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"Harnessing the Full Power of Small Data to Guide Colloidal Nanocrystal Synthesis"

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Bio: Richard L. Brutchey received his B.S. in chemistry from the University of California, Irvine in 2000 and his Ph.D. in chemistry from the University of California, Berkeley in 2005. After a post-doctoral fellowship at the University of California, Santa Barbara, he began his independent career in 2007 at the University of Southern California where he is currently a Professor of Chemistry. The Brutchey group develops new methods of material synthesis to address challenges related to catalysis, energy storage and conversion, and sustainability. Brutchey was the recipient of a Cottrell Scholar Award by the Research Corporation for Science Advancement in 2010, received the ACS Nanoscience Award in 2020, and was elected a 2024 fellow of the Royal Society of Chemistry. His work has been highlighted by *Forbes*, *National Geographic* magazine, and National Public Radio. He has held appointments as a visiting professor at the Swiss Federal Institute of Technology Zürich in 2014 and as the Joseph Meyerhoff Visiting Professor at the Weizmann Institute of Science in 2022. Brutchey currently serves as an Associate Editor for the ACS journal *Inorganic Chemistry*.

Abstract: A critical bottleneck exists in synthesis of new materials. Most materials syntheses lack a deep mechanistic understanding, making prediction and control challenging. The traditional trial-and-error method, reminiscent of Edisonian experimentation, involves adjusting one variable at a time and leads to prolonged timelines for successful synthesis, execution, and optimization. An alternative to this slow process lies in data-driven techniques, which offer an effective and efficient way to predict and control materials synthesis. In this talk, I will share our recent progress in leveraging these techniques to predict and control colloidal nanocrystal synthesis. Remarkably, even with "small" data sets related to novel and inherently low-throughput chemistries, we can accelerate our ability to achieve promising results using data-driven methodologies. I will showcase select case studies from my lab that underscore the power of these techniques in optimizing nanocrystal synthesis and manufacturability, synthetically navigating complex phase diagrams, and fine-tuning the performance of CO_2 reduction catalysts.