

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 (*under review*)
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, *et al.*, 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 *Pseudomonas* 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.**

PUBLIC OUTREACH

- 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.

*Reddit r/Science**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*