PhD opportunity: Fluid dynamics of interacting flexible bio-propulsors at millimeter scales
Department of Mechanical Engineering, Penn State University, State College, PA

Start: January 2022

Duration: 4-5 years

Deadline to apply: October 7, 2021

Position description: The flexibility and deformability of animal bodies and appendages is a key feature that enables high performance and efficiency in swimming and flying. However, little is known about the complex flow structures created by spatiotemporally coordinated flexible surfaces in close proximity to one another. This PhD project will combine 3D flow measurement methods, materials characterization, and experiments with living organisms to understand how flexible structures hydrodynamically interact at millimeter scales. The project is experimental; data collection will take place primarily in the laboratory and during short (1-3 week) sessions at marine field stations. Opportunities for analytical or computational research may arise over the course of the project. Experimental techniques to be used include high-speed videography, volumetric Particle Tracking Velocimetry (PTV), refractive index matching, and physical (robotic) dynamic modeling. The student will be encouraged to design and test new measurement techniques and experimental setups, further developing their understanding of cutting-edge laser diagnostics and optical flow measurement techniques.

Required qualifications: Strong interest in organismal biology, and basic technical background in fluid dynamics, mechanics of materials, and dynamics. Undergraduate degree in engineering, physics, or a related field (MS strongly preferred). Must have past research experience (experimental strongly preferred; if your past work is entirely computational, please address this explicitly in your application). Past experience in experimental fluid dynamics research is an advantage, but not required.

Lab/research group description: The Environmental and Biological Fluid Mechanics (EBFM) Laboratory explores the fundamental fluid dynamics of how animals and particles interact with flow. We are particularly interested in the intermediate scales where both inertia and viscosity are important (see https://sites.psu.edu/byronlab). We are part of Penn State’s Mechanical Engineering Department, which has nearly 60 research groups across a variety of topics (see https://www.me.psu.edu/research/index.aspx). EBFM lab is part of the Rainbow Engineering Network and is actively committed to fostering a diverse and inclusive environment for all affiliated researchers. Students in EBFM lab are encouraged to view science as a human enterprise and scientists as whole people.

Location: Penn State University is located in State College, PA, which is consistently rated one of the best college towns in the United States for its safety, livability, and scenic surroundings. The area offers a compelling juxtaposition of urban and rural: bustling downtown shops, restaurants and entertainment venues are only a few traffic-free minutes from pristine hiking, mountain biking, and fly fishing in the nearby mountains and forests.

How to apply: Send an email to mbyron@psu.edu with your CV, BS/MS transcripts, and the names and email addresses of three references. Please also provide a short letter (maximum 2 pages) explaining your interest in the project, including any relevant past experience that may uniquely qualify you for this work. Top candidates will be invited for an interview via Zoom and directed to formally apply for admission to the Penn State graduate program at https://www.me.psu.edu/students/graduate/admissions.aspx.