OMB No. 0925-0001 and 0925-0002 (Rev. 03/2020 Approved Through 02/28/2023)

BIOGRAPHICAL SKETCH

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NAME: Paul M. Orwin

eRA COMMONS USER NAME (credential, e.g., agency login): PORWIN

POSITION TITLE: Professor, Department of Biology

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

| INSTITUTION AND LOCATION | DEGREE(if applicable) | Completion DateMM/YYYY | FIELD OF STUDY |
| --- | --- | --- | --- |
| Harvey Mudd College, Claremont, CAUniversity of Minnesota, Minneapolis, MNUniversity of Minnesota, St. Paul, MN (postdoc)California Institute of Technology, Pasadena CA | BSPhDn/an/a | 1995200120012001-2003 | BiologyMicrobiologyMicrobiologyMicrobiology |

1. **Personal Statement**Over the past 17 years, I have mentored a large number of undergraduates and MS candidates, from diverse backgrounds. Many of these students have presented posters at international meetings, and eight of them have been co-authors on peer-reviewed journal articles. Of the students who have worked in my lab as undergraduates, ten have gone on to Ph.D. programs, and five additional students have gone on to post-graduate health professional schools. These students learned how to engage in scientific thought and experimentation, and also how to report that information out to the scientific community. They also learned learned cutting edge microbiological, molecular, and genetic techniques in the course of this work. **It is a point of pride for me personally to have students (including undergraduates) as authors on all of my primary publications. Their hard work and development in the laboratory is an important output of my research.**

Although much of my work has been “pure” microbiology without a direct impact on human health, I have always been cognizant of the importance of basic science research in human health, and have always endeavored to keep that a focus of my science. Our recent work on *Variovorax paradoxus* EPS is a case in point. We have identified a surfactant molecule critical to swarming motility, and have identified at least one gene that is necessary for synthesis. We are currently very interested in evaluating the potential for this organism as a probiotic based on results indicating that it has inhibitory or bactericidal activity against Staphylococci. We are simultaneously evaluating it for nematicidal and plant growth promotion activity. This surprisingly versatile and capable organism seems to be remarkable in its ability to succeed in the environment, **and our success in this regard is testimony to the importance of basic, hypothesis driven research into environmental organisms as potential sources for novel probiotics or therapeutics.** We now have a robust collection of Variovorax isolates that we have sequenced and begun analyzing for antimicrobial activity, quorum quenching, and biofilm formation. Their diverse genome architectures, genotypes, and phenotypes will form the basis for subsequent comparative genomics and physiology projects.

**I have recently developed expertise in genome and transcriptome sequencing**. I have continued to build expertise in DNA sequencing using 2nd and 3rd generation techniques. These approaches were initially used to study our *Variovorax paradoxus* isolates, but I have built collaborations with colleagues to study the microbiomes of animals, and plan to continue building on this experience to provide students in our program with an integrative biology experience that includes physiology, genomics, molecular biology, and bioinformatics. This experience will provide excellent preparation as these students prepare to move on to the next phase of their education or profession.

**The Covid**-**19 crisis has had a major impact on the world, the nation, and the CSUSB community. I am deeply committed to doing whatever I can to help my community, and am now applying my expertise in molecular biology and DNA sequencing to this end.** My recent development of expertise in Nanopore sequencing has provided us with an opportunity to engage in the developing rapid response testing for SARS-CoV-2. In my past I have had diverse experience with antimicrobial agent development, infectious disease research, and biosensors. I feel confident that my broad understanding of many aspects of microbiology research and biotechnology, along with my deep commitment to my community, will allow me to successfully integrate my knowledge and that of my collaborators into an effort to bring much needed testing capacity to California’s disadvantaged communities.

