PHILIP EMMANUELE

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EDUCATION

University of California, San Diego **La Jolla, CA**
Ph.D. in Bioengineering *September 2023 - Expected June 2028*

- **Relevant Coursework:** Synthetic Biology, Biochemistry, Mathematical Modeling for Bioengineering, Quantitative Biology

University of California, San Diego **La Jolla, CA**
B.S. in Bioengineering: Biotechnology *June 2023*

- **Major GPA:** 3.92/4.00

PUBLICATIONS AND CONFERENCE PRESENTATIONS

Zhang, J. T., Lezia, A., **Emmanuele, P.**, Wu, M., Olson, C. A., Somani, A., Feist, A. M., & Hasty, J. (2025). Host Evolution improves genetic circuit function in complex growth environments. *ACS Synthetic Biology*. https://doi.org/10.1021/acssynbio.5c00168

O'Laughlin, R., Tran, Q., Lezia, A., Ngamkanjanarat, W., **Emmanuele, P.**, Hao, N., & Hasty, J. (2023). A standardized set of MOCLO-Compatible inducible promoter systems for tunable gene expression in yeast. *ACS Synthetic Biology.* https://doi.org/10.1021/acssynbio.3c00184

Emmanuele P., Thomas P.J., Van der Vagt N., Kumar S., Tsimring L., Hasty J., (2025, Feb 16) *Dynamic Division of Labor using Duplicate Origins of Replication* [Poster presentation]. 2025 Winter qBio, Ko Olina, HI, United States.

Emmanuele P., Kim K., Melendrez R., Narasimman N.B., (2023, May 3) *Discovery and Characterization of Orthogonal Inducible Promoter Systems in Diatoms for use in Synthetic Biology* [Poster presentation]. 2023 Bioengineering Day, La Jolla, CA, United States.

Emmanuele P., Lezia A., Zhang J., Hasty J., (2023, February 23) *Quantifying growth of bacterial populations in microfluidics with fluorescence imaging* [Poster presentation]. 2023 Winter qBio, Rio Grande, PR, United States.

Emmanuele P., Lezia A., Zhang J., Hasty J., (2022, August 12). *Engineering Bacteria for Cancer Therapy* [Conference presentation]. 2022 UCSD Student Research Conference, La Jolla, CA, United States.

RESEARCH PROJECTS

Dynamic division of labor platform **La Jolla, CA**
UCSD Biodynamics Laboratory (PI: Jeff Hasty) *November 2024 - Present*

- **Using plasmid copy number heterogeneity** to dynamically distribute metabolic stress over time to make multistep bioprocesses more efficient.
- **Used agent based modeling** to simulate the system and found the system approaches maximally efficient rates of reaction for a multistep bioprocess.
- Designed a novel **closed loop microfluidics chip** to simulate a fed batch bioreactor.

Development of Arbitrary DNA Biorecorder **La Jolla, CA**
UCSD Biodynamics Laboratory (PI: Jeff Hasty) *February 2024 - Present*

- **Leveraging natural competence** of *Acinetobacter baylyi* to make a living DNA recorder using a non-native CRISPR cas system.
- **Developed a custom assay** to assay CRISPR array expansion due to non-native spacer integration.
- **Built a custom bioinformatic workflow** to analyze NGS reads of integrated spacers, align spacers to genomes of various bacteria, and reconstruct the distinct microbial populations of different locations of the gut.

Development of a Standardized Set of Inducible Promoter Systems in Yeast **La Jolla, CA**
UCSD Biodynamics Laboratory (PI: Jeff Hasty) *July 2022 - December 2023*

- Designed five and built four inducible systems in *S. cerevisiae* with maximal expression levels greater than those of the strong constitutive TDH3 promoter and **fold changes as high as nearly 300.**
- Characterized expression of the inducible systems with different concentrations of inducer using a **microplate reader**.
- Used **Python** to find and plot expression and total fold change of itself and compared to other established promoter systems.

