Title:	Surface Recognition and Incorporation of Additives into Calcium Oxalate Host Crystals
Type:	Student
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Description:	Biological systems direct inorganic mineral synthesis and subsequent composite growth via molecular interactions between macromolecules and mineral phases. The systems are striking examples of materials engineering, but describing the structure/function relationships between the organic and inorganic molecules at the molecular level remains difficult. The aim of this research is to learn how specific additives, ranging in size from ions and small molecules to macromolecular proteins, influence the growth morphology and kinetics of biomineral crystals by molecular recognition of surfaces and eventual incorporation into the bulk lattice structure. Understanding additive/host interactions may eventually lead to engineering crystals at the nanoscale using bioinspired approaches. Our focus is to probe how additives interact (i.e. by way of lattice matching, electrostatics, stereochemistry) with inorganic host crystals. Our model is calcium oxalate, the primary mineral found in kidney stones, and we are using atomic force microscopy (AFM) to directly measure how additives with known charge and structure change the morphology and growth rate on different crystal faces. Fluorescence microscopy compliments these results by providing spectral data that are based on changes in the local environment of labeled additives, the orientation of the transition dipole moments of dyes incorporated within the crystal lattice of the energy transfer between dyes on an incorporated double labeled protein.