

## Dr. Zengyi Shao

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### CONTACT INFORMATION

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### RESEARCH INTEREST

**I. Building** novel microbial manufacturing platforms for the synthesis of high-value compounds

**II. Integrating** biocatalysis and catalysis to nurture a sustainable biorenewable chemical industry

**III. Elucidating** core design principles to streamline nonconventional microbial host development

**IV. Creating** microbial consortia to execute complex tasks

**V. Exploring** nucleosome-depleted sequences for novel applications in synthetic biology

**VI. Establishing** yeasts as models for studying human diseases and disorders

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### EDUCATION

**Doctor of Philosophy, University of Illinois, Urbana-Champaign, IL**  
Chemical and Biomolecular Engineering, 2009  
Advisor: Huimin Zhao

**Master of Science, University of Illinois, Urbana-Champaign, IL**  
Chemical and Biomolecular Engineering, 2005  
Advisor: Huimin Zhao

**Bachelor of Science, Nankai University, Tianjin, China**  
Biochemistry and Molecular Biology, 2002

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### PROFESSIONAL EXPERIENCE

**Associate Professor, Iowa State University, Ames, IA**  
Department of Chemical and Biological Engineering  
Interdepartmental Microbiology Program  
The Ames Laboratory (2019 – Present)

**Assistant Professor, Iowa State University, Ames, IA**  
Department of Chemical and Biological Engineering  
The Center for Biorenewable Chemicals  
Interdepartmental Microbiology Program  
The Ames Laboratory (2013 – 2019)

**Postdoctoral Research Fellow, University of Illinois, Urbana, IL**  
Chemical and Biomolecular Engineering (2009 – 2012)

**Graduate Research Assistant, University of Illinois, Urbana, IL**  
Chemical and Biomolecular Engineering (2003 – 2009)

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HONORS AND AWARDS

National Academies Keck Futures Initiative Award (2010)  
Iowa Energy Center Impact Award (2016)  
ISU Jack R. and Carol A. Johnson Faculty Fellow (2017)  
NSF CAREER Award (2018)  
ISU Vernon Guse Faculty Fellowship (2021)  
ISU Bailey Research Career Development Award (2021)  
NIH MIRA R35 Award (2021)

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PROFESSIONAL AFFILIATION

American Institute of Chemical Engineers  
American Chemical Society  
Society of Industrial Microbiology and Biotechnology  
International Metabolic Engineering Society  
The Society for Biological Engineering

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TEACHING ACTIVITIES

**ChE 415/515** Biochemical Engineering (S2013 – S2021)  
**ChE 440/540** Biomedical Applications of Chemical Engineering (F2020)  
**ChE 210** Material and Energy Balances (F2013 – F2014, F2016 – F2019)  
**Genetics 591** Synthetic Biology (co-teach, F2014)  
**BBMB 301** Biochemistry (co-teach, F2016 – F2017)  
**BBMB 303** Biochemistry (co-teach, F2017 – F2021)  
**ChE 695L** Advanced Topics: Catalysis, Reaction Engineering, and Renewable Energy (co-teach, F2016)  
**BCB/GDCB/ME 585x** Fundamentals of Predictive Plant Phenomics (co-teach, F2016)

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PUBLICATIONS

*Articles published before joining ISU (13)*

**Total citations: 2854; H-index: 27 (\* denotes equal contribution)**

- [1]. W. Zha, **Z. Shao**, J. W. Frost, and H. Zhao, “Rational Pathway Engineering of Type I Fatty Acid Synthase Allows Biosynthesis of Triacetic Acid Lactone from D-Glucose *in vivo*”, *Journal of the American Chemical Society*, 126, 4534-5 (2004).
- [2]. D. Xie, **Z. Shao**, J. Achkar, W. Zha, J. W. Frost, and H. Zhao, “Microbial Synthesis of Triacetic Acid Lactone”, *Biotechnology and Bioengineering*, 93, 727-36 (2006).
- [3]. R. Woodyer, **Z. Shao**, W. M. Metcalf, W. A. van der Donk, and H. Zhao, “Heterologous Production of Fosfomycin and Identification of the Minimal Fosfomycin Biosynthetic Cluster”, *Chemical & Biology*, 13, 1171-82 (2006).
- [4]. **Z. Shao**, J. Blodgett, B. Circello, A. Eliot, R. Woodyer, G. Li, A. van der Donk, W. M. Metcalf, and H. Zhao, “Biosynthesis of 2-Hydroxyethylphosphonate, an Unexpected Intermediate Common to Multiple Phosphonate Biosynthetic Pathways”, *Journal of Biological Chemistry*, 283, 23161-8 (2008).
- [5]. **Z. Shao\***, H. Zhao\*, and H. Zhao, “DNA Assembler, an *in vivo* Genetic Method for Rapid Construction of Large Recombinant DNA”, *Nucleic Acids Research*, 37, e16 (2009).

- [6]. W. Zha, S. B. Rubin-Pitel, **Z. Shao**, and H. Zhao, “Improving Cellular Malonyl-CoA Level in *Escherichia coli* via Metabolic Engineering”, *Metabolic Engineering*, 11, 192-8 (2009).
- [7]. Y. S. Choi, T. W. Johannes, M. Simurdiak, **Z. Shao**, H. Lu, and H. Zhao, “Cloning and Heterologous Expression of the Spectinabilin Biosynthetic Gene Cluster from *Streptomyces spectabilis*”, *Molecular Biosystems*, 6, 336-8 (2010).
- [8]. **Z. Shao**, Y. Luo, and H. Zhao, “Rapid Characterization and Engineering of Natural Product Biosynthetic Pathways via DNA Assembler”, *Molecular Biosystems*, 7, 1056-9 (2011).
- [9]. J. Du\*, **Z. Shao**\*, and H. Zhao, “Engineering Microbial Factories for Synthesis of Value-added Products”, *Journal of Industrial Microbiology and Biotechnology*, 38, 873-90 (2011).
- [10]. J. Sun, **Z. Shao**, H. Zhao, N. Nair, F. Wen, J. Xu, and H. Zhao, “Systematic Characterization of a Panel of Constitutive Promoters for Applications in Pathway Engineering in *Saccharomyces cerevisiae*”, *Biotechnology and Bioengineering*, 109(8), 2082-92 (2012).
- [11]. **Z. Shao**, G. Rao, C. Li, Z. Abil, Y. Luo, and H. Zhao, “Refactoring the Silent Spectinabilin Biosynthetic Pathway Using a Plug-and-Play Scaffold”, *ACS Synthetic Biology*, 2(11), 662–9 (2013, front cover).
- [12]. Y. Luo, H. Huang, J. Liang, M. Wang, L. Lu, **Z. Shao**, R. E. Cobb, and H. Zhao, “Activation and Characterization of a Cryptic Polycyclic Tetramate Macrolactam Biosynthetic Gene Cluster”, *Nature Communications*, 4, 2894 (2013).
- [13]. H. Xiao\*, **Z. Shao**\*, Y. Jiang, Sudhanshu Dole, and H. Zhao, “Exploiting *Issatchenkia orientalis* SD108 for Succinic Acid Production”, *Microbial Cell Factories*, 13(1), 121 (2014).

Book chapters  
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- [14]. **Z. Shao**, E. Ang, and H. Zhao, “Biomolecular Engineering”, In *Encyclopedia of Chemical Processing*, (S. Lee, Ed.) pp. 171-182, Marcel Dekker, Inc., New York, NY (2006).
- [15]. **Z. Shao**, Y. Luo, and H. Zhao, “DNA Assembler Method for Construction of Zeaxanthin Producing Strains of *Saccharomyces cerevisiae*”, *Microbial Carotenoids from Fungi*, 898, 251-62 (2012).
- [16]. **Z. Shao** and H. Zhao, “DNA Assembler: a Synthetic Biology Tool for Characterizing and Engineering Natural Product Gene Clusters”, *Methods in Enzymology*, 517, 203-24 (2012).
- [17]. **Z. Shao** and H. Zhao, “Construction and Engineering of Large Biochemical Pathways via DNA Assembler”, *Methods in Molecular Biology*, 1073, 85-106 (2013).
- [18]. **Z. Shao** and H. Zhao, “Manipulating Natural Product Biosynthetic Pathways via DNA Assembler”, *Current Protocols in Chemical Biology*, 6(2):65-100 (2014).
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Articles published  
since joining ISU  
(26)

(#denotes corresponding author(s); \* denotes equal contribution)