Discovery and Characterization of Inducible Promoter System in Diatoms **La Jolla, CA**
J. Craig Venter Institute *June 2022 - June 2023*

- **Led a team of four bioengineering students** to design and build **the first orthogonal inducible promoter system** in *P. tricornutum.*
- **Developed and utilized motif search algorithms** to mine the *P. tricornutum* genome for novel transcription factor binding sites for use in future promoter systems.
- Used **Golden Gate assembly** and **Gibson assembly** to assemble the custom genetic parts and transcriptional units into plasmids and used recently published methods to transfect *P. tricornutum.*

Quantifying Bacterial Growth on a Microfluidics Platform **La Jolla, CA**

UCSD Biodynamics Laboratory (PI: Jeff Hasty) *August 2021 - February 2023*

- **Designed, assembled, and transformed** a genetic circuit into *E. coli* to quantify bacterial growth rates on a microfluidics platform under various conditions (media, temperature, etc…).
- Used **FIJI** and **Python** to analyze fluorescence and find replication time on a microfluidics chip
- Validated method by comparing results with published data on bacterial doubling times.

Engineered *E. Coli* Nissle as Cancer Therapy **La Jolla, CA**

UCSD Biodynamics Laboratory (PI: Jeff Hasty) *July 2021 - August 2022*

- **Evolved *E. coli* Nissle metabolic mutants** for increased growth rates in the complex tumor microenvironment **using Adaptive Laboratory Evolution**.
- **Created and characterized a library of synchronized lysis circuit (SLC) mutants** to identify stable and consistent circuit expression in a microfluidics device.
- **Developed a protocol** to coculture *E. coli* Nissle and CT26 colorectal cancer tumor spheroids for the bacterial delivery of cancer therapy *in-vitro*.

OUTREACH

High School Outreach Chair **La Jolla, CA**

Bioengineering Graduate Society *September 2023 - present*

- **Developed a network of STEM teachers at underprivileged (Title 1) schools** in the San Diego area
- **Developed 6 hands-on bioengineering lessons** for 12 different high schools that fit the curriculum of biology programs for grades 9-12 including a CRISPR lab, Illumina/Biocom bioinformatics sequencing lab, and a bioethics activity.
- Organizing lab tour events for over 250 underprivileged students who are exposed to cutting edge research such as neuromorphic integrated circuits, development of synthetic blood, and cardiac tissue modeling to spark an interest in STEM careers.

Outreach Chair **La Jolla, CA**

Biomedical Engineering Society *September 2022 - June 2023*

- **Organized 42 UCSD undergraduate volunteers** for the Light the Night charity walk in 2023, which **raised over $1.6 million for research of leukemia and lymphoma.**
- **Designed, developed, and presented** a dynamic 3D printed heart model for a booth at the San Diego Festival of Science and Engineering, which had **over 1000 K-12 students in attendance.**
- Organized a lab tour event for **68 high school students from Clairemont High School,** who interacted with graduate students and toured labs who researched biological imaging, organoids for Alzheimer's research, and biological 3D printing.

3rd Grade Lesson Leader **La Jolla, CA**

Synthetic Biology Institute *September 2022 - June 2025*

- **Developed a hands on first-exposure curriculum for 3rd graders** to learn about the water cycle, forces, and geology.
- **Led weekly lessons for 35 deaf and hard of hearing** 3rd grade students at Lafayette Elementary school.
- **Developed a minor proficiency in sign language** to better connect and teach the students.

SKILLS

Laboratory: Molecular cloning, bacterial and mammalian cell culture, Golden Gate assembly, Gibson assembly, spheroid culture, bacteria-spheroid co-culture, microfluidics, CRISPR-Cas9, yeast culture, yeast transformation, genetic circuit design, numerical systems analysis
Software: MATLAB, Python, AutoCAD, FIJI.

ADDITIONAL INFORMATION

Awards and Honors: Provost Honors (2021, 2022, 2022, 2022, 2023, 2023), 2nd place in UCSD's 2022 BioTechathalon
Hobbies: Hiking, Camping, Tennis, Running, Astrophotography, Teaching