PHILIP EMMANUELE

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EDUCATION

University of California, San Diego — **La Jolla, CA**

Ph.D. in Bioengineering — *September 2023 - Expected June 2028*

- **NIH F31 Fellow:** Ruth L. Kirschstein National Research Service Award (NRSA) Individual Predoctoral Fellowship
- **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., 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: Robert Cooper, Jeff Hasty) — *November 2024 - Present*

- Using copy number heterogeneity to dynamically distribute metabolic stress across a cell population and make chemical production more efficient.
- Built a mathematical model of the agent-based system, which showed that it approaches the maximally efficient rate of converting a reactant into a product.
- Designed a novel closed-loop microfluidic chip that simulates a fed-batch bioreactor.

Development of Arbitrary DNA Molecular Recorder — **La Jolla, CA**

UCSD Biodynamics Laboratory (PI: Robert Cooper, Jeff Hasty) — *February 2024 - Present*

- **Leveraging natural competence** of *Acinetobacter baylyi* to build a living DNA recorder with its native CRISPR immune system.
- Pioneered the adoption of sensitive DNA techniques such as TBE PAGE, PAGE gel extract, and touchdown PCR to the laboratory for regular use.
- Built and validated a bioinformatic pipeline that quality-filters NGS reads of CRISPR spacers and aligns them to reference genomes.

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 quantify and plot expression levels and fold changes, and compared them to 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).
- Used **FIJI** and **Python** to analyze fluorescence images and measure doubling times on a microfluidic 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 and Festival Outreach Chair **La Jolla, CA**

Bioengineering Graduate Society *September 2023 - Present*

- **Developed a network of STEM teachers at Title 1 schools** in the San Diego area.
- **Designed 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, bioinformatics sequencing lab, and a bioethics activity.
- Organizes an annual lab and campus tour for Title I students that exposes them to cutting-edge research such as neuromorphic integrated circuits, synthetic blood, and cardiac tissue modeling.

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 working 3D printed heart model at a booth at the San Diego Festival of Science and Engineering, which had **over 300 K-12 students attend.**
- Organized a lab tour event for **68 high school students from Clairemont High School,** who interacted with graduate students and toured labs that research biological imaging, organoids for Alzheimer's research, and biological 3D printing.

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

Synthetic Biology Institute *September 2022 - Present*

- **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 and 4th 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, PAGE and PAGE gel extraction, touchdown PCR, NGS data analysis, mathematical modeling, microfluidic device design, numerical systems analysis.
Software: MATLAB, Python, AutoCAD, FIJI.

ADDITIONAL INFORMATION

Awards and Honors: NIH Ruth L. Kirschstein NRSA Predoctoral Fellowship (F31), Provost Honors (2021, 2022, 2022, 2022, 2023, 2023), 2nd place in UCSD's 2022 BioTechathalon
Hobbies: Hiking, Camping, Tennis, Biking, Astrophotography, Teaching