

Please note: For summer 2021, GRAP is offered as a **remote** opportunity. If conditions change (Tufts allows international travel, and the country where the research takes place allows incoming student researchers), we will consider allowing students to travel internationally.

Faculty: Marc Hodes, Professor, Mechanical Engineering, School of Engineering

Project Locations: Remote work from home or at Tufts University/Medford, MA and London and/or Oxford, UK

Dates: Late June-mid-August

Project Title: Mathematical Modeling of Biomimetic Lotus-Leaf Type Surfaces

Project Details: Professor Marc Hodes in the Department of Mechanical Engineering has a long-standing collaboration with Professors Demetrios Papageorgiou and Darren Crowdy in the Math Department of Imperial College London and Dr. Toby Kirk in the Math Department of Oxford University. Our project is termed the Red Lotus Project, as it is aimed at exploiting the lubricating properties of the Lotus leaf when used as a platform for surfaces. We have synthesized such biomimetic surfaces in the past and our interests generally involve heat transfer. For example, we have a series of publications related to how such surfaces can be used to enhance the thermal management of electronics by lubricating the flow of liquid metals through microchannels etched into microprocessor chips. Our work has been funded, by, e.g., the National Science Foundation. Modeling the coupled fluid mechanics and heat transfer relevant to such problems is a rich academic opportunity with myriad applications beyond thermal management of electronics. We have exchanged many students between Imperial College London and Tufts University in the past.

Tasks and Responsibilities of Research Assistant:

Remote Work:

We have a number of mathematical models in place for the flows of interests in the above-mentioned applications. The student would be responsible for collaborating with us to further advance these models. We would assign well-defined mathematical problems to the student and mentor them closely. We regularly have meetings over Zoom and the student would participate in such meetings. The student would be assigned a problem that they could take ownership of and extends beyond what we have done previously. Thus the student, in the long term, could aspire towards a journal publication in collaboration with us. Tufts has all necessary licenses to relevant software (Matlab, Mathematica, ANSYS FLUENT, etc.) in place and the student would learn to use some of these software programs.

If international travel is allowed:

Same as above, but partly on-site in the UK.

Qualifications:

The student must have taken all relevant undergraduate math classes and fluid mechanics and heat transfer. Graduate-level math classes, which many undergraduate take as well, would also be very relevant.

Housing in London: The research assistant would live in a temporary apartment at [Vincent House](#) in Notting Hill, within walking distance of Imperial College. Vincent House provides lunch and dinner and has laundry machines in the basement. The rooms at Vincent House are singles.