- [1]. M. Suastegui\*, J. E. Matthiesen\*, J. M. Carraher, N. Hernandez, N. R. Quiroz, A. Okerlund, E. W. Cochran, **Z. Shao**<sup>#</sup>, and J.-P. Tessonnier<sup>#</sup>, “Combining Metabolic Engineering and Electrocatalysis: Application to the Production of Polyamides from Sugar”, *Angewandte Chemie International Edition*, 55, 2368-2373, DOI: 10.1002/anie.201509653 (2016, the front cover). *Journal IF=15.34*
- [2]. Y. Zhao, M. Cao, J. F. McClelland, **Z. Shao**, and M. Lu<sup>#</sup>, "A Photoacoustic Immunoassay for Biomarker Detection", *Biosensors and Bioelectronics*, 85, 261-266, DOI: 10.1016/j.bios.2016.05.028 (2016). *Journal IF=10.6*
- [3]. M. Suastegui, W. Guo, X. Feng<sup>#</sup>, and **Z. Shao**<sup>#</sup>, “Investigating Strain Dependency in the Production of Aromatic Compounds in *Saccharomyces cerevisiae*”, *Biotechnology and Bioengineering*, 113, 2676-2685, DOI: 10.1002/bit.26037 (2016). *Journal IF=4.5*
- [4]. M. Suastegui and **Z. Shao**<sup>#</sup>, “Yeast Factories for Production of Aromatic Compounds: from Building Blocks to Plant Secondary Metabolites”, *Journal of Industrial Microbiology and Biotechnology*, 43, 1611-1624, DOI: 10.1007/s10295-016-1824-9 (2016, the front cover). *Journal IF=3.3*
- [5]. M. Gao, M. Cao, M. Suastegui, J. Walker, N. R. Quiroz, Y. Wu, D. Tribby, A. Okerlund, L. Stanley, J. V. Shanks, and **Z. Shao**<sup>#</sup>, “Innovating a Nonconventional Yeast Platform for Producing Shikimic Acid as the Building Block of High-value Aromatics”, *ACS Synthetic Biology*, 6:29-38, DOI: 10.1021/acssynbio.6b00132 (2016). *Journal IF=5.2*
- [6]. J. Matthiesen, M. Suastegui, Y. Wu, M. Viswanathan, Y. Qu, M. Cao, N. Rodriguez-Quiroz, A. Okerlund, G. Kraus, R. Raman, **Z. Shao**, and J.-P. Tessonnier<sup>#</sup>, “Electrochemical Conversion of Biologically-Produced Muconic Acid: Key Considerations for Scale-up and Corresponding Technoeconomic Analysis”, *ACS Sustainable Chemical Engineering*, 4, 7098-7109, DOI: 10.1021/acssuschemeng.6b01981 (2016). *Journal IF=8.2*
- [7]. M. Suastegui, M. Gao, and **Z. Shao**<sup>#</sup>, “Pathway Assembly and Optimization”, *Biotechnologies for Biofuel Production and Optimization*, 1<sup>st</sup> Edition, Elsevier, 139-164, DOI:10.1016/B978-0-444-63475-7.00006-6 (2016).
- [8]. M. Cao, M. Gao, C. Lopez, Y. Wu, A. Seetharam, A. Severin, and **Z. Shao**<sup>#</sup>, “Centromeric DNA Facilitates Nonconventional Yeast Genetic Engineering”, *ACS Synthetic Biology*, 6, 1545-1553, DOI: 10.1021/acssynbio.7b00046 (2017). *Journal IF=5.2*
- [9]. M. Suastegui, C. Y. Ng, A. Chowdhury, W. Sun, E. House, C. D. Maranas, and **Z. Shao**<sup>#</sup>, “Multilevel Engineering of the Upstream Module of Aromatic Amino Acid Biosynthesis in *Saccharomyces cerevisiae* for High Production of Polymer and Drug Precursors”, *Metabolic Engineering*, 42, 134-144, DOI: 10.1016/j.ymben.2017.06.008 (2017). *Journal IF=9.8*
- [10]. M. Cao, A. Seetharam, A. Severin, and **Z. Shao**<sup>#</sup>, “Rapid Isolation of Centromeres from *Scheffersomyces stipitis*”, *ACS Synthetic Biology*, 6, 2028-2034, DOI: 10.1021/acssynbio.7b00166 (2017). *Journal IF=5.2*

- [11]. L. Zhao, **Z. Shao**, and J. V. Shanks<sup>#</sup>, “Chapter 8 Anti-cancer Drugs”, *Industrial Biotechnology: Products and Processes*, Wiley-VCH, Volume 4, 239-269 DOI: 10.1002/9783527807833.ch8 (2017).
- [12]. J. Sun<sup>\*</sup>, L. Zhao<sup>\*</sup>, **Z. Shao**, J. V. Shanks, and C. Peebles<sup>#</sup>, “Expression of Tabersonine 16-Hydroxylase and 16-Hydroxytabersonine-O-methyltransferase in *Catharanthus roseus* Hairy Roots”, *Biotechnology and Bioengineering*, 115, 673-683, DOI: 10.1002/bit.26487 (2018). *Journal IF=4.5*
- [13]. M. Cao, M. Gao, D. Ploessl, and **Z. Shao**<sup>#</sup>, “CRISPR-mediated Genome Editing and Gene Repression in *Scheffersomyces stipitis*”, *Biotechnology Journal*, 13, 1700598, DOI: 10.1002/biot.201700598 (2018). *Journal IF=4.7*
- [14]. M. Gao, D. Ploessl, and **Z. Shao**<sup>#</sup>, “Enhancing the Co-utilization of Biomass-Derived Mixed Sugars by Yeasts”, *Frontiers in Microbiology*, 9, 3264, DOI: 10.3389/fmicb.2018.03264 (2018). *Journal IF=5.6*
- [15]. M. Cao<sup>\*</sup>, M. Gao<sup>\*</sup>, M. Suastegui, Y. Mei, and **Z. Shao**<sup>#</sup>, “Building Microbial Factories for the Production of Aromatic Amino Acid Pathway Derivatives: From Commodity Chemicals to Plant-sourced Natural Products”, *Metabolic Engineering*, 58, 94-132, DOI: 10.1016/j.ymben.2019.08.008 (2019). *Journal IF=9.8*
- [16]. A. Londono-Calderon, W. Sun, **Z. Shao**, D.H. Alsem, T. Prozorov<sup>#</sup>, “Correlative Microbially-Assisted Imaging of Cellulose Deconstruction with Electron Microscopy”, *Microscopy and Microanalysis*, 24 (S1), 382-383, DOI: doi.org/10.1017/S1431927618002404 (2018). *Journal IF=4.1*
- [17]. C. Lopez, Y. Zhao, and **Z. Shao**<sup>#</sup>, “Modulating Pathway Performance by Perturbing Local Genetic Context”, *ACS Synthetic Biology*, 9 (4), 706-717, DOI: 10.1021/acssynbio.9b00445 (2020). *Journal IF=5.2*
- [18]. W. Sun, A. Vila-Santa, N. Liu, T. Prozorov, D. Xie, N. T. Faria, F. C. Ferreira, N. P. Mira<sup>#</sup>, and **Z. Shao**<sup>#</sup>, “Metabolic Engineering of an Acid-tolerant Yeast Strain *Pichia kudriavzevii* for Itaconic Acid Production”, *Metabolic Engineering Communications*, 10, e00124, DOI: 10.1016/j.mec.2020.e00124 (2020). *Journal IF=4.9*
- [19]. Y. Zhao, Z. Yao, D. Ploessl, G. Saptarshi, M. Monti, D. Schindler, M. Gao, Y. Cai, M. Qiao, C. Yang<sup>#</sup>, M. Cao<sup>#</sup>, and **Z. Shao**<sup>#</sup>, “Leveraging the Hermes Transposon to Accelerate the Development of Nonconventional Yeast-based Microbial Cell Factories”, *ACS Synthetic Biology*, 9 (7), 1736-1752, DOI: 10.1021/acssynbio.0c00123 (2020). *Journal IF=5.2*
- [20]. Y. Chen, E. Boggess, E. Ocasio, A. Warner, L. Kerns, V. Drapal, C. Gossling, W. Ross, **Z. Shao**, J. A. Dickerson, T. J. Mansell<sup>#</sup>, and L. R. Jarboe<sup>#</sup>, “Reverse Engineering of Fatty Acid-tolerant *Escherichia coli* Identifies Design Strategies for Robust Microbial Cell Factories”, *Metabolic Engineering*, 61, 120-130, DOI: 10.1016/j.ymben.2020.05.001 (2020). *Journal IF=9.8*
- [21] M. Cao, Z. Fatma, X. Song, P.-H. Hsieh, V. G. Tran, W. L. Lyon, M. Sayadi, **Z. Shao**, Y. Yoshikuni, and H. Zhao<sup>#</sup>, “A Genetic Toolbox for Metabolic Engineering of *Issatchenkia orientalis*”, *Metabolic Engineering*, 59, 87-97, DOI: 10.1016/j.ymben.2020.01.005 (2020). *Journal IF=9.8*

