Nathan (Nat) B Wang, PhD

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EDUCATION

PhD Chemical Engineering (*GPA: 5.0/5.0*)
Massachusetts Institute of Technology**,** Spring 2025 (Defense: 04/10/2025)
Advisor: Kate E Galloway
Thesis: Synthetic and systems biology approaches to engineer cell fate for cell therapies

BS Chemical Engineering, Certificate in Computer Sciences (*GPA: 4.0/4.0*)
University of Wisconsin–Madison**,** 2019

PROFESSIONAL EXPERIENCE

Researcher with Prof. Kate E Galloway Since 2019
Massachusetts Institute of Technology Cambridge, MA

- Engineered direct conversion of primary mouse embryonic fibroblasts into induced motor neurons
  - Improved conversion yield to >1,000% and purity to >95% (x1,000 and x100 fold improvement)
  - Worked with collaborators to engraft reprogrammed cells into mice *in vivo*
  - Validated induced neurons using scRNA-seq and functional assays (MEA, Ca^{+2} signaling)

- Designed and implemented genetic circuits in primary cells & iPSCs for reprogramming or gene editing
  - Experience with recombinase-DNA circuits, modRNA, selection markers, protein degradation tools, tools for translational rate control, gene syntax design, viral transcript design (lenti, retro, AAV), miRNA circuits

- Led and contributed to diverse science communication projects
  - Led 2 first-author publications; contributed as co-author on 2 manuscripts (both in review); wrote 2 first-author review articles
  - Peer-reviewed several research articles and was featured as an exemplary peer-review in *Cell Systems*
  - Organized new symposium for Boston mammalian synbio with 160 registered attendees in inaugural year

- Mentored undergrad and grad students in lab skills, experimental design, and hypothesis generation
- Developed key assays, protocols, and physical & digital infrastructure as one of the first grad students (one of three) in a new lab

Undergrad researcher with Prof. Sean P. Palecek 2016 – 2019
UW–Madison Madison, WI

- Synthesized, performed, and modeled antifungal and hemolysis assays for over 85 α/β-peptides
- Screened for synergism between different combinatorial drug treatments with 14-helical β-peptides

Drug delivery summer intern Summer 2018
Genentech South San Francisco, CA

- Developed and tested polymer-solvent depots for sustained release of antigen-binding fragment (Fab)

Undergrad researcher with Prof. Lih-Sheng Turng 2014 – 2016
UW–Madison Madison, WI

- Measured effects of electrospun fiber scaffold structure on cell proliferation and morphology

PUBLICATIONS

FIRST-AUTHOR RESEARCH

Wang, NB, Lende-Dorn, BA, Beitz, AM, Adewumi, HO, Han, P, O'Shea, TM, Galloway, KE. Proliferation history and transcription factor levels drive direct conversion. *Cell Systems*. 2025. DOI:10.1016/j.cels.2025.101205

Wang, NB, Adewumi, HO, Lende-Dorn, BA, Beitz, AM, O'Shea, TM, Galloway, KE. Compact transcription factor cassettes generate functional, engraftable motor neurons by direct conversion. *Cell Systems*. 2025. DOI: 10.1016/j.cels.2025.101206

CO-AUTHOR RESEARCH

(In review) Blanch-Asensio, A, Ploessl, DS, **Wang, NB**, Mummery, CL, Galloway, KE, Davis, RP. STRAIGHT-IN Dual: a platform for dual, single-copy integrations of DNA payloads and gene circuits into human induced pluripotent stem cells. *bioRxiv*. 2024. DOI: 10.1101/2024.10.17.616637 (in review at *Nature Biotechnology*)

(In review) Beitz, AM, Teves, JMY, Oakes, C, Johnstone, CJ, **Wang, NB**, Brickman, JM, Galloway, KE. Cells transit through a quiescent-like state to convert to neurons at high rates. *bioRxiv*. 2024. DOI: 10.1101/2024.11.22.624928 (in review at *Cell Systems*)