**B. Positions and Honors**

**2001 (Feb-Jul) Postdoctoral Fellow, Biotechnology Institute (BTI), University of Minnesota**

2001 – 2003 Postdoctoral Fellow, Department of Environmental Science and Engineering, California Institute of Technology

2003 – 2009 Assistant Professor, Department of Biology, CSUSB

2009 - 2013 Associate Professor, Department of Biology, CSUSB

**2013 – Present Professor, Department of Biology, CSUSB**

**Honors and Awards**

**Sep 95 - Jun 96 University of Minnesota Graduate Fellowship**

**Jun 96 - Jun 99 NSF Predoctoral Fellowship in Biology**

**2016 College of Natural Sciences Outstanding Professor, Research and Scholarly Activities**

**C. Contributions to Science**

* **Biofilm genetics and physiology in *Variovorax paradoxus.*** Our research group has made substantial progess on understanding the underlying mechanisms of biofilm formation and swarming motility, including identifying novel mechanisms of regulation and functional analysis of this in a non-model system. *Variovorax paradoxus* is a widespread environmental bacterium that has been associated with a number of important functions in plant associated systems. It is also often detected as part of the human oral microbiome. Our studies have identified common themes in biofilm formation and swarming motility, as well as elements that are less common and may shed light on the diversity of regulatory pathways that control these fundamental bacterial behaviors. As principle investigator, I have been playing a central role in all of this work from grantwriting to experiment planning to manuscript preparation.

Fredendall RJ, Stone JL, Pehl MJ, and **Orwin PM**. (2020) Transcriptome profiling of *Variovorax paradoxus* EPS under different growth conditions reveals regulatory and structural novelty in biofilm formation. Access Microbiology DOI 10.1099/acmi.0.000121

Pehl MJ, Jamieson WD, Kong K, Fredendall RJ, Forbester JL, Healy JM, Gregory GA, McFarland JE, and **Orwin PM**. (2012). Genes that Influence Swarming Motility and Biofilm formation in Variovorax paradoxus EPS. PloS one 7 (2), e31832

Han J-I, Choi H-K, Lee S-W, **Orwin PM**, Kim J, Laroe SL, Kim T-G, et al. (2011). Complete genome sequence of the metabolically versatile plant growth-promoting endophyte Variovorax paradoxus S110. J.Bacteriol., 193(5), 1183-90.

Jamieson WD, Pehl MJ, Gregory GA, and **Orwin PM**. (2009). Coordinated Surface activities in *Variovorax paradoxus* EPS. BMC Microbiology 9:124.

1. **Genomics education and hybrid genome assembly with undergraduate and graduate students.** Working with students in the classroom and in my research lab, we have developed strategies for enriching and isolating bacteria from the environment, purifying DNA and sequencing the genomes using Illumina iSeq100 and Oxford Nanopore MinION instruments. We have developed workflows for hybrid genome assembly and publication of these genomes in the journal Microbial Resource Announcements. This work is part of an overall goal to expose our undergraduate biology students to the process of genomic data acquisition, analysis, and publication in the context of inquiry based education. This work will prepare these students to pursue advanced training in microbiology and bioinformatics. Many of these projects began in undergraduate courses that I taught, and subsequently oversaw the sequencing and assembly of the genomes, as well as manuscript preparation.

Ne Ville C, Enright D, Hernandez I, Dodsworth JA, **Orwin PM**.(2020). Complete Genome Sequences of *Pseudomonas alkylphenolica* Neo and *Variovorax* sp. Strain CSUSB, Obtained in Undergraduate Microbiology Courses Using a Hybrid Assembly Approach. Microbiology Resource Announcements (9) e01520-19

Sanders C and **Orwin PM**.(2019) Sequencing and Hybrid Assembly of Antibiotic Resistant Bacteria from an Undergraduate Microbiology Course. Presented at the Southern California Conference on Undergraduate Research, October 2019.

Perez-Marron J, Ne Ville C, Dodsworth JA, Owerkowicz T, and **Orwin PM**. (2019). The oral microbiome of Alligator mississippiensis varies with age. Presented at ASM Microbe June 2019.