- [22]. C. Lopez, M. Cao<sup>#</sup>, Z. Yao, and **Z. Shao<sup>#</sup>**, “Revisiting the Unique Structure of Autonomously Replicating Sequences in *Yarrowia lipolytica* and Its Role in Pathway Engineering”, *Applied Microbiology and Biotechnology*, 105, 5959-5972, DOI: 10.1007/s00253-021-11399-4 (2021). *Journal IF=4.8*
- [23]. J. Feng, J. Zhang, Y. Ma, Y. Feng, S. Wang, N. Guo, H. Wang, P. Wang, P. Jiménez-Bonilla, Y. Gu, J. Zhou, Z-T. Zhang, M. Cao, D. Jiang, S. Wang, X-W. Liu, **Z. Shao**, I. Borovok, H. Huang, and Yi Wang<sup>#</sup>, “Renewable Fatty Acid Ester Production in *Clostridium*”, *Nature Communications*, 12, 4368, DOI: 10.1038/s41467-021-24038-3 (2021). *Journal IF=14.9*
- [24]. Y-H. V. Soong, L. Zhao, N. Liu, P. Yu, C. Lopez, A. Olson, H-W. Wong, **Z. Shao<sup>#</sup>**, and D. Xie<sup>#</sup>, “Microbial Synthesis of Wax Esters”, *Metabolic Engineering*, 67, 428-442, DOI: 10.1016/j.ymben.2021.08.002 (2021). *Journal IF=9.8*
- [25]. W. Sun<sup>\*</sup>, Y. Zuo<sup>\*</sup>, Z. Yao<sup>\*</sup>, J. Gao<sup>\*</sup>, **Z. Shao<sup>#</sup>**, and J. Lian<sup>#</sup>, “Chapter 10. Recent Advances in Synthetic Biology Applications of *Pichia* Species”, *Synthetic Biology of Yeasts: Tools and Applications*, Springer, 1 (2022).
- [26]. D. Ploessl, Y. Zhao, M. Cao, S. Ghosh, C. Lopez, M. Sayadi, S. Chudalayandi, A. Severin, L. Huang, M. Gustafson, and **Z. Shao<sup>#</sup>**, “A Repackaged CRISPR Platform Increases Homology-directed Repair for Yeast Engineering”, *Nature Chemical Biology*, DOI: 10.1038/s41589-021-00893-5 (2021). *Journal IF=15.0*

Articles submitted  
or in preparation  
(5)

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- [27]. M. Gao and **Z. Shao<sup>#</sup>**, “Discovery of Novel Xylose and Shikimate-specific Transporters Facilitates Microbial Consortium Design as a Chassis to Produce Benzylisoquinoline Alkaloids” (in preparation, 2022).
- [28]. A. Warner, **Z. Shao<sup>#</sup>**, and L. R. Jarboe<sup>#</sup>, “A Method for Identifying Novel Strain Engineering Strategies by Mining Existing Data Concerning Genes of Unknown Function” (in preparation, 2022).
- [29]. C. Lopez and **Z. Shao<sup>#</sup>**, “The Untapped Potential of Non-obvious Regulatory Sequences Harbored in the Yeast Genome” (in preparation, 2022).
- [30]. Y. Zhao and **Z. Shao<sup>#</sup>**, “Engineering *Rhodospiridium toruloides* for Producing Fatty Alcohols and Wax Esters” (in preparation, 2022).
- [31]. Z-Y. Wu<sup>\*</sup>, W. Sun<sup>\*</sup>, Y. Shen, P. Suthers, C. D. Maranas, J. D. Rabinowitz, **Z. Shao<sup>#</sup>**, and Y. Yoshikuni<sup>#</sup>, “Engineering *Issatchenkia orientalis* for Citramalate Production” (in preparation, 2022).

PATENTS AT ISU

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Z. Shao, M. Cao, M. Suastegui, and M. Gao, “Methods and Compositions for Production of Aromatic and Other Compounds in Yeast” (utility patent filed on 6/28/2018, P12286US01).

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CONFERENCE  
TALKS

*Presentations  
made before  
joining ISU  
(14)*

(<sup>†</sup>denotes the speaker)

- [1]. W. Zha, **Z. Shao**, Z. Simurdiak, J. Lee, and H. Zhao<sup>†</sup>, “Biosynthesis of Thermally Stable Energetic Compounds *via* Pathway Engineering”, *Metabolic Engineering V*, Lake Tahoe, CA, September 2004.
- [2]. **Z. Shao**<sup>†</sup>, and H. Zhao, “*In vivo* Biosynthesis of Triacetic Acid Lactone from D-Glucose by Rational Design and Directed Evolution”, *AIChE Annual Meeting*, Austin, TX, November 2004.
- [3]. **Z. Shao**<sup>†</sup>, R. Woodyer, and H. Zhao, “Biosynthesis of Fosfomycin”, *AIChE Annual Meeting*, San Francisco, CA, November 2006.
- [4]. N. U. Nair<sup>†</sup>, **Z. Shao**, H. Zhao, R. P. Sullivan, M. McLachlan, T. W. Johannes, and H. Zhao, “Biobutanol from Yeast. A Synergistic Genome and Protein Engineering Approach”, *AIChE Annual Meeting*, Philadelphia, DE, November 2008.
- [5]. **Z. Shao**<sup>†</sup>, H. Zhao, and H. Zhao, “DNA Assembler, a Highly Efficient Method for Rapid Construction of Large Recombinant DNA”, *ACS Annual Meeting*, Philadelphia, PA, August 2008.
- [6]. N. U. Nair, **Z. Shao**, M. DeSieno, T. Johannes, H. Zhao, T. Lee, R. P. Sullivan, M. McLachlan, and H. Zhao<sup>†</sup>, “Towards the Cost-effective Production of Antimalarial Drug FR900098 and Butanol”, *Proceeding of Foundations of Systems Biology and Engineering (FOSBE)*, Denver, CO, 2009.
- [7]. N. U. Nair<sup>†</sup>, T. Lee, **Z. Shao**, H. Zhao, R. P. Sullivan, M. McLachlan, T. W. Johannes, and H. Zhao, “Biobutanol from Yeast. A Synergistic Genome and Protein Engineering Approach”, *AIChE Annual Meeting*, Nashville, TN, November 2009.
- [8]. **Z. Shao**<sup>†</sup>, Y. Luo, and H. Zhao, “Applying the “DNA Assembler” Approach to Study Natural Product Biosynthetic Gene Clusters”, *AIChE Annual Meeting*, Nashville, TN, November 2009.
- [9]. **Z. Shao**<sup>†</sup>, Y. Luo, and H. Zhao, “Rapid Characterization and Engineering of Natural Product Biosynthetic Pathways *via* DNA Assembler”, *ACS Annual Meeting*, Anaheim, CA, March 2011.
- [10]. Y. Luo<sup>†</sup>, **Z. Shao**, and H. Zhao, “Uncovering Cryptic Biosynthetic Pathways Using Synthetic Biology”, *AIChE Annual Meeting*, Minneapolis, MN, October 2011.
- [11]. **Z. Shao**<sup>†</sup>, Y. Luo, and H. Zhao, “Rapid Characterization and Engineering of Natural Product Biosynthetic Pathways *via* DNA Assembler”, *AIChE Annual Meeting*, Minneapolis, MN, October 2011.
- [12]. **Z. Shao**<sup>†</sup>, Z. Abil, C. Li, Y. Luo, T. Freestone, and H. Zhao, “Refactoring Biosynthetic Pathways: Delineating Pathway Expression from Sophisticated Regulation Cascades *via* Synthetic Biology”, *AIChE Annual Meeting*, Minneapolis, MN, October 2011.
- [13]. H. Xiao<sup>†</sup>, **Z. Shao**, Y. Jiang, S. Dole, and H. Zhao, “Exploiting *Issatchenkia Orientalis* SD108 as a New Platform Organism for Organic Acids Production”, *AIChE Annual Meeting*, San Francisco, CA, November 2013.

Contributed  
presentations made  
since joining ISU  
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[14]. Y. Luo<sup>†</sup>, H. Huang, J. Liang, M. Wang, L. Lu, **Z. Shao**, R. E. Cobb, and H. Zhao, “Activation and Characterization of a Cryptic Polycyclic Tetramate Macrolactam Biosynthetic Gene Cluster”, *AIChE Annual Meeting*, Atlanta, GA, November 2014.

[1]. M. Suastegui<sup>†</sup> and **Z. Shao**, “Engineering *S. cerevisiae* for Production of *cis, cis*-Muconic Acid”, *AIChE Annual Meeting*, Atlanta, GA, November 2014.

[2]. M. Cao<sup>†</sup> and **Z. Shao**, “Development of Genetic Toolkits for Engineering *Scheffersomyces Stipitis* to Produce Biorenewables”, *AIChE Annual Meeting*, Atlanta, GA, November 2014.

[3]. M. Cao, M. Gao, C. Lopez, Y. Wu, and **Z. Shao**<sup>†</sup>, “Facilitating Unconventional Yeast Engineering for Biorenewables Production”, *Synthetic Biology: Engineering, Evolution & Design (SEED)*, Boston, MA, June 2015 (Poster).

[4]. M. Cao, M. Gao, C. Lopez, Y. Wu, and **Z. Shao**<sup>†</sup>, “Facilitating Unconventional Yeast Engineering for Biorenewables Production”, *Biochemical and Molecular Engineering XIX*, Puerto Vallarta, Mexico, July 2015 (Poster).

[5]. M. Cao, M. Gao, C. Lopez, Y. Wu, and **Z. Shao**<sup>†</sup>, “Facilitating Unconventional Yeast Engineering for Biorenewables Production”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Meeting*, Philadelphia, PA, August 2015 (Poster).

