# CORBAN N. SWAIN

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## EDUCATION

### Massachusetts Institute of Technology (MIT) – *Cambridge, MA* 2017 –

- Doctoral Candidate in Biological Engineering
- Successfully proposed thesis work on "Correlative Live Imaging & Expansion Microscopy for Neuroscience: Technology Development and Applications in Zebrafish" to pass qualifying exams. 2019
- Research Advisor: Prof.Ed Boyden
- Thesis Committee: Prof. Douglas Lauffenburger and Prof. Florian Engert
- Cumulative GPA: 4.9 / 5

### Washington University in St. Louis – *St. Louis, MO* 2012 – 17

- Bachelor of Science in Biomedical Engineering, Magna Cum Laude
- Cumulative GPA: 3.84 / 4
- Senior project: development of an iOS application in Swift for Spectrum Perception, LLC capable of configuring and running a portable biomolecular absorbance spectrophotometer over Bluetooth; mobile application could also read in, log, and visualize data from the instrument. 2017
- John B. Ervin Scholar
- James E. McLeod Scholar (one of three in 2012 matriculation year)

### Sparkman High School – *Huntsville, AL* 2008 – 12

- Cumulative GPA: 4.0 / 4, 98%
- Graduated with Advanced Endorsement in Engineering

## PUBLICATIONS

*Academic*

- Unified Methods for 3D Reconstruction in Multiview Light Field Microscopy – *in preparation 2022
- Implosion Fabrication as a Platform for Three-Dimensional Nanophotonics – *Conference on Lasers and Electro-Optics* 2021
- Nanoparticle-macrophage interactions: a balance between clearance and cell-specific targeting – *Bioorganic & Medicinal Chemistry* 2017

- Hydrolytic charge-reversal of PEGylated polyplexes enhances intracellular unpackaging and activity of siRNA – *Journal of Biomedical Materials Research Part A* 2015
- A strategy for combating melanoma with oncogenic c-Myc inhibitors and targeted nanotherapy – *Nanomedicine* 2014
- Surface passivation of carbon nanoparticles with branched macromolecules influences near-infrared bioimaging – *Theranostics* 2013

*Personal*

- Dismantling the racist mindset: Making MIT welcoming to Black students begins with teaching our children to be antiracist—and learning how ourselves – *MIT Technology Review* 2020
- Examining the Interplay Between Active and Passive Transport in Axons – *Koch Institute Image Awards Archive* 2019

## HONORS AND AWARDS

- Wishnok Prize for the Bioengineering and Toxicology Seminar platform presentation, MIT 2019
- Sloan Scholar, Alfred P. Sloan Foundation's Minority PhD Program, MIT 2017 –
- Lemelson Presidential Fellowship, MIT, 2017
- National Science Foundation Graduate Research Fellowship 2017
- Alpha Eta Mu Beta, Biomedical Engineering Honor Society member 2017
- First place winner for chemical engineering undergraduate poster session, Washington University 2016
- Tau Beta Pi, engineering honor society member 2016
- Maximizing Access to Research Careers U-STAR Fellow, Washington University 2014 – 17
- George Washington Carver Award for Undergraduate Research, Washington University 2014
- National Barry M. Goldwater Scholarship Honorable Mention 2014
- Two-time Ralph Bunche Scholar Award recipient for Academic Achievement, Washington University 2013 – 14
- Lock and Chain, Washington University Sophomore Honorary (one of fifteen in class) 2013 – 14
- US Global Grand Challenges Video Contest Runner-up, McKelvey Scholars 2013
- Outstanding Freshman Leader Award, Excellence in Leadership Awards, Washington University 2013
- James M. McKelvey Undergraduate Research Scholar, Washington University 2013 – 17

- Summer Scholar in Biology and Biomedical Research, Washington University 2012
- John J. Sparkman Award and Memorial Scholarship (awarded to one student out of a class of more than 500), Sparkman High School 2012
- National Achievement® Scholar, National Merit Scholarship Corporation 2012
- Timothy Briggs Scholarship, National Society of Black Engineers Alumni Extension, North Alabama Chapter 2012
- AP Scholar, College Board Advanced Placement Program Designation 2011
- Commendable Senior, Class of 2012, Sparkman High School 2011
- Three-time Presidential Medallion, A Honor Roll recipient, Sparkman High School 2009 – 11
- Four-time Top-3 Four-Year Scholar, Delta Sigma Theta 2009 – 12
- Duke Talent Identification Program Scholar with State Recognition: Alabama 2007 – 12
- Outstanding Graduating Student, Holy Family School 2008
- Science Olympiad Regional and State Competitor 2007 – 09
  - → Third place in Robo Cross robot building and control competition, regional (2009)
  - → First place in Compute This mental math competition, regional (2009)
  - → Third place in Robo Cross, Alabama (2008)
  - → First place in Wheeled Vehicle self-powered and self-braking vehicle design competition, Alabama (2007)