Chang DH, Lee, MR, **Wang, NB**, Lynn, DM, Palecek, SP. Establishing Quantifiable Guidelines for Antimicrobial α/β-Peptide Design: A Partial Least-Squares Approach to Improve Antimicrobial Activity and Reduce Mammalian Cell Toxicity. *ACS Infectious Diseases*. 2023. DOI: 10.1021/acsinfecdis.3c00468

de L. Rodríguez López A, Lee, MR, **Wang, NB**, Dunn, KK, Sanchez, H, Raman, N, Andes, DR, Lynn, DM, Palecek, SP. Small-Molecule Morphogenesis Modulators Enhance the Ability of 14-Helical β-Peptides To Prevent *Candida albicans* Biofilm Formation. *Antimicrobial Agents & Chemotherapy*. 2019. DOI: 10.1128/AAC.02653-18

Koshari, S, Chang, DP, **Wang, NB**, Zarraga, IE, Rajagopal, K, Lenhoff, AM, Wagner, NJ. Data-Driven Development of Predictive Models for Sustained Drug Release. *J. of Pharmaceutical Sciences*. 2019. DOI: 10.1016/j.xphs.2019.06.027

Jiang, L, Wang, L, **Wang, NB**, Gong, S, Wang, X, Wang, L, Li, Q, Shen, C, & Turng, LS. Fabrication of polycaprolactone electrospun nanofibers with different hierarchical structures mimicking collagen fibrils for tissue engineering scaffolds. *Applied Surface Science*. 2018. DOI: 10.1016/j.apsusc.2017.08.005

REVIEWS & OTHER

Wang, NB, Galloway, KE. Evaluation of Lee et al.: Clarity and interpretation of mutual information in promoter transfer functions. *Cell Systems*. 2021. DOI: 10.1016/j.cels.2021.08.014

Wang, NB, Beitz, AM, Galloway, KE. Engineering cell fate: Applying synthetic biology to cellular reprogramming. *Current Opinion in Systems Biology*. 2020. DOI: 10.1016/j.coisb.2020.09.002

Johnstone, CP* & **Wang, NB***, Sevier, SA, Galloway, KE. Understanding and Engineering Chromatin as a Dynamical System across Length and Timescales. *Cell Systems*. 2020. DOI: 10.1016/j.cels.2020.09.011. *These authors contributed equally to this work.

AWARDS, HONORS, & SCHOLARSHIPS

- **International Society for Stem Cell Research (ISSCR) Merit Abstract Award, 2023**
- International Society for Stem Cell Research (ISSCR) Travel Award, 2023
- MIT Graduate Student Council Conference Grant Travel Award, 2022
- **NSF Graduate Research Fellowship, 2019**
- **Barry Goldwater Scholarship, 2018**
- Future Leaders of Chemical Engineering Award, 2018
- Roger J. Altpeter Award for Best Writing in Transport Phenomena Laboratory, 2018
- Astronaut Scholarship (45 recipients chosen nationally from distinguished research institutions), 2017
- Genentech Outstanding Student Award, 2017
- Chemical & Biological Engineering Department Scholarships, 2017-2018
- ACS Award for Excellence in Organic Chemistry (scored top 5% nationally on ACS exam), 2017
- Sophomore Research Fellowship, 2017
- Summer Research Scholarship, 2017

PRESENTATIONS & CONFERENCES

SELECTED PRESENTATIONS

Feb, 2024. Talk. Cell Circuits and Epigenetics Seminar. *Proliferation history and transcription factor levels drive direct conversion*. The Broad Institute of MIT and Harvard, MA.

July, 2023. Talk. Synthetic Biology Gordon Research Seminar. *Systems biology-guided design and molecular optimization of transcription factor cassettes for robust, highly efficient reprogramming*. Newry, ME.

June, 2023. Poster. International Society for Stem Cell Research (ISSCR) Annual Meeting. *Systems biology-guided design and molecular optimization of transcription factor cassettes for robust, highly efficient reprogramming*. Boston, MA.

Nov, 2022. Talk. American Institute for Chemical Engineers (AIChE) Annual Meeting. *Minimization of reprogramming cocktail supports robust, highly-efficient reprogramming*. Phoenix, AZ.