[6]. M. Suastegui<sup>†</sup>, J. E. Matthiesen, J.-P. Tessonnier, and **Z. Shao**, “Construction of a Platform Saccharomyces Cerevisiae for the Production of Muconic Acid”, *AIChE Annual Meeting*, Salt Lake City, UT, November 2015.

[7]. M. Gao<sup>†</sup>, M. Cao, and **Z. Shao**, “Systematic Characterization of a Panel of Strong Promoter/Terminator Pairs to Facilitate *Scheffersomyces Stipitis* Engineering”, *AIChE Annual Meeting*, Salt Lake City, UT, November 2015.

[8]. M. Cao, M. Gao, and **Z. Shao**<sup>†</sup>, “Facilitating Unconventional Yeast Engineering for Biorenewables Production”, *AIChE Annual Meeting*, Salt Lake City, UT, November 2015.

[9]. J. E. Matthiesen<sup>†</sup>, M. Suastegui, **Z. Shao**, and J.-P. Tessonnier, “Electrocatalytic Conversion of Biologically Produced Muconic Acid to a Bio-Based Polymer Precursor”, *24th North American Catalysis Society Meeting (NAM24)*, Pittsburgh, PA, 2015.

[10]. J. E. Matthiesen<sup>†</sup>, M. Suastegui, **Z. Shao**, and J.-P. Tessonnier, “Electrocatalytic Hydrogenation of Muconic Acid to Bio-Based Monomers”, *17th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis (ISHHC)*, Utrecht, the Netherlands, 2015.

[11]. M. Cao, M. Gao, C. Lopez, Y. Wu, A. Seetharam, A. Severin, and **Z. Shao**<sup>†</sup>, “Rapid Isolation of Chromosome Hubs to Facilitate Nonconventional Yeast Engineering”, *ACS Annual Meeting*, San Diego, CA, March 2016.

[12]. M. Suastegui, M. Cao, M. Gao, and **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic and Pharmaceutical



Precursors via Shikimate Pathway”, *Metabolic Engineering 11*, Kobe, Japan, June 2016.

[13]. L. Zhao<sup>†</sup>, J. V. Shanks, and **Z. Shao**, “Transcription Analysis and Metabolite Profiling of the Terpenoid Indole Alkaloid Pathway in Engineered *Catharanthus Roseus* Hairy Root Lines”, *Synthetic Biology: Engineering, Evolution & Design (SEED) Annual Meeting*, Chicago, July 2016 (poster).

[14]. M. Suastegui, M. Cao, M. Gao, and **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic and Pharmaceutical Precursors via Shikimate Pathway”, *Society of Industrial Microbiology and Biotechnology (SIMB) Annual Meeting*, New Orleans, LA, July 2016.

[15]. L. Zhao<sup>†</sup>, F. Jing, J. Yu, S. Sandmeyer, J. V. Shanks, and **Z. Shao**, “Production of Wax Esters as High-value Compounds in Yeast *Yarrowia lipolytica*”, *AIChE Annual Conference*, San Francisco, CA, November 2016.

[16]. M. Cao<sup>†</sup>, M. Gao, and **Z. Shao**, “Building a Full Set of Genetic Toolkit to Engineer *Scheffersomyces stipitis*”, *AIChE Annual Conference*, San Francisco, CA, November 2016.

[17]. M. Cao, L. Zhao, and **Z. Shao**<sup>†</sup>, “Exploring Nonconventional Yeasts to Produce Pharmaceutical Precursors and Cosmetics Additives”, *ACS Annual Conference*, San Francisco, CA, April 2017.

[18]. M. Gao<sup>†</sup> and **Z. Shao**, “Enabling Glucose and Xylose Co-utilization in Yeast via Expression of Xylose-specific Transporters”, *ACS Annual Conference*, San Francisco, CA, April 2017.

[19]. M. Suastegui<sup>†</sup> and **Z. Shao**, “Multilevel Engineering of the Upstream Aromatic Module in *Saccharomyces cerevisiae* for High Production of Polymer and Drug Aromatic Precursors”, *ACS Annual Conference*, San Francisco, CA, April 2017 (**awardee of “Best of BIOT”**).

[20]. M. Gao<sup>†</sup>, M. Cao, and **Z. Shao**, “Enabling Glucose and Xylose Co-utilization in Yeast through Expression of Xylose-specific Transporters”, *AIChE Annual Conference*, Minneapolis, MN, November 2017.

[21]. M. Cao<sup>†</sup>, M. Gao, D. Ploessl, and **Z. Shao**, “CRISPR-mediated Genome Editing and Gene Repression in *Scheffersomyces stipitis*”, *AIChE Annual Conference*, Minneapolis, MN, October 2017 (Poster).

[22]. C. Lopez<sup>†</sup> and **Z. Shao**, “Tailoring Pathways for Balanced Expression by Short Mufflers”, *AIChE Annual Conference*, Minneapolis, MN, October 2017.

[23]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts to Produce Polymer, Pharmaceutical and Cosmetics Precursors”, *Iowa State University*, Ames, IA, January 2018.

[24]. **Z. Shao**<sup>†</sup>, M. Cao, M. Gao, L. Zhao, and W. Sun, “Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *ACS Annual Conference*, New Orleans, LA, March 2018.

[25]. **Z. Shao**<sup>†</sup>, M. Cao, M. Gao, L. Zhao, and W. Sun, “Exploring Centromere Epigeneticity to Facilitate Genetic Tool Development in Yeasts”, *2nd Epigenetics and Bioengineering Conference*, San Francisco, CA, October 2018.

- [26]. C. Lopez, M. Gao, D. Ploessl, W. Sun, Y. Zhao, A. Warner, S. Ghosh, Z. Yao, and **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts to Produce Polymer, Pharmaceutical, and Nutraceutical Precursors”, *Iowa State University Research Day*, Ames, IA, March 2019 (poster).
- [27]. W. Sun<sup>†</sup>, N. P. Mira, and **Z. Shao**, “Metabolic Engineering of an Acid-tolerant Strain *Pichia kudriavzevii* for Itaconic Acid Production”, *Central US Synthetic Biology Workshop*, Madison, WI, September 2019 (poster).
- [28]. C. Lopez, M. Gao, D. Ploessl, W. Sun, Y. Zhao, A. Warner, S. Ghosh, Z. Yao, and **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts to Produce Polymer, Pharmaceutical, and Nutraceutical Precursors”, *NIH Synthetic Biology Consortium Meeting*, Bethesda, MD, October 2019 (poster).
- [29]. C. Lopez<sup>†</sup>, M. Cao, and **Z. Shao**, “Investigating Non-coding Sequences with Regulator-like Function on Pathway Expression Balance and Plasmid Stability Improvement”, *AIChE Annual Conference*, Orlando, FL, November 2019.
- [30]. W. Sun<sup>†</sup>, N. P. Mira, and **Z. Shao**, “Metabolic Engineering of an Acid-tolerant Strain *Pichia kudriavzevii* for Itaconic Acid Production”, *AIChE Annual Conference*, Orlando, FL, November 2019.
- [31]. Y. Zhao<sup>†</sup> and **Z. Shao**, “Leveraging Transposon Technology to Accelerate the Development Process of Microbial Cell Factories for High-level Production of Bio-based Chemicals”, *AIChE Annual Conference*, November 2020 (virtual, poster).
- [32]. C. Lopez<sup>†</sup>, M. Cao, Z. Yao, and **Z. Shao**, “Investigating the role of noncoding regulatory DNA in plasmid platforms for *Yarrowia lipolytica*”, *Central US Synthetic Biology Workshop*, September 2020 (virtual, poster).
- [33]. Y. Zhao<sup>†</sup> and **Z. Shao**, “Leveraging Transposon Technology to Accelerate the Development Process of Microbial Cell Factories for High-level Production of Bio-based Chemicals”, *Central US Synthetic Biology Workshop*, September 2020 (virtual, poster).
- [34]. D. Ploessl<sup>†</sup> and **Z. Shao**, “A Repackaged CRISPR Platform Unlocks the Utility of Non-Homologous End Joining in Yeast Factory Engineering”, *Central US Synthetic Biology Workshop*, September 2021 (virtual).
- [35]. D. Ploessl and **Z. Shao**<sup>†</sup>, “A Repackaged CRISPR Platform Unlocks the Utility of Non-Homologous End Joining in Yeast Factory Engineering”, *4<sup>th</sup> International Conference on CRISPR Technologies*, October 2021 (virtual).
- [36]. D. Ploessl<sup>†</sup> and **Z. Shao**, “A Repackaged CRISPR Platform Unlocks the Utility of Non-Homologous End Joining in Yeast Factory Engineering”, *AIChE Annual Conference*, November 2021.

Formally invited  
seminars and  
conference talks  
(23)

- 
- [37]. **Z. Shao**<sup>†</sup>, “Enabling Biosynthesis of High-value Compounds through Synthetic Biology”, *Nankai University*, Tianjin, June 2013.
- [38]. **Z. Shao**<sup>†</sup> and H. Zhao, “Refactoring Natural Product Gene Clusters Using a Plug-and-play Scaffold”, *Sino-USA Chinese Collaborative Workshop on Synthetic Biology*, Tianjin University, Tianjin, June 2013.

