

Trevor Bush

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RESEARCH INTERESTS

Pharmacology, Ethnopharmacology, Pharmacognosy, Medicinal Plant Chemistry, Systems/Network Pharmacology, Systems Biology, Multi-Omics, Proteomics, Lipidomics, Spatial Omics, Polypharmacology, Synergy, Immunomodulation, Inflammation, Autoimmunity, Aging, Chronic Disease Bioinformatics & Computational Biology, Single-Cell technology, Precision Medicine, Translational Science

EDUCATION

Yale University, New Haven, CT
PhD Pharmacology

May 2031

Worcester Polytechnic Institute, Worcester, MA
Bachelor of Science, Biotechnology and Biochemistry, GPA 3.88

May 2025

COURSEWORK

Medical and Applied Immunology, Medicinal Chemistry, Mechanisms of Drug Action, Principles of Signal Transduction, Organic Chemistry 1-3, Anatomy and Physiology, Chemical Thermodynamics, Protein Structure and Function, Nucleic Acids and Bioinformation, Metabolism and Disease, Lipids and Biomembrane Functions, Statistics in Genetics and Bioinformatics, Bioinformatics, Quantitative Methods in Biology and Biophysics

SKILLS

Programming Languages: R Studio, Python, MatLab

Software: Chimera, AlphaFold, GraphPad Prism, ImageJ, BLAST, Multiple Sequence Alignment

Lab Techniques: Cell Culture (CRL-2097, CT-1005, NIH-3T3, HaCaT, MCF-7, Hybridoma, *E. coli*, HEK-293), qRT-PCR, Western Blot, ELISA, Confocal Microscopy, Immunocytochemistry, Transfection, Mutagenesis, Transformation, Phage Culture & Plaque Assay, Nematode Culture, Plaque Assay, Column Chromatography, UV-Vis Spec., Resazurin Assay, Brine Shrimp Lethality Assay, Sirius Red/Fast Green Collagen Detection, Michaelis-Menton Kinetics

Language: Spanish – Professional Working Proficiency C1

Certifications: CPR/AED/First Aid, Kognito

RESEARCH EXPERIENCE

Liu Lab Rotation Student, Yale University

- Advanced MALDI technique with AgNO₃ to spatially detect and quantify lipid species in mouse brain, lung, and liver

Cheng Lab Rotation Student, Yale University

October 2025 – January 2026

- Identified potent inhibitors of SMPD1 in *Punica granatum* using LC-MS

Bennett Lab Rotation Student, Yale University

September 2025 – October 2025

- Assessed necessity of TNF receptor-associated factor as a JNK substrate in MKP5/TGF- β signaling using siRNA, MKP5 KO/WT MEF, & westerns

Weathers Lab Undergraduate Researcher, WPI

April 2023 – August 2025

- Investigated therapeutic & mechanistic properties of *Artemisia annua* and *A. afra* for treating TB, and fibrosis
- Cultured human dermal fibroblasts (HDF) and treat cells with *A. annua* tea, artemisinin, and derivatives with \pm TGF β
- Quantified pro/anti-fibrotic protein concentrations in HDF with ELISA, immunofluorescence, western blot
- Determined gene regulation via pro/anti-fibrotic gene regulation using qRT-PCR
- Conducted brine shrimp lethality assays to assess cytotoxicity of *A. afra* fractions to develop a novel TB therapeutic

PROJECT EXPERIENCE

Experimental Genetic Engineering, WPI

October – December 2024

- Transformed *E. coli* twice to produce a blue shifted GFP with an improved quantum yield

Interactive Qualifying Project, WPI & UCuenca

January – May 2024

- Conducted an economic and environmental assessment of farmers' practices to propose strategies that alleviate a pertinent agricultural problem in Cuenca, Ecuador

Cell Culture Models for Tissue Regeneration, WPI & Holy Cross

January – March 2024

- Developed a 3D fibrosis model using a spinach scaffold and wrote a journal article

Bioinformatics, WPI

October – December 2023

- Computationally analyzed *B. burgdorferi* P35 antigen to propose drug targets for inhibiting factor H-binding protein
- PDB, UniProt KB, CLUSTALW, UCSF Chimera, and HDOCK, were integrated for proteomic, structural, sequence, and docking analysis to elucidate P35 Antigen's characteristics and propose a novel drug target

Immunotherapies: The Next Generation of Pharmaceuticals, WPI

August – October 2023

- Produced, characterized, and purified mouse IgG monoclonal antibodies from a hybridoma cell line
- Employed Pierce 660 protein assay, ELISA, 1D-SDS PAGE, and Western Blot to confirm presence and quantify IgG

TEACHING EXPERIENCE

Biotechnology Peer Learning Assistant, WPI, Worcester, MA January 2023 – Present

- Lead discussion/review sections, mentored course project/presentations, created rubrics and graded assignments
- Courses Assisted: Biodiversity 2x, Animal Behavior, Capstone Course Gut-Brain Axis
- Developed curriculum and co-taught for *Foundations of Ecology and Environmental Biology*

WORK EXPERIENCE

Arts and Sciences Undergraduate Advisory Board, WPI, Worcester, MA August 2024 – May 2025

- Advise the Dean of Arts and Sciences on initiatives that will have a direct impact on students
- Increase the visibility of the Arts & Sciences
- Promote the accomplishments of talented students and faculty

Biology and Biotechnology Department Ambassador, WPI, Worcester, MA April 2024 – May 2025

- Assist with departmental presentations at outreach events
- Communicate regularly with assigned first-year advisees
- Post news and reminders to department social media feeds

