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Education

PhD, Mechanical Engineering, University of Washington

Key Interests

Self-propelled Nanoparticles | Mechanobiology | Extracellular Matrix | Electroporation | Electrokinetics | Microbiology | Microfluidics | Heat Transfer

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SELECT PUBLICATIONS

- J. Moran, Robotic colloids: engineered self-propulsion at the micro-scale (and smaller) in *Robotic systems and autonomous platforms: Advances in materials and manufacturing* (2018).
- J. Moran & J. Posner, Phoretic self-propulsion. *Annu Rev Fluid Mech* 49, 511-540 (2017).
- P. Garcia *et al.*, Microfluidic screening of electric fields for electroporation. *Sci Rep* 6, 21238 (2016).
- J. Moran & J. Posner, Electrokinetic locomotion due to reaction-induced charge auto-electrophoresis. *J Fluid Mech* 680, 31-66 (2011).

Research Focus

Self-propelled microparticles have been in development for 15 years, but we are a long way from fully understanding their capabilities. They can swim in externally-controlled patterns and deliver cargo (e.g. drugs, nanoparticles) to specific locations. My group develops novel designs for self-propelled micro and nanoparticles and is actively developing them for use in targeted drug delivery within diseased extracellular matrices (e.g. surrounding a solid tumor), wastewater treatment and remediation, and enhancement of heat transfer in liquids.

Current Projects

- Project 1: The goal of this project is to create submicron-size helical nanoparticles capable of self-propulsion (using magnetic fields) and payload delivery in diseased extracellular matrices. We are also developing novel imaging methodologies to track these particles in vivo. Together, these could lead to advanced targeted therapies for cancer, fibrosis, etc.
- Project 2: The goal of this project is to use self-propelled micro and nanoparticles to significantly enhance heat transfer through liquids compared to passive (non-propelled) particles (i.e., nanofluids) or the liquids alone.
- Project 3: This project aims to create wetsuits that provide better thermal insulation, allowing divers to spend two to three times longer in cold water than they otherwise could. This is done by infusing insulating noble gases into the wetsuit material.