Curriculum vitae
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U.S. Citizen

SUMMARY

As an aspiring scientist, I am enthusiastic about constantly learning and teaching, especially in the fields of bioelectronics, conformable devices, and materials science. There is always more to learn, and the best way to do so is to (i) take initiative, (ii) get your hands dirty, and, (iii) after developing deep understanding backed by both experimentation and strong theory, teach others what you learned. Due to my history, I believe nothing can be taken for granted -- every grain of rice and every second of time is worth being grateful for.

Since my junior year of undergrad (Feb. 2018), I have been working in the Conformable Decoders group, focusing on creating novel, self-powered systems using microfabrication of thin film materials, digital image correlation, and machine learning. These devices target early disease detection and quantitative, localized, and wirelessly trackable decoding of the human body's ocean of patterns in conformable form factors that seamlessly integrate functional inorganic materials with soft, curvilinear biological tissues *in vivo*.

I am now transitioning to research the physics of living systems, particularly by working on the theory of nonequilibrium thermodynamics to understand the emergence of self-replicating, adapting, evolving behavior (i.e. life) in mesoscopic ensembles.

EDUCATION

Massachusetts Institute of Technology | Cambridge, MA *Jun. 2019 - Present*
M.S. & Ph.D. Candidate, Media Arts and Sciences
Relevant Coursework: *Materials at Equilibrium (Thermodynamics) (G), Electrical, Optical, & Magnetic Properties of Materials (G), Statistical Physics of Particles (G)*

Massachusetts Institute of Technology | Cambridge, MA | 3.5 years *Sep. 2015 - Dec. 2018*
Bachelor of Science, Electrical Engineering
Total GPA: 4.9/5.0 | In-Major GPA: 5.0/5.0
Relevant Coursework: *Analog Electronics Lab, Fundamentals of Programming, Solid-State Circuits, Medical Device Design (G), D-Lab: Education and Learning, Cellular Neurobiology and Computation, The Challenge of World Poverty, Signals, Systems, & Inference, Intro to Machine Learning, Feedback System Design (G), Microeconomic Theory & Public Policy, Microfabricated Devices (G), Intro to Deep Learning*

SKILLS

Electrical	Circuit design (analog, digital, mixed signal, wireless), simulation (LTSpice), and layout (Altium, Kicad) for rigid or flex PCBs; SMD soldering, reflow, and rework; Custom embedded systems design; Test equipment and automation (VSCode)
Mechanical	Mechanical design and modeling (AutoCAD, Solidworks, PTC Creo, Autodesk Inventor), Machine shop usage (mill, lathe, waterjet, laser cutter, 3D printer, drill press, bandsaw)
Software	Basic algorithms (e.g. KNN-DTW) and machine learning (e.g. Reinforcement Learning); Image processing; Research automation; Data collection, analysis, and plotting. Languages: Python, C, MATLAB, Java, HTML, Javascript
System Design & Research	Closed-loop conformable device design, fabrication, and testing; Feedback control systems design, implementation, and analysis, Microfabrication techniques in cleanroom (fabrication steps design, mask design, deposition, photolithography, etching, spin coating, transfer printing; electrical, mechanical, and vibrational characterization)
Teaching	Workshop design and implementation, Course design and implementation, Teaching assistantship (2 graduate & 6 undergraduate courses at MIT), Mentoring undergraduates in research (6 in the past year)

PUBLICATIONS

Published

Sun, T.*, ***Tasnim, F.****, McIntosh, R. T., Amiri, N., Solav, D., Anbarani, M. T., Sadat, D., Zhang, L., Gu, Y., Karami, M.A., Dagdeviren, C.†. Closed-loop conformable systems for spatiotemporal decoding of facial strains. *Nature Biomedical Engineering.* **2020**. ~Officially accepted but under final proof before publication

Obidin, N.*, ***Tasnim, F.****, Dagdeviren, C.†. The Future of Neuroimplantable Devices: A Materials Science and Regulatory Perspective. *Advanced Materials*, 1901482, **2019**. https://doi.org/10.1002/adma.201901482

Tasnim, F., Sadraei, A., Datta, B., Khan, M., Choi, K. Y., Sahasrabudhe, A., Alfonso Vega Gálvez, T., Wicaksono, I., Rosello, O., Nunez-Lopez, C., Dagdeviren, C.†. Towards personalized medicine: the evolution of imperceptible health-care technologies. *Foresight*, 20(6), 589-601, **2018**. https://doi.org/10.1108/FS-08-2018-0075