- [39]. **Z. Shao**<sup>†</sup>, “Enabling Biorenewables Production in Yeast through Synthetic Biology”, *Synthetic Biology Workshop*, Department of Biochemistry, Biophysics, and Molecular Biology, Iowa State University, Ames, IA, December 2014.
- [40]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic and Pharmaceutical Precursors *via* Shikimate Pathway”, *Synthetic Biology Young Scholar Forum*, Beijing, China, July 2016.
- [41]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic and Pharmaceutical Precursors *via* Shikimate Pathway”, *Nankai University*, Tianjin, China, July 2016.
- [42]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic and Pharmaceutical Precursors *via* Shikimate Pathway”, *Tianjin Institute of Industrial Biotechnology*, Chinese Academy of Sciences, Tianjin, China, July 2016.
- [43]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic, Pharmaceutical, and Cosmetic Precursors”, *University of Iowa*, Iowa City, IA, October 2016.
- [44]. **Z. Shao**<sup>†</sup>, “Exploring Yeast Platforms for Producing Bio-based Chemicals *via* Synthetic Biology”, *Iowa Energy Summit*, Des Moines, IA, October 2016.
- [45]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Bioplastic, Pharmaceutical, and Cosmetic Precursors”, *University of Illinois*, Urbana-Champaign, IL, March 2017.
- [46]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts for Producing Polymer, Pharmaceutical and Cosmetics Precursors”, *National Renewable Energy Laboratory (NREL)*, Golden, CO, August 2017.
- [47]. **Z. Shao**<sup>†</sup>, “Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *Vet Med College*, Iowa State University, Ames, IA, November 2017.
- [48]. **Z. Shao**<sup>†</sup>, “Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *2018 Biocatalysis, Bioconversion and Green Manufacturing US-China Bilateral Symposium*, Beijing, China, July 2018.
- [49]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts to Produce Polymer, Pharmaceutical and Cosmetics Precursors”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Conference*, Chicago, IL, August 2018.
- [50]. **Z. Shao**<sup>†</sup>, “Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Conference*, Chicago, IL, August 2018.
- [51]. **Z. Shao**<sup>†</sup>, “Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *Inaugural Central US Synthetic Biology Workshop*, Chicago, IL, September 2018.

[52]. **Z. Shao**<sup>†</sup>, “Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *AIChE Annual Conference*, Pittsburgh, PA, November 2018.

[53]. **Z. Shao**<sup>†</sup>, “Elucidating the Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Chassis”, *Cold Spring Harbor Asia Conference on Synthetic Biology*, Suzhou, China, October 2019.

[54]. **Z. Shao**<sup>†</sup>, “Exploring Conventional and Nonconventional Yeasts to Produce Polymer, Pharmaceutical and Cosmetics Precursors”, *University of Nebraska–Lincoln*, Lincoln, NE, March 2020.

[55] **Z. Shao**<sup>†</sup>, “Teaching an Old Dog New Tricks: Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *Conagen*, Bedford, MA, September 2020 (virtual).

[56] **Z. Shao**<sup>†</sup>, “Teaching an Old Dog New Tricks: Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *China Three Gorges University International Forum on Synthetic Biology*, Chongqing, China, October 2020 (virtual).

[57] **Z. Shao**<sup>†</sup>, “Teaching an Old Dog New Tricks: Elucidating Core Design Principles to Engineer Nonconventional Yeasts as Novel Microbial Factories”, *Tsinghua Forum on Industrial Biocatalysis*, Beijing, China, December 2020 (virtual).

[58] **Z. Shao**<sup>†</sup>, “Teaching an Old Dog New Tricks: Elucidating Core Design Principles to Engineer Yeasts as Novel Microbial Factories and Disease Models”, *University of Wisconsin–Madison*, Madison, WI, November 2021.

[59] **Z. Shao**<sup>†</sup>, “Teaching an Old Dog New Tricks: Elucidating Core Design Principles to Engineer Yeasts as Novel Microbial Factories and Disease Models”, *Virginia Commonwealth University*, Richmond, VA, November 2021 (virtual).

FUNDING  
SUPPORT

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**(Total funds granted to Z. Shao: \$5,203,531)**

[1]. Project: NSF Engineering Research Center for Biorenewable Chemicals

Investigators: Brent Shanks; co-PI: another 26 faculty members including **Z. Shao**

Funding agency: NSF

Funding period: 09/01/2008-08/31/2018

Total amount of the grant: \$35,822,283

Dollar amount allocated to Z. Shao: **\$372,523**

Role on project: Thrust 2 co-PI, responsible for implementing synthetic biology strategies to design microbial platforms for producing value-added chemicals (e.g., polymer, nutraceutical, and pharmaceutical precursors).

[2]. Project: Building a Highly Adaptable Yeast Consortium for Efficient Biomass Utilization

Investigators: **Zengyi Shao**  
Funding agency: Iowa Energy Center  
Funding period: 03/01/2014-02/28/2015  
Total amount of the grant: \$75,000  
Dollar amount allocated to Z. Shao: **\$75,000**  
Role on project: sole PI

[3]. Project: Mesoporous Block Copolymer Membranes with Tunable Selectivity for Bioseparations

Investigators: Eric Cochran, **Zengyi Shao**, and Tong Wang  
Funding agency: New Biochemical Separations Initiative,  
Plant Sciences Institute, Iowa State University  
Funding period: 03/01/2013-06/30/2015  
Total amount of the grant: \$228,000  
Dollar amount allocated to Z. Shao: **\$76,000**  
Role on project: co-PI, responsible for designing microbial fermentation platforms to produce dicarboxylic acids.

[4]. Project: Designing Fatty Acid Sensors for High throughput Product Profiling

Investigators: **Zengyi Shao**  
Funding agency: NSF Center for Biorenewable Chemicals,  
Industry Seed Fund  
Funding period: 03/01/2014-02/28/2016  
Total amount of the grant: \$100,000  
Dollar amount allocated to Z. Shao: **\$100,000**  
Role on project: sole PI

[5]. Project: Optimizing Muconic Acid Production in Fed-batch Fermenter

Investigators: **Zengyi Shao**  
Funding agency: NSF Center for Biorenewable Chemicals,  
Industry Seed Fund  
Funding period: 03/01/2015-02/28/2016  
Total amount of the grant: \$50,000  
Dollar amount allocated to Z. Shao: **\$50,000**  
Role on project: sole PI

[6]. Project: Engineering Stable Two- and Three-component Bacterial Consortia

Investigators: Laura Jarboe and **Zengyi Shao**  
Funding agency: NSF CBET-Biotechnology and Biochemical Engineering  
Funding period: 09/01/2015-08/31/2019  
Total amount of the grant: \$300,000  
Dollar amount allocated to Z. Shao: **\$150,000**  
Role on project: co-PI, co-advising one graduate student with L. Jarboe; mentoring the student for genome editing.

[7]. Project: Collaborative Research: Mechanisms for Cell Membrane Damage During Production of Biorenewable Fuels

Investigators: Laura Jarboe and **Zengyi Shao**

Funding agency: NSF CBET–Energy for Sustainability

Funding period: 09/01/2016-08/31/2019

Total amount of the grant: \$295,135

Dollar amount allocated to Z. Shao: **\$0**

Role on project: co-PI, offering the knowledge of yeast engineering.

[8]. Project: Optimizing TAL Production in *Yarrowia lipolytica* – a Minimalist Approach

Investigators: James Yu (UC-Irvine) and Le Zhao

Funding agency: NSF Center for Biorenewable Chemicals,  
Student-Led Research

Funding period: 03/01/2015-06/30/2016

Total amount of the grant: \$10,000

Dollar amount allocated to Z. Shao's group: ~ **\$5,000**

Role on project: Faculty advisor (Le Zhao is co-advised by Z. Shao and J. Shanks).

[9]. Project: Integrated Conversion of Glucose to Value-added Chemicals by Simultaneous Biological and Electrocatalytic Conversions

Investigators: John Matthiesen and Miguel Suastegui

Funding agency: NSF Center for Biorenewable Chemicals,  
Student-Led Research

Funding period: 03/01/2015-06/30/2016

Total amount of the grant: \$10,000

Dollar amount allocated to Z. Shao's group: ~ **\$5,000**

Role on project: Faculty advisor (Miguel Suastegui is advised by Z. Shao)

[10]. Project: Far-Field Subdiffraction Raman Imaging and *in situ* Correlative Electron Microscopy for Elucidating Details of Plant Cell Wall Structure and Deconstruction

Investigators: Emily Smith, Jacob Petrich (Ames Lab), Tanya Prozorov (Ames Lab), **Zengyi Shao**, Xueyu Song (Ames Lab), and Olga Zabolina

Funding agency: DOE Office of Science

Funding period: 10/01/2016-09/30/2019

Total amount of the grant: \$3,000,000

Dollar amount allocated to Z. Shao: **\$279,201**

Role on project: co-PI, responsible for building yeast consortia to deconstruct biomass and collaborating with microscopic specialists to monitor and optimize the biomass degradation processes.

