C., Lovell, N.H. and Howard, N., **Fletcher, R.,** Ward R., Elgendi, M., "Multimodal Photoplethysmography-Based Approaches for Improved Detection of Hypertension," *Journal of Clinical Medicine, 2020*, *9*(4), p.1203.

(2019)

- **Fletcher, R.R.**, Olasubomi, O., Sonthalia, H., Kateera, F., Nkurunziza, T., Ashby, J.L., Riviello, R., Hedt-Gauthier, B., "Application of Machine Learning to Prediction of Surgical Site Infection," *IEEE Engineering in Medicine and Biology Society (EMBC),* 2019.

- **Fletcher, R.R.**, Kateera, F., Olasubomi, O., Nkurunziza, T., Ashby, J.L., Riviello, R., H. Sonthalia, Hedt-Gauthier, B., "Machine Learning Prediction Of Surgical Site Infection Using Color Images Of Wound Captured By Community Health Workers," Surgical Infection Society, 38th Annual Meeting, June 2019.
  Best New Member Paper Award

- **Fletcher, R.,** Zhang, J., Drokhlyansky, A., Oreskovic, N., Taveras, E., "Sensor Band Device and Algorithm for Simultaneous Measurement of Multiple Behaviors: Screen Time, Physical Activity, and Sleep," *Society for Behavior Medicine Annual Meeting,* Apr 2019.

- Chan, G., Cooper, R., Hosanee, M., Welykholowa, K., Kyriacou, P.A., Zheng, D., Allen, J., Abbott, D., Lovell, N.H., **Fletcher, R.** and Elgendi, M., "Multi-Site Photoplethysmography Technology for Blood Pressure Assessment: Challenges and Recommendations," *Journal of clinical medicine*, *8*(11), 2019.

- Elgendi, M., **Fletcher, R.**, Liang, Y., Howard, N., Lovell, N.H., Abbott, D., Lim, K. and Ward, R., 2019. "The Use of Photoplethysmography for Assessing Hypertension," *Nature Digital Medicine*, *2*(1), pp.1-11

(2018)

- Anand, A., Chamberlain, D., Kodgule, R., **Fletcher, R.**, "Pulmonary Screener: A Mobile Phone Screening Tool for Pulmonary and Respiratory Disease," *IEEE Global Humanitarian Technology Conference (GHTC), San Jose, Oct. 2018.*

- Diaz, X.S., Mofor, J., Bhat, R., **Fletcher, R.**, " Smart Phone-Based Non-Contact Assessment of Human Breathing and Respiration for Diagnostic and Therapeutic Applications," *IEEE Global Humanitarian Technology Conference (GHTC), San Jose, Oct. 2018.*

- Leonard, N., Casarjian, B., **Fletcher, R.**, Prata, Cathleen, Sherpa, D., Keleman, A., Rajan, S., Salaam, R., Cleland, C., Gwadz, M., "Theoretically-Based Emotion Regulation Strategies Using a Mobile App and Wearable Sensor Among Homeless Adolescent Mothers: Acceptability and Feasibility Study," *JMIR Pediatrics and Parenting, 2018, vol1.*

- Pignatelli, N., Ma, B., Sengupta, S., Sengupta, P., Mungulmare, and **Fletcher, R.**,, "Low-Cost Mobile Device for Screening of Atherosclerosis and Coronary Arterial Disease," *IEEE Engineering in Medicine and Biology Society (EMBC),* 2018.

(2017)

- **Fletcher, R.**, Soriano, X., Bajaj, H., Gosh-Jerath, S., "Development of Smart-phone Based Child Health Screening Tools for Community Health Workers," *IEEE Global Humanitarian Technology Conference (GHTC), San Jose, Oct. 2017.*

- Infante, C., Chamberlain, D., Thorat, Y., Kodgule, R., and **Fletcher, R.**, " Use of Cough Sounds for Diagnosis and Screening of Pulmonary Disease," *IEEE Global Humanitarian Technology Conference (GHTC), San Jose, Oct. 2017.*

- **Fletcher., R.**, Chamberlain, D., Thorat, Y., Vincent, V, Kodgule, R.; "The Use of Respiratory Sounds for Automated Detection of Obstructive Pulmonary Disease: Do Lung Sound Labels Provide Value?," *European Respiratory Journal*, (2017).