Wang, L., Panaitescu, E., ***Tasnim, F.***, Fontana, E., and Menon, L.†. 2017. Iron Oxide Decorated Titania Nanotubes for Solar Energy Harvesting Applications. *Journal of Nanoscience and Nanotechnology* 17, 3, Article 7. **2017**. https://doi.org/10.1166/jnn.2017.12824

Under Review

Tasnim, F., Acosta, D., Shahsavari, S., Schwendeman, L. A., Fernandez, S. V., Sadat, D., Dagdeviren, C.†. Ubiquitous, imperceptible conformable systems. *Foresight*. **2020**.

Now In Preparation

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*equal contribution

RESEARCH PROJECTS

Bounding injected energy versus dissipation in a minimal self-replicating system *Jul. 2020 - Present*
Using a stochastic thermodynamics and cellular automata approach to uncovering theoretical constraints on a minimal system which achieves self-replication near full complexity.

Quantifying time irreversibility in mesoscopic nonequilibrium living systems *Jul. 2020 - Present*
Studying broken detailed balance and entropy production (irreversibility) in a variety of cellular (stem cells, oncogenic cells) and subcellular systems (ribozymes).

Closed-loop conformable systems for high dynamic range strain sensing *in vivo* *Jul. 2019 - Jun. 2020*
Existing systems for biomedical strain sensing either have low bandwidth or require bulky hardware, limiting applicability to flat, low-strain regions of the body. I designed a novel conformable system which can intimately couple to any curvilinear region of the body and simultaneously capture accurate quantitative patterns of deformation with high dynamic range (high bandwidth and high sensitivity). The closed-loop system will be tested both *in vitro* on custom-built actuated mock knees and *in vivo* on patients with neuromuscular disorders, such as Parkinson's disease. Mentored 5 UROPS for this project.

Closed-loop conformable systems for spatiotemporal decoding of facial strains *Aug. 2018 - Jun. 2020*
Existing nonverbal communication systems typically result in high uncertainties, cumbersome response time, or are bulky and unsuitable for use on curvilinear regions of the body, such as the face. We introduce skin-like, conformable devices together with non-contact optical methods for full-field strain mapping and rigorous theoretical models to offer a system capable of predictable, spatiotemporal, biokinematic assessment of the face. The enabling advances in engineering science include mass-manufacturable microfabrication of soft, piezoelectric interfaces to the skin; three-dimensional reconstruction of soft-tissue surfaces in vivo under dynamic deformation conditions; extensive theoretical modeling of complex epidermis-device mechanical interactions; and algorithms for real-time detection and classification of distinct epidermal deformation signatures. Preliminary studies on healthy and amyotrophic lateral sclerosis subjects demonstrate reliable performance that establishes potential viability for use in clinically-realizable nonverbal communication technologies. Mentored 2 UROPs for this project.

TEACHING EXPERIENCE

MAS.809 Decoders 1.1: Introduction to Microfabrication (Fall), MAS.810 Decoders 1.2: Project Realization (Spring) Teaching Assistant

Sep. 2018 - May 2019

As an MIT undergraduate student, I taught MIT graduate students in MAS.809 and MAS.810 about the theory and hands-on experimental methods involved in microfabricating devices for conformable personal health monitors. TA duties involved designing lecture material, delivering lecture content, designing lab experiments for hands-on student experiments, and assisting students with microfabrication experiments in the cleanroom. MAS.810 additionally involved guiding students in the design and fabrication of microfabricated conformable device ideas conceived by them. TA ratings

6.01 (x2) Introduction to Electrical Engineering and Computer Science, 6.002 Circuits and Electronics, 6.169 Application of Circuits and Electronics, 6.101 (x2) Analog Circuits Lab Assistant

Feb. 2016 – May 2018

As an MIT undergraduate student, I taught fellow undergrads how to break down complex electronics and programming problems into do-able chunks, and how to design, test, and debug analog and digital circuits, often to perform signal processing tasks. I helped run lab sessions and shape teaching methods. I was also requested to be a TA for 6.320 Feedback Systems and 6.036 Introduction to

Machine Learning, but could not partake due to multiple ongoing projects.