[11]. Project: A Portable Point-of-need Device for Rapid, Automated, and High-throughput Profiling of Bacterial Antibiotic Resistance

Investigators: Meng Lu, Qijing Zhang, and **Zengyi Shao**

Funding agency: ISU Antimicrobial Resistance Seed Grant Competition

Funding period: 10/01/2016-09/30/2017  
Total amount of the grant: \$50,000  
Dollar amount allocated to Z. Shao: **\$10,000**  
Role on project: co-PI, responsible for designing polymerase chain reaction and microarray-based diagnosis.

[12]. Project: Integrated PhotoElectroMicrobial Cell for Efficient Artificial Photosynthesis

Investigators: **Zengyi Shao**, Wenzhen Li, and Meng Lu  
Funding agency: ISU Exploratory Research Program  
Funding period: 1/01/2017-08/15/2017  
Total amount of the grant: \$26,105  
Dollar amount allocated to Z. Shao: **\$26,105**  
Role on project: PI, responsible for building an integrative conversion scheme between microbial conversion and photoelectrochemistry and engineering a selected photosynthetic bacterium to convert CO<sub>2</sub>, sunlight, and water to value-added chemicals.

[13]. Project: Framework for the Identification of Bioprivileged Molecules

Investigators: Jean-Philippe Tessonnier, **Zengyi Shao**, and Linda Broadbelt (Northwestern University)  
Funding agency: NSF Center for Biorenewable Chemicals  
Funding period: 3/01/2017-08/31/2018  
Total amount of the grant: \$112,000  
Dollar amount allocated to Z. Shao: **\$54,806**  
Role on project: co-PI, responsible for implementing metabolic engineering strategies to design various microbial manufacturing platforms for the production of value-added drop-in chemicals and novel molecules, which will be further converted by chemical reactions to a wide spectrum of compounds.

[14]. Project: Unraveling Core Design Principles to Explore the World of Nonconventional Yeasts

Investigators: **Zengyi Shao**  
Funding agency: NSF MCB-Systems and Synthetic Biology  
Funding period: 09/01/2017-08/31/2020  
Total amount of the grant: \$600,000  
Dollar amount allocated to Z. Shao: **\$600,000**  
Role on project: sole PI

[15]. Project: Building a Novel Microbial Manufacturing Platform for *de novo* Synthesis of High-value Nutraceuticals

Investigators: **Zengyi Shao**  
Funding agency: Regents Innovation Fund Phase I  
Funding period: 08/15/2017-05/31/2018  
Total amount of the grant: \$50,000  
Dollar amount allocated to Z. Shao: **\$50,000**  
Role on project: sole PI

[16]. Project: Exploring Nucleosome-depleted Sequences for Novel Applications in Synthetic Biology

Investigators: **Zengyi Shao**  
Funding agency: NSF CAREER  
Funding period: 03/15/2018-03/14/2023  
Total amount of the grant: \$551,154  
Dollar amount allocated to Z. Shao: **\$551,154**  
Role on project: sole PI

[17]. Project: The Molecular Hallmark of Epigenetic Control in High-performing Yeasts

Investigators: **Zengyi Shao**, Emily A. Smith, Michael Shogren-Knaak, Peng Liu, and Arun Seetharam  
Funding agency: Presidential Interdisciplinary Research Seed Grant Program at ISU  
Funding period: 01/01/2018-12/31/2019  
Total amount of the grant: \$50,000  
Dollar amount allocated to Z. Shao: **\$37,179**  
Role on project: PI, conceiving the main idea, developing the skeleton of the project, and bringing people from different fields to collaborate on an interdisciplinary frontier.

[18]. Project: Leveraging Transposon Technology to Accelerate the Development Process of Microbial Cell Factories for High-level Production of Bio-based Chemicals

Investigators: **Zengyi Shao**  
Funding agency: Biobased Chemical/Bioproduct Seed Grant at ISU  
Funding period: 10/01/2019-09/30/2020  
Total amount of the grant: \$75,000  
Dollar amount allocated to Z. Shao: **\$75,000**  
Role on project: sole PI

[19]. Project: Probing the Integration and Expression Hotspots of Nonconventional Yeasts for Producing High-value Chemicals

Investigators: **Zengyi Shao**  
Funding agency: DOE Center for Advanced Bioenergy and Bioproduct Innovation (CABBI)  
Funding period: 12/01/2019-11/30/2022  
Total amount of the grant: **\$627,223**  
Dollar amount allocated to Z. Shao: **\$627,223**  
Role on project: Theme 2 co-PI, responsible for developing novel genetic engineering tools for nonconventional yeasts to produce precursors with polymer and lubricant applications.



[20]. Project: Establishing a Novel Instrumental Model for Elucidating Mitochondrial DNA-Associated Dysfunction and Pathogenicity

Investigators: **Zengyi Shao**

Funding agency: ISU Bailey Research Career Development Award

Funding period: 3/01/2021-2/28/2024

Total amount of the grant: \$150,000

Dollar amount allocated to Z. Shao: **\$150,000**

Role on project: sole PI

[21]. Project: Establishing a Novel Instrumental Model for Elucidating Mitochondrial DNA-Associated Dysfunction and Pathogenicity

Investigators: **Zengyi Shao**

Funding agency: NIH MIRA R35 Award

Funding period: 7/01/2021-6/20/2026

Total amount of the grant: \$1,834,340

Dollar amount allocated to Z. Shao: **\$1,834,340**

Role on project: sole PI

[22]. Project: Discovery and Application of *p*-Coumaric Acid Transporters for the Production of Stilbenoids

Investigators: **Zengyi Shao**

Funding agency: Conagen Inc.

Funding period: 8/01/2021-7/31/2022

Total amount of the grant: \$75,000

Dollar amount allocated to Z. Shao: **\$75,000**

Role on project: sole PI

SUPERVISION  
OF STUDENTS  
AND POSTDOCS

*Current mentees*  
(7)

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**Postdoc scholar (1)**

Yuxin Zhao (Ph.D., June 2020 – Present)

- Project: Probing the Integration and Expression Hotspots of Nonconventional Yeasts for Producing High-value Chemicals

**Graduate student (6)**

Deon Ploessl (Ph.D. candidate, CBE, January 2017 – Present)

- Project: Programmable DNA Repair for Improved Genome Editing Outcomes

Wan Sun (Ph.D. candidate, Microbiology, June 2015 – Present)

- Project: Engineering Acid Tolerance Yeast to Produce Dicarboxylic Acids

Zhanyi Yao (Ph.D. candidate, CBE, October 2018 – Present)

- Project: Exploring Nucleosome-depleted Sequences for Novel Applications in Synthetic Biology

Jeniffer Perea-Lopez (Ph.D. candidate, CBE, Oct. 2020 – Present)

- Project: One Stone, Five Birds: Expanding the Current Collection of Microbial Factories Using CRISPR and Transposon Technologies

Daniel Bun (Ph.D. candidate, CBE, Oct. 2020 – Present)  
- Project: Systematic Characterization of Transposon Systems for Engineering Nonconventional Yeasts

Esther Jokodola (new graduate student, CBE, Jan. 2022 – Present, co-advised by Z. Shao and D. Vigil)

- Project: Rational Fermentation Scaleup: Response of Metabolic Kinetics to Hydrodynamic Variability

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Alumni  
(24)

#### Ph.D. students (5)

Miguel Suastegui (CBE, January 2013 – May 2017)

- worked as a postdoc at Wyss Institute at Harvard and is currently a scientist at Joyn Bio, Boston, MA

- Ph.D. thesis: Metabolic Engineering Strategies for High-level Production of Aromatic Amino Acid Pathway Derivatives in *Saccharomyces cerevisiae*

Le Zhao (CBE, September 2013 – June 2017)

- Postdoc at Iowa State University

- Ph.D. thesis: Exploring the Production of High-value Compounds in Plant *Catharanthus roseus* Hairy Roots and Yeast *Yarrowia lipolytica*

Meirong Gao (CBE, November 2013 – June 2019)

- Scientist at Corteva Agriscience, Johnston, IA

- Ph.D. thesis: Designing High-performance Yeast Factories for the Production of High-value Aromatics based on a Novel Species and Its Consortia

Aric Warner (Microbiology, July 2015 – July 2021, co-advised by Z. Shao and L. Jarboe)

- Scientist at Sustainable Conversion Ventures, Chandler, AZ

- Ph.D. thesis: Microbial Engineering, Characterization, and Applications through Novel Data Processing and Synthetic Biology Systems

Carmen Lopez (Microbiology, November 2014 – December 2021)

- Scientist at Double Rainbow Biosciences, Inc., Cambridge, MA

- Ph.D. thesis: Synthetic Biology Approaches for the Construction of Improved Microbial Cell Factories

#### Postdoc scholar (2)

Dr. Mingfeng Cao (March 2013 – May 2018)

- worked as a research scientist at the DOE Center for Advanced Bioenergy & Bioproducts Innovation (CABBI), University of Illinois, Urbana-Champaign (supervised by Professor Huimin Zhao) and currently is working as a professor at Xiamen University, Fujian, China  
- Project: Unraveling Core Design Principles to Explore the World of Nonconventional Yeasts

Dr. Saptarshi Ghosh (Postdoc, September 2018 – August 2019)

- Project: Developing Transposon-based Platform for Engineering Nonconventional Yeasts