OTHERS

June, 2024. Poster. Synthetic Biology: Engineering, Evolution & Design (SEED). *Proliferation histoy and transcription factor levels drive direct conversion*. Atlanta, GA.

July, 2023. Poster. Synthetic Biology Gordon Research Conference. *Systems biology-guided design and molecular optimization of transcription factor cassettes for robust, highly efficient reprogramming*. Newry, ME.

Aug, 2022. Talk. Boston Mammalian Synthetic Biology Symposium. *A streamlined protocol for highly-efficient motor neuron reprogramming*. Massachusetts Institute of Technology.

April, 2022. Talk. Chemical Engineering Doctoral Student Seminar. *Optimizing motor neuron reprogramming:*
a testbed for cell-fate transitions. Massachusetts Institute of Technology.

April, 2022. Poster. Multi-Cellular Engineered Living Systems Symposium. *Highly efficient motor neuron reprogramming reveals unexpected role for proliferation in facilitating transition to a post-mitotic cell-fate*. MIT Center for Multi-Cellular Engineered Living Systems.

Oct, 2018. Poster. Future Leaders of Chemical Engineering National Award Symposium. *Synergistic enhancement of 14-helical β-peptide antifungal activity against C. albicans biofilm formation*. North Carolina State University.

Aug, 2018. Poster. Genentech Pharma Technical Operations Intern Poster Session. *Polymer-solvent depots for use as a long-acting delivery system*. Genentech, South San Francisco, CA.

May, 2018. Poster. Undergraduate Chemical Engineering Poster Session. *Enhancement of 14-helical β-peptide antifungal activity against C. albicans biofilm formation*. University of Wisconsin – Madison.

April, 2018. Poster. Undergraduate Chemical Engineering Poster Session. *Predicting the antifungal activity of α/β-peptides against C. albicans using SVM regression*. University of Wisconsin – Madison.

TEACHING & MENTORING EXPERIENCE

TEACHING EXPERIENCE

Teaching assistant Jan 2022 – May 2022
Massachusetts Institute of Technology Cambridge, MA

- Created and graded exams, and held office hours for "Chemical Engineering Thermodynamics"

Student assistant Jan 2017 – May 2019
UW–Madison Madison, WI

- Taught 1 discussion section per week for "Introduction to Chemical Process Modeling" which uses MATLAB as the programming language for 5 semesters

Tutor/General body member for National Society of Black Engineers Sept 2017 – May 2019
UW–Madison Madison, WI

- Tutored students in thermodynamics and transport phenomena at weekly study tables

Tutor for Division of Diversity, Equity & Educational Achievement Sept 2016 – Dec 2016
UW–Madison Madison, WI

- Group tutored 2 undergraduate students and 1 individually in "Introduction to Biology"

MENTORING EXPERIENCE

Galloway lab	Brittany Lende-Dorn (PhD student), Kei Takahashi (Postdoc)
Rotation students	Evan Holbrook (PhD student), Judy Xia (PhD student), Allison Glynn (PhD student), Mead Lockwood (PhD student)
Undergrad students	Freya Edholm, Antonio Diaz, Jessie Liu

LEADERSHIP & OUTREACH

Boston Mammalian Synthetic Biology Symposium Aug 17, 2022
Co-Lead Organizer with Prof. Kate E Galloway Cambridge, MA

- Organized symposium for Boston mammalian synthetic biology researchers with 16 talks, 19 posters, and 160 registered attendees

Summer Science Camp at the Wisconsin Institute for Discovery July 12 & 26, 2017
Volunteer Madison, WI

- Mentored high school students from underserved areas in lab skills and cell culture

Engineering Expo April 8, 2017
Competition Leader Madison, WI

- Science competition leader for elementary and middle school students

TECHNICAL SKILLS

Lab Skills: Cell reprogramming, mammalian synbio, genetic engineering, multicolor flow cytometry, scRNA-seq, molecular biology techniques, cloning, genetic circuit design, mammalian & primary cell culture
Computer Languages: Python, R, MATLAB