YEP (Youth Electronics Program) Bangladesh Founder

Jan. 2017 - Sep. 2017

I started an initiative at MIT, partnered with JAAGO Foundation, aimed at stopping the cycle of poverty through education. I obtained funding from MIT D-Lab, created a curriculum for a three-week workshop to teach Bangladeshi Class VI students coming from Dhaka slums how to design basic circuits and build thMIT MISTI GTL Israelem on breadboards. Students' culminating project was a heartbeat monitor built around a PPG sensor. Please read more here: https://bit.ly/2BJ73ac; I'm currently looking for avenues to continue this program in Bangladesh and other international locations.

MIT MISTI Global Teaching Lab (GTL) Israel

Jan. 2017

I taught first year Israeli college students at ORT Yami in Ashdod to read and understand datasheets as well as debug simple circuits.

TEACHING PROJECTS

Interactive Web Network for Course Material Organization and Visualization

Jan. 2020 - Present

Given my interest in open digital learning, I am working from scratch on a custom-built interactive network visualization web application, the goal of which is to organize and visualize the complex web of concepts often taught in any course. My reasoning: I love books deeply, but due to their linear format, I find it extra time consuming to tie different concepts together to form a coherent whole in my nonlinear mind. As such, I figured that I should try to represent this nonlinear, interconnected network of concepts in the form of an elegant web-app. I speak of something similar to the HyperPhysics - of course, clicking on any concept will provide a detailed description of that concept; however, I'm building something that is crucially different in the following ways: it can (i) dynamically portray the local graph of any particular concept (e.g. presence of a miscibility gap), (ii) display its adjacent nodes and the reason for connection with those nodes (e.g. regular solution model, quasi-chemical model, order-disorder transformations related to miscibility gaps, etc.), (iii) allow for seamless navigation breadth-wise or depth-wise through related concepts, (iv) provide the option to organize the graph in different layouts (e.g. all statistical mechanics concepts versus macroscopic concepts) and, (v) provide the option to choose to show only specific subgraphs of the network (e.g. all topics related to the determination of binary phase diagrams or to statistical modeling of polymers). Course material for four separate courses which I have taken and/or TA'd will be utilized to test & publish my web app, open to the public for free: (1) 3.20 Materials at Equilibrium, (2) Statistical Physics of Particles. Expected finish date is end of Dec. 2020.

Interactive Web Application for Automatic Verification of Circuit Breadboard Layouts

Jan. 2020 - Present

I am simultaneously creating a web app to accompany future realizations of the Youth Electronics Program workshop. I'm developing this web-app using Javascript and various visualization libraries. The app will allow students to interactively build a breadboard circuit layout using standard DIP and through-hole components and check if their layout matches an instructor-specified circuit design before building it on a real breadboard.

INDUSTRY WORK EXPERIENCE

Electrical/Energy/Fashion Engineering Intern, Microsoft Research

Jun. 2017 - Jan. 2018

I developed body energy harvesting solutions in order to reduce form factor and energy needs of wearables, and created a novel electronic outfit that harvests energy via a knee energy harvester and powers a stunning peacock display.

Electrical Engineering Intern, Microsoft Hololens

Jun. 2016 - Aug. 2016

I developed a flexible PCB for the bring-up and testing of internal Hololens motherboards. The project involved digital circuitry design, PCB layout, system integration.

Electrical/Energy Engineering Intern, Intel Corporation, New Devices Group

Jun. 2015 - Sep. 2015

I created PCB's, firmware, and an integrated product to harvest and analyze natural sources of energy from action sports to power sensors without batteries, which reduces form factor, maintenance, and market advantage.

FELLOWSHIPS, HONORS, & AWARDS

Santa Fe Institute Complexity Interactive Accepted Student	*Sep. 2020*
World Science Festival Teaching Fellow	*Jan. 2020*
MIT Burchard Scholar	*Feb. 2018*
Microsoft Scholarship Recipient ($2.5K)	*Apr. 2017*
HerCampus 22 Under 22 Most Inspiring College Women	*Aug. 2016*
NCWIT Collegiate Award Honorable Mention ($1.5K)	*May 2016*
Microsoft Scholarship Recipient ($10K)	*Apr. 2016*
Proton Onsite Energy Scholarship Winner ($36K)	*May 2015*
Georgia Regional STAR Student	*Apr. 2015*
FIRST Robotics Regionals, First Place Alliance Captain and Regional Winner	*Mar. 2015*
NCWIT Aspirations in Computing National Runner Up and State Winner	*Mar. 2015*
Research Science Institute Scholar	*Jun. 2014*