## PRESENTATIONS AND SPEAKING

*Academic*

- "Multiview Light-field Microscopy for Isotropic 3D Imaging of Neural Activity" poster presentation at the MIT Biological Engineering Retreat, MIT 2019
- "Multimodal Interrogation of Olfactory-Driven Behaviors in the Zebrafish Brain" platform presentation at the Bioengineering and Toxicology Seminar, MIT 2021
- Platform presentation at the Biological Engineering Retreat MIT, Boston, 2019
- "Multi-view light-field microscopy for isotropic 3D imaging of neural activity" platform presentation at the Bioengineering and Toxicology Seminar, MIT 2019
- "The Confluence of Scientific Inquiry and Artistic Expression" platform presentation at CoSI Sidney-Pacific Graduate Student Dinner Seminar Series, MIT 2018
- "Toward a Better Understanding of Graphene Oxide Nanomaterials for Active Biosensing" platform presentation at the Washington University Spring Undergraduate Research Symposium 2016
- "Graphene Oxide Nanomaterials for Active Biosensing" poster presentation, Washington University, 2016 2016

- "A dangerous polymer: Organic Synthesis of Poly(glutamine)" poster presentation at the University of Alabama Huntsville Research and Creative Experience for Undergraduates — 2015
- Platform presentation to the Washington University Journal Club for Undergraduates in Biological Engineering and Sciences — 2014
- Platform presentation to the St. Louis Chapter of the Biomedical Engineering Society — 2013
- "Charge Reversing, Endosomolytic Nanoparticles to Enhance Intracellular Bioavailability of siRNA" Platform presentation at the Biomedical Engineering Society Annual Meeting, Seattle, WA — 2013
- "Controlled Release of siRNA from Hydrolytically Degradable Nanomicelles for Potent Gene Knockdown" poster presentation at the Vanderbilt Research Experience for Undergraduates — 2013
- "Facile and Commercially Amenable Access to Novel Myc-Max Inhibitor Prodrugs" platform presentation at the Washington University Summer Science in Biology and Biomedical Research showcase — 2012

*Personal*

- "Being Black Globally—Musings from an Intellectual Brother," interviewed by InflexionPoint Podcast — 2022
- "An Inquisition on Liberation," remarks for MIT's 47th annual Martin Luther King Celebration — 2021

## RESEARCH PROJECTS

### Synthetic Neurobiology (Boyden Lab) – *MIT* — 2018 –

- Wrote a codebase of more than half a million lines in MATLAB for fully parametrized processing of single and multi-view light field images from 2D light fields into 3D reconstructed image volumes for applications in the high-speed whole-brain voltage imaging of zebrafish larvae. — 2018 –
- Designed, constructed, and utilized a custom pulsed blue-light stimulation system for mutagenesis and transgene integration in *C. elegans* for development of novel lines for neuro-behavorial studies. — 2021
- To create nanoscale structures using implosion fabrication I wrote a library of Python programs to convert image-based patterning masks into photoactivation mask files for import into 2-photon imaging software. — 2020 –
- Took on responsibility as manager and maintainer for the lab's electronics and shop room, computational resources, and 2 photon microscope system. — 2020 –
- Mentor to: Theodore Addo, Nicole Harris

- Mentored by: Prof. Ed Boyden, PhD; Dr. Young-Gyu Yoon, PhD; Dr. Nikita Pak, PhD; Dr. Dan Goodwin, PhD; and Dr. Justin Kinney, PhD

Aerosol and Air Quality Research Laboratory – *Washington University* 2016 – 17

- Investigated graphene oxide nano-complexes for their biosensing ability
- Employed aptamers and crumpled graphene oxide for metabolite sensors.
- Mentored by Dr. Pratim Biswas and Dr. Ramesh Raliya

Polymer Synthesis Laboratory – *University of Alabama Huntsville* 2015

- Developed novel methods to synthesize and purify glutamine homopolymers
- Mentored by Dr. Carmen Scholz and Dr. David Ulkoski

