Bioinspired Ocean Exploration

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12:30 PM

EQUAD Building, Room D221

MAE Baetjer Colloquium

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The ocean remains largely impenetrable to human observation, especially in comparison to our ability to view the inner workings of cells or peer deep into space. Efforts toward high-resolution ocean measurement have primarily focused on interrogating the ocean with increasing numbers of surface and submarine vehicles. The extent to which this approach can scale is fundamentally limited by the energetic requirements of propulsion—a challenge that was solved millions of years ago by swimming zooplankton. But how do they do it? This talk will describe lab and field experiments focused on understanding the fluid mechanics of efficient locomotion by jellyfish, the most energy-efficient of all animal swimmers. That knowledge is leveraged to develop bio-inspired robotic systems with the potential to enable exploration of the entire ocean. Such data can inform longstanding questions regarding the past, present, and future of the ocean.

John Dabiri is the Centennial Chair Professor at Caltech, with appointments in the Graduate Aerospace Laboratories (GALCIT) and Mechanical Engineering. His research focuses on unsteady fluid mechanics and flow physics, with particular emphasis on topics relevant to biology, energy, and the environment. Current interests include biological fluid dynamics in the ocean, next-generation wind energy, and development of new experimental methods. Dabiri is a MacArthur Fellow and Fellow of the American Physical Society. Other honors include the Alan T. Waterman Award from the National Science Foundation, the Presidential Early Career Award for Scientists and Engineers (PECASE), the Office of Naval Research Young Investigator Program Award, and being named one of MIT Technology Review's "35 Innovators Under 35" as well as one of Popular Science's "Brilliant 10." Dabiri serves on President Biden's Council of Advisors on Science and Technology (PCAST), the Secretary of Energy Advisory Board (SEAB), the Board of Directors of NVIDIA Corporation, and the Board of Trustees of the Gordon and Betty Moore Foundation. He is Past Chair and member of the Executive Committee of the American Physical Society Division of Fluid Dynamics, as well as a member of the National Academies' Committee on Science, Technology, and Law. He previously served on the editorial board of the Journal of Fluid Mechanics, the U.S. National Committee for Theoretical and Applied Mechanics (USNCTAM), the Defense Science Study Group, and as an Advisor to X at Alphabet (formerly GoogleX). Dabiri received his B.S.E. summa cum laude in Mechanical and Aerospace Engineering from Princeton University (2001); his M.S. in Aeronautics from Caltech (2003); and his Ph.D. in Bioengineering with a minor in Aeronautics from Caltech (2005). He was a Professor of Aeronautics and Bioengineering at Caltech from 2005 to 2015, during which time he also served as Director of the Center for Bioinspired Wind Energy, Chair of the Faculty, and Dean of Students. From 2015 to 2019 he served as a Professor of Civil and Environmental Engineering and of Mechanical Engineering at Stanford University, where he was recognized with the Eugene L. Grant Award for Excellence in Teaching.

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