### **Master student (1)**

- Lili Zheng (Master of Engineering, CBE, January 2014 – May 2015)
- worked as a bioprocess scientist at Boehringer Ingelheim, San Francisco, CA and is now a senior scientist at Lakepharma, San Francisco, CA
  - Project: Designing Novel Fatty Acid Sensors for High Throughput Product Profiling

### **Visiting scholar (3)**

- Dr. Yanzhen Mei (Visiting scholar, October 2016 – September 2017)
- Associate Professor at Nanjing Normal University, China
  - Project: Improving the Production of Shikimate Pathway Derivatives in *Saccharomyces cerevisiae*
- Dr. Lei Huang (Visiting scholar, October 2018 – April 2019)
- Associate Professor at Tianjin University of Technology, China
  - Project: Improving the Genome Editing Efficiency in Nonconventional Yeasts
- Yuxin Zhao (Visiting Ph.D. student, May 2018 – May 2020)
- Postdoc at Iowa State University
  - Project: Unraveling Core Design Principles to Explore the World of Nonconventional Yeasts

### **Undergraduate students (13)**

- David Plotnik (Senior, Sept. 2020 – Dec. 2020)
- Attending group meetings virtually during the COVID-19 pandemic
- Infant Nathaniel (Senior, Sept. 2020 – Dec. 2020)
- Attending group meetings virtually during the COVID-19 pandemic
- Matthew Schaschwary (Senior, Sept. 2020 – Dec. 2020)
- Attending group meetings virtually during the COVID-19 pandemic
- Trang Hoang (CBE, September 2019 – May 2020)
- joining the graduate school at Michigan University
  - Project: Unraveling Core Design Principles to Explore the World of Nonconventional Yeasts
- Marissa Gustafson (CBE, January 2019 – May 2019)
- Project: CRISPR-mediated Genome Editing
- Payton Van Beek (CBE, January 2018 – December 2018)
- Project: Designing High-performance Factories for the Production of High-value Aromatics based on Yeast Consortia
- Qianhe Su (CBE, June 2016 – May 2017)
- joining the graduate school at Northwestern University
  - Project: Isolation of Novel Xylose Transporters to Relieve Carbon Catabolite Repression
- Deon Ploessl (CBE, June 2016 – August 2016)
- joining the graduate school at Iowa State University
  - Project: CRISPR-mediated Genome Editing and Gene Repression in *Scheffersomyces stipitis*

Yutong Wu (CBE, August 2014 – May 2016)  
- joining the graduate school at Georgia Tech  
- Project: Discovering Centromeric DNA to Facilitate *Scheffersomyces stipitis* Genetic Engineering

Yi-Chen Tu (CBE, Mar 2014 – May 2014)  
- joining the graduate school at SUNY-Buffalo, Biomedical Engineering  
- Project: Developing Genetic Manipulation Tools for Engineering *Scheffersomyces stipitis*

Ian Baer (CBE, August 2014 – May 2015)  
- Project: Engineering *Saccharomyces cerevisiae* for Producing Muconic acid

Laurel Limaye (CBE, July 2013 – July 2014)  
- working at Nalco, Naperville, IL  
- Project: Engineering *Streptomyces lividans* for Albomycin Biosynthesis

Korey Gramenz (CBE, July 2013 – July 2014)  
- working at Cambrex, Charles City, IA  
- Project: Engineering *Streptomyces lividans* for Albomycin Biosynthesis

Summer  
Programs  
(REU, RET,  
and YES, 6)

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Nam Nguyen (Des Moines Area Community College, BioMaP REU, 2014)  
- Project: Increasing Muconic Acid Production in the Yeast *Saccharomyces cerevisiae*

Elaine Butler (Grand View University, CBiRC REU, 2014)  
- Project: Developing a Fatty Acid Sensor Based on FadR Crystal Structure

Dana Tribby (University of Minnesota at Duluth, CBiRC REU, 2015)  
- Project: Promoter Characterization in *Scheffersomyces stipitis*

Nik Leung (Ames High School, CBiRC-YES, Fall 2015)  
- Project: Designing Novel Fatty Acid Sensors for High Throughput Product Profiling

Emma House (Wayne State University, CBiRC REU, 2016)  
- Project: Multilevel Engineering of *Saccharomyces cerevisiae* for the Production of Muconic Acid from Glucose

Eric Anderson (Carlisle High School, CBiRC RET, 2017)  
- Project: Modulating Gene Expression through Perturbing Genetic Context

Program of study  
committee (40)

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Mark Brown (CBE, Ph.D., 2015), Chunyu Liao (Biochemistry, Ph.D., 2015), Sagarika Weerasekara (Chemistry, M.S., 2015), Lili Zheng (CBE, Master of Engineering, 2015), Meirong Jia (Biochemistry, Ph.D., 2016), Xi Gao (CBE, Ph.D., 2016), Jin Tao (CBE, Ph.D., 2016), Kayla Flyckt (Biochemistry, M.S., 2016), Le Zhao (CBE, Ph.D., 2017), James Walker (Chemistry, Ph.D., 2017), Miguel Suastegui (CBE, Ph.D., 2017), Aaron Marcella (Biochemistry, Ph.D., 2017), Huazhang Zhu (CBE, M.S., 2017), Varsha Gaonkar (ABE, M.S., 2017), Yingxi Chen (CBE, Ph.D., 2018), Bokki Min (CBE, M.S., 2018),

Meirong Gao (CBE, Ph.D., 2018), Liza Alexander (Biochemistry, Ph.D., 2019), Naazneen Sofeo (Biochemistry, Ph.D., 2019), Kirsten Davis (CBE, Ph.D., 2019), Wei Zheng (CBE, Ph.D., 2019), Zhe Li (CBE, Ph.D., 2019) Maria Oliveira (ABE, Ph.D., 2019), Nazira Mahmud (ABE, Ph.D., 2019) Aric Warner (Microbiology, Ph.D., 2021), Samuel M. Rothstein (CBE, Ph.D., 2020), Kenna Goodlaxson (Biochemistry, Ph.D., 2021), Moises R. Contreras (CBE, Ph.D., 2021), Ana Isabel de Vila-Santa Braga Campos (Bioengineering, Instituto Superior Técnico, Ph.D., 2021), Carmen Lopez (Microbiology, Ph.D., 2021), Wan Sun (Microbiology, Ph.D., in progress), Deon Ploessl (CBE, Ph.D. in progress), Reid Brown (Biochemistry, Ph.D., in progress), Mingjun Ma (ABE, Ph.D., in progress), Richard Oyagbenro (BBMB, Ph.D., in progress), Luman Liu (CBE, Ph.D., in progress), Zhanyi Yao (CBE, Ph.D., in progress), Efrain Rodriguez Ocasio (CBE, Ph.D., in progress), Raymond Larsen (Biochemistry, Ph.D., in progress), Marissa Roghair Stroud (Microbiology, Ph.D., in progress)

STUDENT  
AWARDS

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Miguel Suastegui

- Research Award, Graduate and Professional Student Senate (2015)  
*(1 of 5 graduate awardees for the entire university per year)*

Miguel Suastegui

- Award for Student-led Research, Center for Biorenewable Chemicals (2015-2016)  
*(collaborating with John Matthiesen from the Tessonnier group at ISU)*

Le Zhao

- Award for Student-led Research, Center for Biorenewable Chemicals (2015-2016)  
*(collaborating with James Yu from the Sandmeyer group at UC-Irvine)*

Miguel Suastegui

- Research Excellence Award, College of Engineering (2016)  
*(single awardee per department per semester)*

Deon Ploessl

- Presidential Fellowship (2016)  
*(single new student awardee per department per year)*

Deon Ploessl

- NSF Graduate Research Fellowship (GRFP, 2017)  
*(1 of the 2,000 awardees from 17,000 applicants)*

Miguel Suastegui

- Best Presentation Award of BIOT (2017)  
*(American Chemical Society, Division of Biochemical Technology, San Francisco)*

Payton Van Beek

- Griswold Undergraduate Internship (2017 – 2018)  
*(motivating high-performing undergraduates to participate in research at an early stage)*

Aric Warner

- 1<sup>st</sup> Place in Perfect Pitch Competition, Center for Biorenewable Chemicals Annual Meeting (2017)

Carmen Lopez

- Trinet Fellowship (2017)  
*(awarded to the recipient who is proactive in helping support K-12 education)*

Marissa Gustafson

- Griswold Undergraduate Internship (2019 – 2020)  
*(motivating high-performing undergraduates to participate in research at an early stage)*

Trang Hoang

- Griswold Undergraduate Internship (2019 – 2020)  
*(motivating high-performing undergraduates to participate in research at an early stage)*

Deon Ploessl

- Teaching Excellence Award, College of Engineering (2019)  
*(1 of the 3 awardees for the Department)*

David Plotnik

- Griswold Undergraduate Internship (2020 – 2021)

Deon Ploessl

- 3<sup>rd</sup> place in the 3-min Thesis Competition, CBE (2021)

Deon Ploessl

- Research Excellence Award, College of Engineering (2021)  
*(1 of the 2 awardees for the Department)*