- Infante, C., Chamberlain, D., Kodgule, R., and **Fletcher, R.**,, "Classification of Voluntary Coughs Applied to the Screening of Respiratory Disease," *IEEE Engineering in Medicine and Biology Society (EMBC),* 2017.

- **Fletcher, R.,** Chamberlain, D., Oreskovic, N., Taveras, E., "Automated Measurement of Screen Time Using a Wearable Light Sensor," *Society for Behavior Medicine Annual Meeting,* Apr 2017.

- Sethi, T., Nagori, A., Bhatnagar, A., Gupta, P., **Fletcher, R.**, & Lodha, R. (2017, March). "Validating the Tele-diagnostic Potential of Affordable Thermography in a Big-data Data-enabled ICU," In *Proceedings of the Special Collection on eGovernment Innovations in India* (pp. 64-69). ACM.

- Bhatnagar, A., Nagori, A., **Fletcher, R.**, Lodha, R., & Sethi, T. (2017, March). "Leveraging Thermal Patterns in Children for Telemedicine: Role of Affordable Imagers, Smartphones and Data-analytics." In *Proceedings of the 10th International Conference on Theory and Practice of Electronic Governance*(pp. 588-589). ACM.

(2016)

- Oreskovic, N.M., **Fletcher, R.**, Sharifi, M., Knutsen, J.D., Chilingirian, A. and Taveras, E.M.; "Design And Rationale Of The STRIVE Trial To Improve Cardiometabolic Health Among Children And Families," *Contemporary Clinical Trials*, 2016. *49*, pp.149-154.

- **Fletcher, R.**, Pignatelli, N., Jimenez-Galindo, A., Gosh-Jerath, S., "Development of Smart Phone Tools for Printed Diagnostics: Challenges and Solutions," *IEEE Global Humanitarian Technology Conference (GHTC), Seattle, WA, Oct. 2016.*

- Chamberlain, D., Kodgule, R., Thorat, Y., Das, V., Miglani, V., Ganelin, D., Dalal, A., Sahasrabudhe, T., Lanjewar, A. and **Fletcher, R.**, "Smart phone-based auscultation platform," *European Respiratory Journal*, *48*(suppl 60), p.OA2000, (2016). ****Citation Award****

- Kodgule, R., Chamberlain, D., Thorat, Y., Das, V. and **Fletcher, R.**, "Evaluation of novel augmented reality based mobile application to record peak expiratory flow rates," *European Respiratory Journal*, *48*(suppl 60), p.PA855, (2016).

- Chamberlain, D., Kodgule, R., Thorat, Y., Das, V. and **Fletcher, R.,** "Smart phone-based platform for diagnosing asthma and COPD," *European Respiratory Journal*, *48*(suppl 60), p.PA1033, (2016).

- **R. Fletcher**, D. Chamberlain, D. Richman, N. Oreskovic, E. Taveras, "Wearable Sensor and Algorithm for Automated Measurement of Screen Time," IEEE *Wireless Health Conference*, 2016.

- Coffman, D., Leonard, N., **Fletcher, R.**,Cleland, C., Gwadz, M., "A Pipeline for Processing and Modelling Electrodermal Activity Data Collected in an Ambulatory Setting," IEEE *Wireless Health Conference*, 2016.

- D. Chamberlain, R. Kodgule, and **R. R. Fletcher**, "A Mobile Platform for Automated Screening of Asthma and Chronic Obstructive Pulmonary Disease," *IEEE Engineering in Medicine and Biology Society (EMBC)*, 2016.

- D. Chamberlain, R. Kodgule, D. Ganelin, V. Miglani, and **R. R. Fletcher**, "Application of Semi-Supervised Deep Learning to Lung Sound Analysis," *IEEE Engineering in Medicine and Biology Society (EMBC),* 2016.

- D. Chamberlain, R. Kodgule, A. Jimenez-Galindo, and **R. Fletcher**, "Applying Augmented Reality on Mobile Phones to Enable Automated and Low-Cost Data Capture from Medical Devices," *Proceedings of the Eighth International Conference on Information and Communication Technologies and Development (ICT4D)*, 2016.

