

Jonathan Konstantine Sakkos

SCIENTIST · ENGINEERED LIVING MATERIALS

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Education

University of Minnesota

2012 – 2018

PH.D. IN MECHANICAL ENGINEERING

Minneapolis, MN

- Advisor: Alptekin Aksan, Ph.D.
- Co-advisor: Lawrence P. Wackett, Ph.D.
- Thesis: “Engineering Biocatalytic Materials: Encapsulation Systems for Biotechnology”

University of Portland

2005-2009

B.S. IN MECHANICAL ENGINEERING

Portland, OR

Skills

Engineering 🔧

Synthetic Biology, Biointerfaces, Bioencapsulation, Sol-Gel Synthesis, Biomaterials

Characterization 🔍

Microscopy, Spectroscopy, Mechanical Testing, Contact Angle

Computation 💻

Python, Solid Modelling, High-Performance Computing, Image Analysis, Applied Machine Learning

Publications

PEER-REVIEWED JOURNAL ARTICLES

1. M. Fuentes-Cabrera, J. K. Sakkos, D. C. Ducat, and M. Ziatdinov, “Investigating Carboxysome Morphology Dynamics with a Rotationally Invariant Variational Autoencoder,” *ACS Nano*, p. 2021.11.15.468661, 2022 (*under review*)
2. J. Sakkos, J. Weaver, C. Robertson, B. Li, D. Taniguchi, K. Maheshwari, D. Ducat, P. Zuliani, A. S. McGough, T. Curtis, and M. Fuentes-Cabrera, “Investigating the growth of an engineered strain of Cyanobacteria with an Agent-Based Model and a Recurrent Neural Network,” *Frontiers in Microbiology*, p. 2021.10.11.463942, 2021 (*revision*)
3. A. K. Singh, M. Santos-Merino, J. K. Sakkos, B. J. Walker, and D. C. Ducat, “Multi-layer Regulation of Rubisco in Response to Altered Carbon Status in *Synechococcus elongatus* PCC 7942,” *Plant Physiology*, p. 2021.10.11.463961, 2022
4. J. K. Sakkos, S. Hernandez-Ortiz, K. W. Osteryoung, and D. C. Ducat, “Orthogonal Degron System for Controlled Protein Degradation in Cyanobacteria,” *ACS Synthetic Biology*, p. acssynbio.1c00035, 2021
5. E. J. Young, J. K. Sakkos, J. Huang, J. K. Wright, B. Kachel, M. Fuentes-Cabrera, C. A. Kerfeld, and D. C. Ducat, “Visualizing in Vivo Dynamics of Designer Nanoscaffolds,” *Nano Letters*, vol. 20, pp. 208–217, 2019
6. M. Schwab, C. Bergonzi, J. Sakkos, C. Staley, Q. Zhang, M. J. Sadowsky, A. Aksan, and M. Elias, “Signal disruption leads to changes in bacterial community population,” *Frontiers in Microbiology*, vol. 10, pp. 1–13, 2019
7. J. K. Sakkos, L. P. Wackett, and A. Aksan, “Enhancement of biocatalyst activity and protection against stressors using a microbial exoskeleton,” *Scientific Reports*, vol. 9, no. 1, p. 3158, 2019
8. J. J. Benson, J. K. Sakkos, A. Radian, L. P. Wackett, and A. Aksan, “Enhanced biodegradation of atrazine by bacteria encapsulated in organically modified silica gels,” *Journal of Colloid and Interface Science*, vol. 510, pp. 57–68, 2018
9. K. Zhu, W. A. Arnold, J. Sakkos, C. W. Davis, and P. J. Novak, “Achieving high-rate hydrogen recovery from wastewater using customizable alginate polymer gel matrices encapsulating biomass,” *Environmental Science: Water Research and Technology*, vol. 4, no. 11, pp. 1867–1876, 2018
10. J. K. Sakkos, B. R. Mutlu, L. P. Wackett, and A. Aksan, “Adsorption and Biodegradation of Aromatic Chemicals by Bacteria Encapsulated in a Hydrophobic Silica Gel,” *ACS Applied Materials and Interfaces*, vol. 9, no. 32, pp. 26848–26858, 2017-08-16
11. B. R. Mutlu, J. K. Sakkos, S. Yeom, L. P. Wackett, and A. Aksan, “Silica ecosystem for synergistic biotransformation,” *Scientific Reports*, vol. 6, p. 27404, 2016
12. J. K. Sakkos, D. P. Kieffer, B. R. Mutlu, L. P. Wackett, and A. Aksan, “Engineering of a silica encapsulation platform for hydrocarbon degradation using *Pseudomonas* sp. NCIB 9816-4,” *Biotechnology and Bioengineering*, vol. 113, no. 3, pp. 513–521, 2015

CONFERENCE PROCEEDINGS

1. J.K. Sakkos, D.P. Kieffer, B.R. Mutlu, L.P. Wackett, A. Aksan "Design of Porous Silica Gels for Bioremediation of Aromatic Hydrocarbons" *Northeast Bioengineering Conference*, Troy, NY, USA, 2015.