OTHER  
SERVICES AT  
ISU

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- [1]. CBE Graduate Student Committee (Spring 2013, Fall 2014 – Spring 2018)
  - [2]. CBE Faculty Search Committee (Fall 2013 – Spring 2014)
  - [3]. Microbiology Graduate Student Admission Committee (2014 – 2018)
  - [4]. Microbiology Graduate Student Admission Committee Chair (2016 – 2017)
  - [5]. CBE Faculty Advisor for Omega Chi Epsilon (Fall 2014 – Summer 2019)
  - [6]. Faculty Advisor for the Preparing Future Faculty program  
(Student: Liza Alexander from BBMB, 2017; Shailja Goyal, 2019; Geet Gupta, 2020)
  - [7]. CBE Shared Equipment/Lab Integration Ad Hoc Committee (Fall 2018 – Present)
  - [8]. Conflict of Interest Scientific Oversight Committee (Spring 2019 – Present)
  - [9]. CBE Recruiting and Retention Committee (Fall 2019 – Present)
  - [10]. Faculty mentor of Vertically Integrated Projects (VIP), a research initiative that provides undergraduate students the opportunity to participate in a multi-year research project (Spring 2020)
  - [11]. CBE Assessment Committee (Fall 2020 – Present)
  - [12]. CBE Faculty Search Committee (Fall 2021– Spring 2022)

PROFESSIONAL  
ACTIVITIES

*Panelists*

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- [1]. NSF SBIR/STTR Phase I (Arlington, VA, 2013, 2015–2017)
  - [2]. USDA SBIR/STTR Phase I (virtual, 2014–2015; *ad hoc*, 2016)
  - [3]. NSF Energy for Sustainability (Arlington, VA, 2014)
  - [4]. NSF SBIR/STTR Phase II (Arlington, VA, 2015)
  - [5]. NSF CBET Biochemical Engineering (Arlington, VA, 2017)
  - [6]. DOE BER Genomic Sciences Program (Washington DC, 2017)
  - [7]. NASA RosBio 2018 EM-1 (virtual, 2018)
  - [8]. NSF MCB Systems and Synthetic Biology (virtual, 2019)
  - [9]. NSF CBET Cellular & Biochemical Engineering (Arlington, VA, 2019)
  - [10]. NSF Joint Systems & Synthetic Biology and Mathematical Biology (Arlington, VA, 2019)
  - [11]. External reviewer for BBSRC-NSF/BIO (2019)
  - [12]. External reviewer for NSF MCB CAREER (2021)
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*Conference  
organizers*

- [1]. Chair, “Biobased Fuels and Chemicals II: Enzymatic Conversion of Lignocellulosic Biomass”, *AIChE Annual Meeting*, San Francisco, CA, November 2013.
- [2]. Chair, “Biobased Fuels and Chemicals II: Moving Beyond Glucose”, *AIChE Annual Meeting*, Atlanta, GA, November 2014.
- [3]. Co-chair, “Advances in Metabolic Engineering and Bioinformatics for Biofuels II: Next Generation Method Development”, *AIChE Annual Meeting*, Atlanta, GA, November 2014.
- [4]. Chair, “Cell Culture I: Host Cell Engineering, Screening, and Scale-down Models”, *AIChE Annual Meeting*, Salt Lake City, UT, November 2015.
- [5]. Co-chair, “Synthetic Biology and Metabolic Engineering”, *Metabolic Engineering 11*, Kobe, Japan, June 2016.
- [6]. Chair, “Advances in Mixed Culture/Microbial Consortium for Metabolic Engineering”, *AIChE Annual Meeting*, San Francisco, CA, November 2016.
- [7]. Chair, “Synthetic Biology Approaches to Engineer Production of Biofuels and Value-added Chemicals”, *ACS Annual Meeting*, San Francisco, CA, April 2017.
- [8]. Chair, “Symposium: New Tools and Approaches”, *ACS Annual Meeting*, San Francisco, CA, April 2017.
- [9]. Chair, “Metabolic Engineering for Fuels and Chemicals”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Meeting*, Denver, CO, July 2017.
- [10]. Co-chair, “Advances in Metabolic Engineering of Photosynthetic/Non-Model Organisms”, *AIChE Annual Meeting*, Minneapolis, MN, October 2017.
- [11]. Co-chair, “Protein Engineering II: Combinatorial Techniques”, *AIChE Annual Meeting*, Minneapolis, MN, November 2017.

- [12]. Program Committee, “Metabolic Engineering”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Conference*, Chicago, IL, August 2018.
- [13]. Co-chair, “Microbial Metabolic Engineering I and II”, *ACS Annual Meeting*, Orlando, FL, April 2019.
- [14]. Program Committee, “Metabolic Engineering”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Conference*, Washington DC, July 2019.
- [15]. Steering Committee, Central US Synbio Workshop, Madison, September 2019.
- [16]. Program Committee, “Microbial Metabolic Engineering”, *ACS Annual Conference*, August 2020 (virtual).
- [17]. Program Committee Chair, “Metabolic Engineering”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Conference*, San Francisco, CA, August 2020 (canceled).
- [18]. Organizing Committee, *Central US Synbio Workshop*, Chicago, September 2020 (virtual).
- [19] Co-chair, “Metabolic Engineering of Microbes II”, *Metabolic Engineering 14*, July 2021 (virtual).
- [20]. Program Committee Chair, “Metabolic Engineering”, *Society for Industrial Microbiology and Biotechnology (SIMB) Annual Conference*, Austin, TX, August 2021.
- [21] Organizing Committee, *Central US Synbio Workshop*, Chicago, September 2021 (virtual).

*Editorial Board*

Journal of Industrial Microbiology and Biotechnology (editorial board)

Metabolic Engineering Communications (editorial board)

Engineering in Life Sciences  
(Guest editor for the special issue – “Synthetic Biology and Metabolic Engineering”, 2018)

Engineering in Life Sciences (Co-editor, 2019)

Journal of Industrial Microbiology and Biotechnology  
(Guest editor for the special issue – “Frontiers of Industrial Microbiology and Biotechnology: SIMB-2019”)

*Journal Reviewer*

Science, Nature Communications, Nature Chemical Biology, ACS Synthetic Biology, Metabolic Engineering, ACS Catalysis, Applied Microbiology and Biotechnology, Biotechnology Journal, ACS Macro Letters, AIChE Journal, Biochemical Engineering Journal, PLOS ONE, Scientific Reports, Journal of Industrial Microbiology and Biotechnology, Chemical Engineering Science, Engineering in Life Sciences, Frontier in Microbiology, Journal of Visualized Experiments, Enzyme and Microbial Technology, Microbial Cell Factories, Metabolic Engineering Communications, Biotechnology for Biofuels, Current Opinion in Biotechnology, etc.



OTHER  
EXEMPLARY  
OUTREACH  
ACTIVITIES

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[1]. *EPSCoR-Ames summer enrichment program*: The program was held Monday through Thursday for 6 weeks during the summer of 2014 to involve elementary-aged children—many of whom belong to minority populations and low-income families—in achieving a perspective to appreciate the STEM fields through hands-on interactive experiments.

[2]. *Middle-school and high-school science symposium*: Shao served as a science judge for The State Science and Technology Fair of Iowa (SSTFI) held in March 2014. SSTFI brought together approximately 700 pre-collegiate students from all over the state of Iowa, aiming to spark the interest of younger students in STEM.

[3]. *Young Engineers and Scientists (YES)*: As a pre-college program offered by CBiRC at ISU, YES helps high school students align their science interests with research labs. In 2015, Shao mentored a student from the Ames High School and introduced him to the biochemical engineering field. Under the supervision of a graduate student, the high school student spent 6–8 hours per week, working on a project entitled “Designing novel fatty acid sensors for high-throughput product reporting”. He developed a basic understanding of how to leverage natural molecular sensing machinery to benefit fatty acid production and obtained hands-on skills in recombinant DNA technology.

[4]. *Trinect program*: The graduate student Carmen Lopez from the Shao group was appointed as a Trinect Fellow in 2017–2018, working with the underrepresented minority elementary school students in Des Moines with the goal of delivering engineering concepts to K-12 classes.

[5]. *Scientific talk at Saylorville visitor center theater*: A team led by Dr. L. Jarboe, Dr. T. Mansell, and Dr. Z. Shao went to the Saylorville visitor center theater in the summer of 2017, discussing with the public audience about building cell factories for the production of medicines, fuels, and chemicals.

[6]. *Freshman Research Initiative (FRI)*: Shao participated as one of the guest instructors in the Biorenewable Resources Research Stream, which was organized with 10–20 freshman participants in the spring semesters of 2015 – 2018. Students coming from the Departments of Chemical Engineering, Biochemistry, Genetics, and Agriculture, worked on “Building a microbial factory to manufacture renewable products”.

[7]. *Vertically Integrated Project (VIP)*: Shao was involved as a faculty mentor for a HHMI research initiative that provided undergraduate students the opportunity to participate in frontier research projects in 2020. She led a team of 6 undergraduates, working on “Assessing Genome Accessibility and the Impact on Microbial Factory Performance Using CRISPR-based Genome Editing Tool”.

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(Updated on December 10, 2021)