- **Fletcher, R.,** Chamberlain, D., Paggi, N., "No Wearable Sensors Required: Using the Mobile Phone Camera to Passively Measure Physiology for EMA," *Society for Behavior Medicine Annual Meeting,* Apr 2016. **** Citation Award ****

- Leonard, N., Coffman, D., **Fletcher, R.**, Sherpa, D., Cleland, C., Gwadz, M., "Usage and Acceptance of an mHealth Technology for Enhancing a Provider-Delivered Parenting Intervention," *Society for Behavior Medicine Annual Meeting,* Apr 2016.

(2015)

- D. Chamberlain, R. Kodgule, and R. **Fletcher**, "Towards a Pulmonary Diagnostic Kit for Telemedicine and Global Health Point-Of-Care Diagnosis," *NIH-IEEE 2015 Strategic Conference on Healthcare Innovations and Point-of-Care Technologies for Precision Medicine*, 2015.

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- **Fletcher, R.,** Paggi, N., Chamberlain, D., Deng, X., "Implementation of Smart Phone Video Plethysmography and Dependence on Lighting Parameters," *IEEE Engineering in Medicine and Biology Society, (EMBC),* Milan, IT, Aug. 2015.

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- **Fletcher, R.,** Oreskovic, N., Robinson, A., "Design and Clinical Feasibility of Personal Wearable Monitor for Measurement of Activity and Environmental Exposure," *IEEE Engineering in Medicine and Biology Society, (EMBC),* Chicago, IL, Aug. 2014.

- **Fletcher, R.,** "Engineering Opportunities and Challenges for the Treatment of Mental Health and Behavioral Medicine," *IEEE Engineering in Medicine and Biology Society, (EMBC),* Chicago, IL, Aug. 2014. (also organized this panel session on Mental Health)

- Leonard, N., **Fletcher, R.**, Casarjian, B., Gwadz, M., Cleland, C., Rajan, S., Salam, R., "Integrating Emotional and Behavioral Skill Building with Mobile Biosensor Technology for At-Risk Adolescent Mothers," *Society for Behavior Medicine Annual Meeting,* Apr 2015.

- **Fletcher, R.,** "Using Wearable Sensors for Behavior Monitoring and Interventions: Lessons Learned and Future Directions," *Society for Behavior Medicine Annual Meeting, Philadelphia, PA,* Apr 2014. (also organized a panel session on wearable sensors)

- Mota, **S., Fletcher**, R., K. Larson, "Continuous Longitudinal Monitoring of Motor-Related Symptoms in Parkinson's Patients Using Wearable Accelerometers," 35th Annual Meeting & Scientific Sessions of the Society of Behavioral Medicine. April 23–26, 2014.

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- **Fletcher, R.,** "Next-Generation Emerging Technologies for Ambulatory Physiology and Behavior Measurement," *Society for Behavior Medicine Annual Meeting,* Apr 2013.

- Hernandez, J., McDuff, D., **Fletcher, R.,** Picard, R.,"Inside-Out: Reflecting on Your Inner State," *IEEE International Conference on Pervasive Computing and Communications,*Feb.2013.

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- Rajan, S., Leonard, N., **Fletcher, R.,** Casarjian, B., Casarjian, R., Cisse, C., Gwadz, M.,"Ambulatory Autonomic Monitoring Among At-Risk Adolescent Mothers," *Journal of Mobile Technology in Medicine,*Sept 2012.

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- **Fletcher, R.**, Tam, S., Omojola, O., Redemske, R., J. Kwan; *"Wearable Sensor system and Mobile Application for Use in Cognitive Behavioral Therapy for Drug Addiction and PTSD,"* Proceedings of Engineering in Medicine and Biology Conference, Boston, 2011.

- **Fletcher, R.**, Tam, S., Omojola, O., Redemske, R., Fedor, S., Mugisha, J.; *"Mobile Application and Wearable Sensors for Use in Cognitive Behavioral Therapy for Drug Addiction and PTSD,"* Proceedings of Pervasive Health Conference, 2011.

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- **Fletcher, R.**, Poh, M.Z.; *"Wearable Sensors: Opportunities and Challenges for Low-Cost Health Care,"* Proceedings of IEEE Engineering in Biomedicine Conference, 2010.

- **Fletcher, R.**, Kulkarni, S.; *"Clip-on Wireless Wearable Microwave Sensor for Ambulatory Cardiac Monitoring,"* Proceedings of IEEE Engineering in Biomedicine Conference, 2010.