MANUSCRIPTS IN PREPARATION

1. M. Kokarakis, R. Rillema, D. C. Ducat, and J. K. Sakkos, "Towards the division of labor in cyanobacterial bioproduction with quorum sensing modules," 2022
2. M. Santos-Merino, J. K. Sakkos, A. K. Singh, and D. C. Ducat, "Identification of a two-component signaling network implicated in carbon balancing in *Synechococcus elongatus* pcc 7942," 2022
3. J. K. Sakkos, M. Santos-Merino, M. Kokarakis, B. Li, M. Fuentes-Cabrera, P. Zuliani, and D. C. Ducat, "Elucidating the impact of proximity on partner fitness in a sucrose-secreting cyanobacterial consortium," 2022

Patents

1. A. Radian, B.R. Mutlu, J.K. Sakkos, A. Aksan, L.P. Wackett, 2015, "Compositions Including A Silica Matrix And Biomaterial, Methods Regarding The Same And Uses Thereof," U.S. Patent Application Number 14/883,053
2. L.P. Wackett, A. Aksan, J.K. Sakkos, T. Dodge, 2017, "Cyanuric Acid Remediation," U.S. Patent Application Number 62/486,491
3. J.K. Sakkos, L.P. Wackett, A. Aksan, 2018, "Biological Assembly Including Biological Component and Shield" U.S. Patent 16/959,812 pending, International Patent Application PCT/US2018/068154

Honors & Awards

2017	Joachim and Yuko Heberlein Award , Department of Mechanical Engineering, University of Minnesota	Minneapolis, MN
2015	BioTechnology Institute Travel Award , University of Minnesota	Minneapolis, MN
2012	Fellowship , Department of Mechanical Engineering, University of Minnesota	Minneapolis, MN
2008-2009	Dean's List , University of Portland	Portland, OR
2005-2009	President's Scholarship , University of Portland	Portland, OR

Conference Presentations & Invited Talks

11th European Workshop on the Biology of Cyanobacteria	2020
ORAL PRESENTATION	Porto, Portugal
• J.K. Sakkos , J. Huang, S. Hernandez-Ortiz, <i>et al.</i> , Orthogonal degron system for controlled protein degradation in cyanobacteria.	
University of Michigan	2018
INVITED TALK	Ann Arbor, MI
• "Engineering Biocatalytic Materials: Encapsulation Systems for Biotechnology"	
5th International Conference on Multifunctional, Hybrid and Nanomaterials	2017
POSTER PRESENTATION	Lisbon, Portugal
• J. K. Sakkos , B.R. Mutlu, L. P. Wackett, A. Aksan "Bioregeneration of Ormosil gel for remediation of PAHs from water"	
• J. K. Sakkos , B.R. Mutlu, L. P. Wackett, A. Aksan "Engineering of a Silica Encapsulation Platform for Hydrocarbon Degradation using <i>Pseudomonas</i> sp. NCIB 9816"	
Summer Biomechanics, Bioengineering, and Biotransport Conference	2016
POSTER PRESENTATION	National Harbor, MD
• J. K. Sakkos , L. P. Wackett, A. Aksan "Microbial Regeneration of Adsorbent Silica Gel for Sustainable Treatment of Environmental Pollutants"	
• G. Heo, J. K. Sakkos , S. Yeom, L. P. Wackett, A. Aksan "Bacterial Growth Inside Reversible Ca-alginate Beads Encapsulated in a Thin Silica Film"	
University of Minnesota MnDRIVE Environment Symposium	2016
POSTER PRESENTATION	Minneapolis, MN
• B. R. Mutlu, J. K. Sakkos , S. Yeom, L. P. Wackett, A. Aksan "Silica ecosystem for synergistic biotransformation"	

Materials Research Society Fall Meeting

2015

POSTER PRESENTATION

Boston, MA

- **J. K. Sakkos**, D. P. Kieffer, B.R. Mutlu, L. P. Wackett, A. Aksan "Organic Modification of Silica Gels with Encapsulated *Pseudomonas* sp. NCIB 9816 for Enhanced Biodegradation of Aromatic Hydrocarbons"

Battelle Bioremediation Symposium

2015

PLATFORM TALK

Miami, FL

- **J. K. Sakkos**, D. P. Kieffer, B.R. Mutlu, L. P. Wackett, A. Aksan, "Design of Porous Silica Gels for Biodegradation of Aromatic Hydrocarbons"