Michigan Nanotechnology Institute for Medicine and Biological Sciences 2014

- Probed the effects of surface passivation on uptake and toxicity of dendrimers
- Mentored by Dr. Sascha Goonewardena and Dr. Ryan Tsuchida

Advanced Therapeutics Laboratory – *Vanderbilt University* 2013

- Applied endosomolytic nanopolyplexes for enhanced delivery of siRNA
- Mentored by Dr. Craig Duvall and Dr. Christopher Nelson

Consortium for Translational Research in Advanced Imaging and Nanomedicine – *Washington University School of Medicine* 2012 – 14

- Developed facile syntheses of a novel c-Myc/Max inhibitor
- Studied a STAT3 inhibitor prodrug for targeted melanoma treatment
- Mentored by Dr. Gregory Lanza and Dr. Dipanjan Pan

## TEACHING EXPERIENCE

*Academic*

- Graduate Teaching Assistant for "Computational Systems Biology: Deep Learning in the Life Sciences" (6.874). Wrote and tested problem sets for machine learning applied to biological datasets in Python/Jupyter notebooks, graded student problem sets and provided individual feedback, wrote and graded exam questions, advised and graded student group projects and presentations, organized course logistics. MIT 2019
- "Code Management with Git and GitHub" presentation and workshop at the Synthetic Neurobiology retreat. Developed a three-level set of hands-on exercises to teach participants how to get started with version control and sharing of software by using git and GitHub. MIT 2018
- Graduate Teaching Assistant for "Laboratory Fundamentals in Biological Engineering" lab course (20.109). Prepared lab supplies and equipment for student 2018

use, taught students basic wet lab skills, and graded student quizzes and assignments. MIT

- Held open tutoring sessions for undergraduate students in physics, mathematics, and computer science through the Talented Scholar Resource Room, MIT — 2018 – 19
- Led an independent weekly 1 hour review session for Electromagnetism (8.02) with six undergraduate students meeting through the Seminar XL program, MIT — 2018
- "Quantitative Physiology I" Teaching Assistant, Washington University — 2016
- Organic Chemistry I Teaching Assistant, Washington University — 2015
- Introduction to Biomedical Engineering Teaching Assistant, developed a comprehensive course overhaul and restructuring with Prof. Kurt Thoroughman — 2014 – 15
- Introduction to Biomedical Engineering Problem Solving Team Leader; led a group of ten first and second-year students through the process of solving quantitative problems in electrophysiology, biomechanics, and other BME topics. — 2013 – 17
- Independent tutor in college and high school math and science courses with more than 150 hours of experience. — 2013 – 17
- Minority Association of Premedical Students, weekly general chemistry help session leader — 2013 – 14
- Pre-Calculus/Calculus Tutor, Sparkman High School Math Department — 2010 – 12

*Personal*

- Co-led and developed a curriculum entitled "Black Men Listening" to imagine and live out radically new ways of relating to other Black men and all gender identities in the Black community that promote a culture of equitable flourishing, unqualified intimacy, and sacrificial love. Group of 15 met biweekly for 10 months. — 2020 – 21
- Designed, organized and led a cyanotype alternative process printmaking workshop at the MIT Media Lab and at Jeremiah E Burke high school, Boston, MA. — 2019 – 20

## LEADERSHIP

- Co-president of the Black Art Collective. Organized and hosted the inaugural "Kaleidescope Nights" Arts Showcase featuring live performance, 2D and 3D pieces from ten student artists. — 2021 –
- President, Administrator, and Bible Study Leader Every Nation Campus Ministry, MIT — 2020 – 22
- Co-president and administrator of the Black Graduate Student Association, MIT — 2018 – 20
  - → Co-president (2018–2019). Worked to bring the BGSA back to prominence on campus after more than a year of dormancy. Commissioned and promoted a new brand identity on campus. Founded the "First Function" Black graduate student welcome event.Hosted

an Institute wide showcase of academic, artistic, and business innovations from students.
  - → Administrator (2019–2020).
- Bible Study Leader Harambee Men of Integrity small-group, Washington University 2016 – 17
- Vice President WU-SLam (Spoken-Word Poetry) 2014 – 15
- Publicity Chair of Lock and Chain Sophomore Honorary 2013 – 14
- Vice President of Biomedical Engineering Society, St. Louis Chapter. Initiated and organized a mentoring program where upperclassmen BME students would be paired with underclassman for guidance, support and connections outside of classes. 2013 – 14
- Executive Administrator of Learning to Live high school mentoring program, Washington University 2012 – 14
- Vice-President of Spanish Club, Sparkman High School 2011 – 12
- Youth Leadership Council, First Missionary Baptist Church 2012 – 10