- **Fletcher, R.**, Dobson, K, Goodwin, M.S., Eydgahi, H., Wilder-Smith, O., Fernholz, D., Kuboyama, Y., Hedman, E., Poh M.Z., Picard, R.W.; "*iCalm: Wearable Sensor and Network Architecture for Wirelessly Communicating and Logging Autonomic Activity*," IEEE Trans. Info. Technol. Biomedicine. vol 14, no.2, Mar. 2010

- **Fletcher, R.**, Kulkarni, S.; *"Wearable Doppler Radar with Integrated Antenna for Patient Vital Sign Monitoring,"* Proceedings 2010 IEEE Radio and Wireless Symposium, Jan 10-14 2010.

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- **Fletcher, R.**, Han, J.; *"Low-Cost Differential Front-End for Doppler Radar Vital Sign Monitoring,"* Proceedings 2009 International Microwave Symposium, July 2009.

- Markus, A., Davidzon, G., Law, D., Verma, N., **Fletcher, R.**, Khan, A., Sarmenta, L.; *"Using NFC-Enabled Phones for Public Health in Developing Countries,"* Proceedings of 1st IEEE Conference on Near-Field Communication (NFC), 2009 – Winner 1st place NFC Forum Global Competition 2009.

- Markus, A., Davidzon, G., Law, D., Verma, N., **Fletcher, R.**, Khan, A., Sarmenta, L.; *"Using NFC-Enabled Phones in Developing Countries"*, Proceedings of American Medical Informatics Association, May 27-30, 2009, Orlando, FL. ***Best Paper Award***

- Redemske, R., **Fletcher, R.**; *"The Design of UHF Tag Emulators with Applications to RFID testing and Data Transport,"* Proceedings of 4nd IEEE Conference on Automatic Identification Technologies, October 2005.

- **Fletcher, R.**, Marti, U.P., Redemske, R.; *"Study of UHF RFID Signal Propagation through Complex Media,"* IEEE Antennas and Propagations Society International Symposium, 2005, Vol. 1B, July 2005, p. 747-750.

- Pentland, A., **Fletcher, R.**, Hassan, A.; *"DakNet: Rethinking Connectivity in Developing Nations"*, Computer, IEEE Computer Society, (featured as the cover story), Vol. 37, Issue 1, January 2004, p.78-83. (**over 700 citations**)

- Pentland, A., **Fletcher, R.**, Hassan, A.; *"A Road to Universal Broadband Connectivity"*, Proceeding of 2nd International Conference on Open Collaborative Design for Sustainable Innovation," Bangalore, India, Dec. 1-2, 2002.

- **Fletcher, R.**, Omojola, O., Boyden, E.; *"The Design of Agile RFID Tags as a Catalyst for RFID Standardization,"* 3nd IEEE Conference on Automatic Identification Technologies, March 2002.

- **Fletcher, R.**, Omojola, O., Gray, S.; *"Application of RFID to Remote Sensors and Wireless Data Peripherals,"* 3nd IEEE Conference on Automatic Identification Technologies, March 2002.

- Ju, W., Bonanni, L., **Fletcher, R.**, Hurwitz, R., Judd, T., Post, R., Reynolds, M., Yoon, J.; *"Origami Desk: Integrating Technological Innovation and Human-Centric Design,"* Proceedings of the Conference on Designing Interactive Systems: processes, practices, methods, and techniques , June, 2002.

- Post, R., Maguire, Y., Omojola, O., Strachman J.P., **Fletcher R.**; *"An Installation of Interactive Furniture*," IBM Systems Journal, Vol 39 No 3&4, 2000.

- **Fletcher, R.** Gershenfeld,N.; *"Remotely Interrogated Temperature Sensors Using Magnetic Materials*," Magnetics, IEEE Transactions on, Volume 36, Issue 5, Part 1, Sept 2000, p1569-1575.

- **Fletcher, R.**, Omojola, O., Boyden, E.; *Reconfigurable Agile Tag Reader Technologies with Combined EAS and RFID Capabilities*," 2nd IEEE Conference on Automatic Identification Technologies, 1999.

- Weinberg, G., **Fletcher, R.**, Gan, S.; *"The BabySense Environment – Enriching and Monitoring Infants' Experiences and Communication,"* Proceedings of Computer Human Interface Conference, CHI '98, Los Angeles, CA. pp. 325-326.