Community Advisor, WPI, Worcester, MA August 2022 – December 2024

- Selected orientation leader for first year students
- Advised and assisted a total of 80 students throughout the course of the fall semester
- Lead programs that facilitate community, professional development, networking, and wellbeing

Admissions Tour Guide, WPI, Worcester, MA January 2022 – May 2025

- Selected to work for the Office of Admissions and provide tours to prospective students and families

Head Counselor, Cape Cod Museum of Natural History, Brewster, MA June 2016 – August 2022

- Created curriculum and taught 6th graders the principles of STEM, biomimicry, biology, ecology, & the environment
- Led hikes, experiments, paddle boarding, and museum programs and tours

PUBLICATIONS

1. Hoffman, D., Garcia, J., Bush, T., & Shen, J. (2024). *An economic and environmental assessment of farmers' practices to propose strategies that alleviate a pertinent agricultural problem in Cuenca, Ecuador.* : Worcester Polytechnic Institute. https://digital.wpi.edu/concern/student_works/jh343x67x?locale=en
2. Bakermans, M., Bush, T., & Abraham, L. (2024) *Current Challenges in Biodiversity and Conservation, Volume 2.* : Worcester Polytechnic Institute. <https://doi.org/10.55900/dVrNXWn1>
3. Sadlon, A., San Martín, W., & Bakermans, (2022). M. *Biodiversity Loss in the Age of the Sixth Mass Extinction.* : Worcester Polytechnic Institute. <https://doi.org/10.55900/34zi8r81>

JOURNAL PUBLICATIONS

4. Bush T, Urakawa M, Dutson E, Towler M, Weathers P. (2026). Differential effects of *Artemisia sp.* and artemisinins on dermal fibrosis. Proceedings of the 1st Artemisia Symposium held Oct.8-10, 2025 in Arusha, Tanzania. Acta Horticulturae, Accepted.
5. Kellogg, J. J., Alonso, M. N., Jordan, R. T., Xiao, J., Cafiero, J. H., Bush, T., Towler, M., Weathers, P., & Shell, S. S. (2023). A methoxylated flavone from *Artemisia afra* kills *Mycobacterium tuberculosis*. *bioRxiv : the preprint server for biology*, 2023.10.11.561885. <https://doi.org/10.1101/2023.10.11.561885>

PRESENTATIONS

1. "Identification of JNK Substrates Involved in MKP5/TGF- β Signaling and Fibrosis." **Lab Rotation Presentation at Yale, MA.** October 2025.
2. "Differential Effects of *Artemisia sp.*, Artemisinin, and Dihydroartemisinin in Human Dermal Fibroblasts." **Major Qualifying Project Presentation Day at WPI, MA.** April 2025.
3. "Validating Methodology for MMP3 and Collagen Detection and Quantification in Human Dermal Fibroblasts." **External Arts and Sciences Advisory Board at WPI, MA.** October 2024.
4. "Validating Methodology for MMP3 and Collagen Detection and Quantification in Human Dermal Fibroblasts." **Undergraduate Summer Research Showcase at WPI, MA.** August 2024.
5. "Fibrotic responses differ after treatment with *Artemisia sp.*, artemisinin, and its derivatives." **World Congress on In Vitro Biology in St. Louis, MO.** June 2024.

6. “An economic and environmental assessment of farmers' practices to propose strategies that alleviate a pertinent agricultural problem in Cuenca, Ecuador.” **WPI Project Showcase in Cuenca, Ecuador**. May 2024.
7. “Toxicity Testing of Artemisia annua and afra Teas, Crude Extracts, and Fractions to Develop a TB Therapeutic.” **Undergraduate Summer Research Showcase at Worcester Polytechnic Institute, MA**. August 2023.

LEADERSHIP

Executive Board Member, Christian Bible Fellowship, WPI	April 2023 – May 2025
VP of Recruitment, Omicron Delta Kappa, WPI	October 2022 – May 2025
Founder/President, Spanish Fluency Association, WPI	April 2022 – February 2024
VP, Biotechnology Club, WPI	October 2021 – February 2024

HONORS & AWARDS

ACMAP Student Travel Award	February 2026
Provost Major Qualifying Project Award (1st Place)	April 2025
In Vitro Animal Sciences Poster Presentation Competition First Place Award, Society of In Vitro Biology	June 2024
WPI Two Towers Prize Honorable Mention, WPI	April 2024
LaPré Summer Research Fellowship, Department of Biology and Biotechnology WPI	March 2024
SIVB Student Travel Award, Society of In Vitro Biology	February 2024
Wilton R. Earle Award, Society of In Vitro Biology	February 2024
Trustee Mentor Program, WPI	Fall 2023
Omicron Delta Kappa, ODK National Leadership Honor Society	November 2022
Dean’s List, WPI	Fall 2022 – May 2025
Biotechnology Merit-Based Scholarship, WPI	August 2021 – May 2025

SERVICE

Construction Volunteer, Habitat for Humanity North Central Massachusetts	March 2019 - June 2021
Youth Band and Church Pianist, Trinity Congregational Church Bolton, MA.	August 2016 - January 2024

REFERENCES

Assistant Professor Xiaoi Zhao, Yale Comparative Medicine Department
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 Principal Investigator

Henry Bronson Professor Yung-Chi Cheng, Yale Pharmacology Department
 +1 (203) 785 7118
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 Thesis Committee Member

Associate Professor Yansheng Liu, Yale Pharmacology Department & Yale Cancer Center
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 Thesis Committee Member

Professor Pamela Weathers, WPI Biotechnology Dept., Affiliated: Biomedical Engineering, Biochemistry
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 Academic advisor and principal investigator for four years