Northeast Bioengineering Conference

2015

PLATFORM TALK

Troy, NY

- **J. K. Sakkos**, D. P. Kieffer, B.R. Mutlu, L. P. Wackett, A. Aksan "Design of Porous Silica Gels for Biodegradation of Aromatic Hydrocarbons"

Experience

Postdoctoral Research Associate

2018-present

DUCAT LAB - MICHIGAN STATE UNIVERSITY

East Lansing, MI

- Developed a tunable protein degradation system in cyanobacteria
- Studied a light-driven, modular platform based on cyanobacteria for fundamental insight into emergent microbial interactions within consortia using both computational and experimental methodology
- Led a team developing genetic circuits based on quorum sensing for use in cyanobacteria and microbial consortia

Research Assistant

2012-2018

BIOENCAPSULATION LAB - UNIVERSITY OF MINNESOTA

Minneapolis, MN

- Studied bioencapsulation (physical confinement) of bacteria for applications in biotechnology
- Synthesized new porous materials for bioencapsulation
- Performed materials characterization on novel materials

Teaching Assistant

Spring 2018

MECHANICAL ENGINEERING DEPARTMENT - UNIVERSITY OF MINNESOTA

Minneapolis, MN

- ME 3331 - Thermodynamics

Product Engineer

2009-2012

COLUMBIA STEEL CASTING CO.

Portland, OR

- Designed replacement wear parts for heavy scrap shredders
- Modeled parts and assemblies in SolidWorks, created 2D drawings in AutoCAD

Product Engineer-Intern

2007-2009

COLUMBIA STEEL CASTING CO.

Portland, OR

Engineering Tech. I

May. 2006 - Aug. 2006

COUNTY OF SONOMA

Santa Rosa, CA

Mentoring & Outreach

International Genetically Engineered Machine Team (iGEM)

June - November 2021

COMPUTATIONAL MODELLING SUBTEAM

Michigan State University

- Worked on developing Individual-based Models to simulate microbial populations

Rees Rillema

January - February 2021

GRADUATE STUDENT

Michigan State University

- Worked on cloning genetic circuits into cyanobacteria and flow cytometry assays
- Primary co-author on a manuscript resulting from this work

Manos Kokarakis

September - November 2020

GRADUATE STUDENT

Michigan State University

- Worked on cloning genetic circuits into cyanobacteria and *E. coli*
- Primary co-author on a manuscript resulting from this work

Joshua Kaste

GRADUATE STUDENT

- Worked on cloning genetic circuits into cyanobacteria

January - February 2020

Michigan State University

Serena Lotreck

GRADUATE STUDENT

- Worked on cloning genetic circuits into cyanobacteria and prepared samples for flow cytometry

November - December 2019

Michigan State University

Nick Schlecht

GRADUATE STUDENT

- Worked on cloning genetic circuits into cyanobacteria and prepared samples for flow cytometry

September - October 2019

Michigan State University

Sergio Hernandez-Ortiz

GRADUATE STUDENT

- Prepared samples for flow cytometry and conducted photosynthetic efficiency assays towards a publication

July - August 2019

Michigan State University

Kam Kennicott

UNDERGRADUATE

- Prepared samples for flow cytometry and worked on cloning

April 2019 - June 2020

Michigan State University

Ezgi Evcik

UNDERGRADUATE

- Conducted biochemical assays related to cyanuric acid biodegradation, bioencapsulation, and mechanical testing
- Now a Systems Engineer at Roche

University of Minnesota

May 2018 - September 2018

Science A.M.A.

Reddit r/Science

PUBLIC OUTREACH

2016

- J.K. Sakkos, r/Science. "Science AMA Series: I'm Jonathan Sakkos, a graduate student in mechanical engineering at the University of Minnesota. I trap bacteria within porous materials for cleaning pollutants from water. AMA!" *The Winnower* 2016.

Meera Harihara

UNDERGRADUATE

- Conducted biochemical assays and mechanical testing

January 2016 - July 2016

University of Minnesota

Daniel P. Kieffer

UNDERGRADUATE

- Performed mechanical and biological assays contributing to a co-authorship on a peer-reviewed publication
- Now a J.D. Candidate at University of Iowa College of Law

December 2013 - December 2015

University of Minnesota

Amanda Eidem

UNDERGRADUATE

- Performed mechanical testing, bioencapsulation, and biodegradation assays

January 2013 - January 2014

University of Minnesota

James Bienieck

UNDERGRADUATE

- Worked on developing mechanical testing protocols
- Now a Manufacturing Engineer at Collins Aerospace

September 2013 - June 2014

University of Minnesota

Kanav Khosla

UNDERGRADUATE

January 2013 - May 2013

University of Minnesota