- **Fletcher, R.**, Gershenfeld, N.; *"Materials-Based Approach for Low-Cost Electromagnetic Tagging*," Auto-ID '97, First IEEE Conference on Automatic Identification Technologies, IEEE Robotics and Automation Society, 1997.

- **Fletcher, R.**, Levitan, J., Rosenberg, J., Gershenfeld, N.; *"Applications of Smart Materials to ID Tags and Remote Sensing*," Proceedings of Materials Research Society Fall Meeting, 1996, vol 360.

- **Fletcher, R.**; *"Force Transduction Materials for Human-Technology Interfaces*," IBM Systems Journal, Vol 35 No 3&4, 1996.

- **Fletcher, R.**, Cook, J.; *"Measurement of High-Tc Superconductor Surface Impedance as a Function of Temperature Using a Dielectric Resonator Technique*," Review Of Scientific Instruments, Vol. 65, No. 8, Aug1994.

Keynotes and Invited Talks to large audiences:

Keynote: *"Emerging Mobile Technologies and Artificial Intelligence for Public Health," AI and Smart Health Workshop,* West Virginia University, July 21-23, 2021.

Keynote: *"Emerging Mobile Technologies and Artificial Intelligence for Public Health," Annual Global Health Conference,* West Virginia University, Oct. 2019.

Keynote: *"Mobile Technologies and Artificial Intelligence Applied to Global Health," Maker Health Conference,* Bogota, Colombia, Dec. 2019.

Speaker: *"IoT and Behavior Change: Can We Build a GPS for Our Brains?,"* MIT Digital Health Conference, Sept. 2016.

Speaker: *"Sensors for Tracking Behavior and Mental Health,."* MIT Research and Development Conference, Nov 2014.

Keynote: *"Mobile Health Technologies," Medicine 2.0 Conference,* London, England, Sept. 2013.

Keynote: *"The Emerging Impact of Mobile Health," Digital Innovation and Technology for Patient Benefit Conference, Institute of Digital Healthcare*, Warwick, England, Nov 2011.

"Overview of Real-time Location Systems using Active RFID," Invited session for *IEEE RFID Conference 2010*, Orlando, Florida, April 2010.

Speaker: *"Overview of RFID Industry and Commercial Applications"*
Invited briefing to National Academies for special conference on Nano-Technologies and Tagging
Washington, DC., Feb 2004.

Speaker: *"Electromagnetic Issues in RFID and Packaging Materials"*; International Conference on Intelligent Packaging, Miami, Jan. 2003.

Speaker: "*Enabling Technologies for Future RFID Systems*", World-wide industry conference, DataLogic Sorrento, Italy. (audience over 2,000 people)

Keynote: *"Tiny Chips and New Materials: Enabling Technologies for Smart Things"*
Smart Card Alliance Annual Meeting, Pheonix, November 2002
(this is the largest annual industry conference for the Smart Card mobile payment industry, including NFC)

Workshops, Panel Sessions, Courses, and Tutorials:

"New Diagnostic Tools and Algorithms for COVID-19", D. Smith, M. Elgendi, N. Savvas, R. Fletcher. Session organizer and speaker, IEEE Engineering in Medicine and Biology , Annual Meeting, Guadalajara Mexico, Nov 2021.

"Engineering Behavior: Engineering and Computer Science Work that Facilitate Better mHealth Research,", R. Fletcher, D. Rivera, S. Kumar, E. Hekler, and W. Neilsen. Society for Behavior Medicine, Annual Meeting, Philadelphia, Apr 2014.

"Mobile Technologies for Assessing and Supporting Mental Health and Behavioral Therapy", D. Mohr, S. Kumar, R. Fletcher, N. Leonard. Session organizer and speaker, IEEE Engineering in Medicine and Biology , Annual Meeting, Chicago, Ill., Aug 2014.

"Wearable Sensors for Behavioral Medicine: Lessons Learned and Future Challenges," R. Fletcher, D. Mohr, S. Kumar, N. Leonard, and S. Mota. Session organizer and speaker, Society for Behavior Medicine, Annual Meeting, Philadelphia, Apr 2014.

"*Biomedical Applications of RFID*", Workshop, IEEE RFID Conference, Orlando, FL, 2013.