## SOFTWARE DEVELOPMENT

- Contributor to Seaborn, an open source Python data visualization library based on matplotlib starred on GitHub by nearly ten thousand users.
- Developed Java and Python scripts for the rapid configuration of InDesign Find-Change commands via source `.yaml` files.
- Developed Python scripts to take in audio files and transform them into an abstract visualization of the temporal course of energy in the recording (e.g. a poem).
- Actively maintaining a repository of more than 150 general purpose metaprograming tools, plotting libraries, and volumetric image analysis utilities for MATLAB.
- Developed a MATLAB guided user interface for the visual selection and export of points in a 3D volume.
- Wrote a Google Chrome extension to automate the process of adding the MIT libraries proxy string to URLs for off-campus journal access.

## PROFESSIONAL PHOTOGRAPHY

- Small-business owner photographing headshots, portraits, weddings, and events. 2012 –
  Digital portfolio at corbanswainphoto.com
- Notable professional clients include:
  - → Google
  - → Beacon Press
  - → Massachusetts Institute of Technology
  - → Washington University in St. Louis
  - → Selux Diagnostics

- → Jordan Harrod – *YouTube Creator with more than 80 thousand subscribers*
- → Devyn S. Keith – *Council Member, City of Huntsville, AL District 1*

- Work published in:
  - → Reinvented Magazine's Princesses with Powertools Calendar (2022)
  - → Rhode Island Monthly (2021)
  - → Boston Common Magazine (2021)
  - → The St. Louis American (2018)
  - → Interiors and Sources Magazine (2018)
  - → Celebrating 150 Years of Washington University School of Law book(2017)
  - → Morehead-Cain Year in Review book (2017)
  - → Sparkman High School Student Newspaper (2011–2012)
  - → Sparkman High School Yearbook (2011–2012)
- Massachusetts Institute of Technology Martin Luther King Art Installation Award Winner — 2020
- Featured for traditional black and white portraiture at "Exposures II: The Sky is Not Blue" analog photography showcase — 2019
- St. Louis Arch Photo Contest Grand Prize Winner, St. Louis Post Dispatch — 2015
- 3rd Place winner for school newspaper feature photo, Alabama Scholastic Press Association, 2013 — 2013
- 1st and 3rd place winner for school newspaper feature photo, Alabama Scholastic Press Association — 2011
- Featured artist as part of student artwork display "Liquid Memory" and "Dream of Flight", Huntsville Museum of Art — 2010 – 11
- Sparkman High School Photography Program Bi-annual photography show multi-award winner including Best-in-Show — 2010 – 12

## SPOKEN-WORD POETRY

- Performance at MIT Community Vigil — 2020
- Recital and improvisation of John Legend and Common's *Glory* at the 46th annual MIT Martin Luther King Luncheon — 2020
- Repeated performances at the annual MIT Graduate Students of Color Welcome event — 2019 – 21
- Performance at Washington University first-year welcome event — 2013
- Competitor at the National College Union Poetry Slam Invitational — 2013
- All-university Poetry Champion at the Washington University Slam Poetry Grand Slam — 2013

## VOLUNTEER WORK

- Jeremiah E. Burke high school career day speaker. 4 hours, Boston, MA — 2019
- Member of the Aletheia Church Technology Media Team recording video and capturing photographs during service and events. 50 hours / year, Boston, MA — 2018 –
- "The Eureka: Peer Collaboration and Learning." Founded, designed and hosted a space where fellow students could come together for homework help, collaboration, and organic learning, Washington University — 2013
- National Society for Black Engineers annual Career Fair Support, Washington University — 2012 – 13
- Brittany Woods Middle School mentor and tutor. Tutored middle school children in math and science, provided teachers with feedback from students, St. Louis, MO — 2012 – 13
- National Honor Society Service Projects, Sparkman High School, — 2011 – 12
- Education Assistant at Sci-Quest, a children's hands-on science and learning center. Assisted and facilitated grade school students with learning and projects in the classroom during summer programs. 80 hours / year, Huntsville, AL — 2008 – 15
- Greeters Ministry, First Missionary Baptist Church — 2007 – 12

