

Scanning Tunneling Microscopy (STM) is a technique that allows for atomic resolution imaging of surfaces. The student's role in this research will be to study two-dimensional supramolecular self-assembly. Research in our group focuses on the design, synthesis, and physical characterization of new helical bio-inspired model folding systems. These molecules are designed to self-assemble into regular supramolecular arrays as a result of specific and directional intermolecular interactions. Well-defined 2D structures have important technological applications including innovative catalysts and sensors. The goal of this research program is to provide a molecular-level rationale for self-assembly at the liquid-solid interface and to ultimately design molecules that will self-assemble into predictable and modifiable arrangements. Research in the Cuccia group (Concordia) focuses on the design, synthesis, and physical characterization of new helical bio-inspired model folding systems.² These compounds integrate the structural and functional characteristics of biopolymers, *i.e.* well-defined shapes, conformations, and functions based on the sum of weak supramolecular interactions, with the stability and diversity of synthetic molecules. Templating or pre-organization of reactants has also been used to drive related macrocyclisation reactions. Macrocycles and shape-persistent foldamers are expected to self-assemble into regular supramolecular arrays as a result of specific and directional non-covalent interactions where both molecule-substrate and molecule-molecule interactions must be considered. The Hanan group (Université de Montréal) has designed and synthesized a variety of shape-persistent molecules that contain suitable metal binding groups as well as alkyl side groups that promote dynamic self-assembly at the liquid-solid interface (Figure 1; R: *t*-Bu; HOPG/1,2,4-trichlorobenzene).⁵ In related work, we have

recently taken advantage of a novel transamination reaction of 2,4-diaminoresorcinols⁷ to access a series of long-chain dialkyl-substituted zwitterionic quinones. With these in hand, we would like to investigate the effect of chain length on surface adsorption onto highly oriented pyrolytic graphite using STM (Figure 2; R: *n*-C₁₈H₃₇; HOPG/1,2,4-trichlorobenzene).

The focus of this work will be to

obtain atomic scale resolution images for determining the 2D unit cell using molecular modeling. This multi-faceted research program is unique in terms of our molecular design, synthetic strategy, and characterization. Essential to this program, STM provides us with unprecedented details of the 2D supramolecular self-assembly in these systems. The student working on this project will have the opportunity to learn many facets of chemistry including organic, inorganic and organometallic synthesis, and a variety of surface techniques, especially STM.