"Electromagnetic Sensors for Plants and Environmental Sensing," Invited series of talks to educators from Latin America. (talks presented entirely in Spanish), Annual Latin-American Education Conference, Costa Rica, August 26-28, 2005. Sponsored by Cientec (http://www.cientec.or.cr)

"Overview of Chipless RFID"; Smart Labels 2002 Conference, Cambridge, England, Oct 2002.

"Overview of Packaging and Electromagnetic Issues for RFID"; Smart Labels USA Conference, Boston, March 2003

U.S. Patents:

I am the lead inventor on almost all my MIT patents, and most of my industry patents. Several of these have been successfully licensed to outside companies.

21 Patents granted:

- **US 8,655,441** "Methods and Apparatus for Monitoring Patients and Delivering Therapeutic Stimuli"
- **US 8,525,677** "Blister Package with Integrated Electronic Tag and Method of Manufacture" (2nd)
- **US 8,140,143** "Washable Wearable Biosensor"
- **US 8,120,492** "Blister Package with Integrated Electronic Tag and Method of Manufacture"
- **US 8,033,478** "System and method for RFID-based printed media reading activity data acquisition and analysis" (2nd patent)
- **US 7,740,179** "System and method for RFID-based printed media reading activity data acquisition and analysis"
- **US 7,327,705** "Hybrid Wireless Network for Data Collection and Distribution"
- **US 7,221,275** "Tuneable Wireless Tags Using Spatially Inhomogeneous Structures"
- **US 7,216,805** "Method and Apparatus for Counting and Positioning Resonant Tags"
- **US 6,891,474** "Electromagnetic Identification Label for Anti-Counterfeiting, Authentication, and Tamper Protection"
- **US 6,834,251** "Methods and Devices for Identifying, Sensing, and Tracking Objects Over a Surface"
- **US 6,791,452** "Platform for Item Sensing and Identification"
- **US 6,724,310** "Frequency-based Wireless Monitoring and Identification Using Spatially Inhomogeneous Structures"
- **US 6,693,540** "Wireless Monitoring and Identification Using Spatially Inhomogeneous Structures"
- **US 6,611,199** "Capacitively Powered Portable Communication Device and Associated Exciter/Reader and Related Method"
- **US 6,472,987** "Wireless Monitoring and Identification Using Spatially Inhomogeneous Structures"
- **US 6,411,213** "Radio-Frequency Identification Tag System Using Tags Arranged for Coupling to Ground"
- **US 6,380,858** "Systems and Methods for Monitoring Patient Compliance with Medication Regimens"
- **US 6,294,999** "Systems and Methods for Monitoring Patient Compliance with Medication Regimens" (2nd patent)
- **US 6,208,253** "Wireless Monitoring of Temperature"
- **US 6,025,725** "Electrically Active Resonant Structures for Wireless Monitoring and Control"

Additional patents pending in the areas of wireless health monitoring and electromagnetic sensors.

Personal:

- I am 100% Latino, both biological parents from Colombia, South America;
- Born in Miami, Florida; raised in Newark, New Jersey by single mother;
- I am a first-generation college graduate from my family;
- Changed my last name from “Ribon” to “Fletcher” upon starting college, after mother remarried;
- My first language was Spanish (fluent reading + writing), still fluent;

Veteran history:

- I’m a military veteran (US Air Force), protected veteran status, from Gulf War I, Desert Storm campaign
- When applying to college, I successfully received a congressional appointment to the US Air Force Academy (but later decided to enroll at MIT instead)

International experience:

- I have done extensive field work in many Developing Countries:
  - India, Bangladesh, Cambodia, Vietnam, Pakistan, Colombia, Costa Rica, Brazil, Philippines, Honduras with additional projects in Rwanda, Uganda
  - Travel experience in many other developed countries

Sports:

- Intramural Sports: Soccer, Volleyball, Ice Hockey
- Ashdown House (grad dorm) Team Captain: soccer 1997, 1998; finished second in MIT league
- Organized intramural sports teams (soccer, volleyball) at MIT Media Lab

Visual Arts:

- Undergraduate Minor: Visual Art and Design
- Accomplished photographer, lifetime hobby
- Trained at New England School of Photography and worked as professional photographer (dance, fashion), with photographs published in variety of magazines and newspapers.
- Awarded the MIT Schnitzer Prize in the Arts (1999). This is the top award is given annually by MIT for student achievement in the Visual Arts.