## PROFESSIONAL AND COMMUNITY DEVELOPMENT

- Racket (functional programming language) summer school, Salt Lake City, UT — 2018
- LeaderShape Institute, Leadership Capacity Development, Washington University — 2013
- AP Summer Institute for Math and Science, awarded Perfect Attendance, University of Alabama Huntsville — 2011
- Engineering Experience program, Studied applications of molecular tools in genomics research at the Broad Institute, MIT — 2011
- Nanotechnology and Engineering course Vanderbilt Summer Academy, Vanderbilt University — 2009
- Summer Science Academy II, learning about carbon nanotube research, Emory University School of Medicine — 2010
- Abnormal Psychology Scholar Weekend, Duke University — 2010
- Bio-Imaging in Research and Medicine Scholar Weekend, University of Georgia — 2010
- Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPIRE) Online Learning Community, National Aeronautics and Space Administration (NASA) — 2009 – 12
- Chemistry of Food Scholar Weekend, University of South Carolina — 2009
- Inside the Mind Weekend Academy, Vanderbilt University — 2009

- Bioengineering course Summer Science Engineering and Architecture enrichment program, Studied Brain-Computer Interfaces for Neuro-Prosthesis, Clemson University — 2009
- Transforming DNA, HudsonAlpha Institute/Sci-Quest — 2009
- Nanotechnology and Engineering Vanderbilt Summer Academy, Vanderbilt University — 2009
  - → Took course "The Art of Building Small" learning and performing nano-fabrication methods
  - → Awarded 1st Place for excellence in reporting lab results
- Human Sensation and Perception Scholar Weekend, University of Georgia — 2009
- Hematology Scholar Weekend, Duke University — 2008
- TIGERs Engineering Camp, Auburn University, received Best Attitude Award — 2008
- The Code of Life and Biotech at Home course, HudsonAlpha Institute/Sci-Quest — 2008
- Self-Study: Neuroscience, Game Theory, Quantum Mechanics, Physiology Advanced Origami Craft — 2000 – 12

*Selected University Coursework*

- Computational and Systems Biology: Deep Learning in the Life Sciences
- Frontiers in Chemical Biology
- Computational Intelligence
- Principles of Molecular Bioengineering
- Biological Networks
- Engineering Math A & B
- Organic Chemistry I & II with Labs
- Electrical Circuits with Lab
- Engineering Tools: MATLAB
- Biochemistry
- Quantitative Physiology
- Biomechanics
- Physiological Control Systems
- Engineering for First and Third World Health
- Materials Science
- Biological Imaging Technology
- Synthetic Biology and Metabolic Engineering

*Member of Organizations and Teams*

- MIT Outdoor Club 2022
- Inline Club of Boston 2020 –
- Community in Bowls (CIB) Boston quad roller skating club, Administrator (2021–) 2020 –
- MIT Darkroom Society, analog photography and printmaking 2018 –
- Aletheia Church, 2017 – 22
- Black Graduate Student Association, MIT 2017 –
- WUrld Cinema and Cuisine, Engage Living and Learning Community, Washington University 2014 – 15
- Minority Association of Pre-medical Students, Washington University 2012 – 14
- National Society of Black Engineers 2012 – 14
- Association of Black Students, Washington University 2012 – 17
- Sparkman High School Track Team, 400 m dash 2006 – 12

## CLINICAL EXPOSURE

- Volunteer work at Huntsville Hospital cleaning patient rooms and preparing beds. 65 hours. 2015
- Medical Scientist Training Program Annual Scientific Retreat, Higgins Lake, MI, University of Michigan Medical School 2014
- Physician Shadowing:
  - → Dr. Jason Knight, MD, PhD – *Rheumatologist*
  - → Dr. Brent Williams, MD, MPH – *General Internist*
  - → Dr. Sascha Goonwardena, MD – *Cardiologist*
  - → Dr. Heidi Schaefer, MD – *Transplant Nephrologist*
  - → Dr. Mell Welborn, MD – *Vascular Surgeon*
  - → Dr. Frank A. Honkanen, MD – *Pathologist*
- Med School 101 course at Vanderbilt Summer Academy. Gave presentation on "Targeted Drug and Gene Delivery: Liposomes" 2011
- Medicine: Anatomy, Carolina Master Scholars Series summer program included Case Investigations, Symptomatology, and Cadaver Dissections 2010

## PRESS

- "Protesters march from Cambridge to Boston, demanding justice for Daunte Wright," *Boston Globe*, 2021
- "Exploring his depth of field: Photographer, poet, and PhD student in biological engineering Corban Swain pursues diverse interests with a keen eye," *MIT News*, 2018