UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UCSD NanoEngineering/Chemical Engineering

SPECIAL SEMINAR

Friday, October 4, 2019
Seminar Presentation: 11:00am – 12:00pm
SME room 347

"Insect-Inspired Translational Research"

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Abstract: In this seminar, I will introduce the physics and chemistry of superhydrophobicity that enabled five *Halobates*, out of approx. 5.5 million extant species of insects, to colonize the surface of the open ocean, the largest biome on Earth. On translating microtextures similar to the mushroom-shaped microtrichia on the legs of *Halobates*, the conventional wisdom in wetting goes topsy-turvy. I will present variations on these architectures to pin-point their strengths and weaknesses. In the grand finale, I will unveil

(i) gas entrapping microtextured surfaces (GEMS) that robustly entrap air on immersion in polar and apolar liquids for drag reduction[1-3] and mitigating surface erosion from cavitation,
(ii) the first-ever gas entrapping membranes (GEMs) for desalination by membrane distillation that do not require water-repellent materials/coatings[4], and
(iii) a sustainable technology to strengthen the global food-water security.

References:

1. Domingues, E. M.; Arunachalam, S.; Mishra, H., Doubly Reentrant Cavities Prevent Catastrophic Wetting Transitions on Intrinsically Wetting Surfaces. *ACS Applied Materials & Interfaces* **2017,** *9* (25), 21532-21538.
2. Domingues, E. M.; Arunachalam, S.; Nauruzbayeva, J.; Mishra, H., Biomimetic coating-free surfaces for long-term entrapment of air under wetting liquids. *Nature Communications* **2018,** *9* (1), 3606.
3. Arunachalam, S.; Das, R.; Nauruzbayeva, J.; Domingues, E. M.; Mishra, H., Assessing omniphobicity by immersion. *Journal of Colloid and Interface Science* **2019,** *534*, 156-162.
4. Das, R.; Arunachalam, S.; Ahmad, Z.; Manalastas, E.; Mishra, H., Bio-inspired gas-entrapping membranes (GEMs) derived from common water-wet materials for green desalination. *Journal of Membrane Science* **2019,** *588*, 117185.

Biosketch: Himanshu Mishra is an Assistant Professor of Environmental Science and Engineering and a principal investigator at Water Desalination and Reuse Center at King Abdullah University of Science and Technology (KAUST). His research Group investigates chemistries and forces at interfaces of water with hydrophobic materials, including air, hydrocarbons, or perfluorocarbons. Mishra's translational research has produced technologies for sustainably boosting food production in hot and arid areas and achieving liquid-repellent surfaces/membranes without using (liquid-repellent) coatings. Before starting his independent career at KAUST, he earned his PhD at Caltech in 2013 (with Prof. Bill Goddard and Prof. Mike Hoffmann) and was the Elings Prize Postdoctoral Fellow at University of California Santa Barbara (with Late Prof. Israelachvili). For work-life balance Mishra reads an eclectic mix of books and does outdoor activities. He is an open-ocean swimmer, runs half-marathons and mini-triathlons, and hikes mountains (highest so far, El Misti > 19,000 ft).