1. **Superantigenic toxins in *Staphylococcus aureus.***As a graduate student I was involved in the discovery of multiple superantigenic exotoxins present in the genomes of *S. aureus*, and the evaluation of their toxic properties as well as their genomic context. These toxins were present in elements that were described as Staphylococcal Pathogenicity Islands (SaPIs) which have since been shown to be defective phage elements. The presence of multiple superantigenic toxins in each of these SaPIs, as well as the distribution of these elements across human and animal pathogen strains, provided important insights into the evolution of diversity among these elements, and their contribution to the pathogenesis of non-menstrual Toxic Shock Syndrome.

**Orwin PM**, Fitzgerald JR, Leung DYM, Gutierrez JA, Bohach GA, Schlievert PM. (2003). Characterization of *Staphylococcus aureus* Enterotoxin L. Infect Immun 71 (5) 2916-2919

**Orwin, PM**, Leung DYM, Tripp TJ, Bohach GA, Earhart CA, Ohlendorf DH, and Schlievert PM. 2002. Characterization of a novel staphylococcal enterotoxin-like superantigen, a member of the group V subfamily of pyrogenic toxins. Biochemistry 41. 14033-14040.

Yarwood JM, McCormick JK, Paustian ML, **Orwin PM**, Kapur V, Schlievert PM. 2002. Characterization and expression analysis of Staphylococcus aureus pathogenicity island 3. Implications for the evolution of staphylococcal pathogenicity islands. J Biol Chem 277(15):13138-47.

**Orwin PM**, Leung DYM, Donahue HL, Novick RP, and Schlievert PM. 2001. Biochemical and Biological Properties of Staphylococcal Enterotoxin K. Infect. Immun. 69. 360-366.

1. **Antimicrobial Drug Development and Assay Design.**  As a new faculty member in Biology, I led a team including a post-doctoral scholar from Synedgen and several undergraduate students from our department in studying a novel chitosan based antimicrobial compound. This included developing a killing assay, synergy assays with other antibiotics, and microscopy based analysis. Although it took a number of years to get to fruition, this work has now resulted in an antimicrobial product available for public use.

Narayanaswamy VP, Giatpaiboon SA, Uhrig J, **Orwin P**, Wiesmann W, et al. (2018) *In Vitro* activity of novel glycopolymer against clinical isolates of multidrug-resistant *Staphylococcus aureus*. PLOS ONE 13(1): e0191522.

1. **Biosensor development.** As a postdoc at the Biotechnology Institute in St. Paul, MN I worked with Michael Flickinger and Janet Schottel on a mercury biosensor that used a MerR response element to control GFP expression in response to very low levels of mercuric ion. The key innovation in this work was the embedding of the biosensor strain in latex patches that could be stored for long periods of time while maintaining viability and sensitivity. This experience gave me insight into the opportunities and need for rapid response biosensor and testing technologies.

Schottel JL, **Orwin PM,** Anderson CR, Flickinger MC. Spatial expression of a mercury-inducible green fluorescent protein within a nanoporous latex-based biosensor coating. *J Ind Microbiol Biotechnol*. 2008;35(4):283-290.

**D. Additional Information: Research Support and/or Scholastic Performance**

1R15GM116173-01 Orwin (PI) 8/01/2015-7/31/2019

NIH/NIGMS

Investigation of Genetic, Biochemical,and Regulatory Aspects of Surface Motility

and Anti-Staphylococcal Activity in *Variovorax parado*xus EPS

 Role: PI

This project focused on using biochemistry, genetics, and transcriptome analysis to study the surfactant produced by *Variovorax paradoxus* EPS*,* and the anti-Staphylococcal activity of this strain in co-culture.

R25GM100829 (Co-I; Crawford PI)

NIH/NIGMS

CSUSB RISE Program 3/01/13-12/31/2017

The goal of this project is to increase the number of underrepresented students who attend Ph.D. programs in the behavioral or biomedical sciences.