Stereospecific Chemical Sensors for Amino Acids and Carbohydrates C. D. Paavola[1], M. Kabir[2], Amanda Crochet[3] and Matthew Francis[3]
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Introduction: Specific organic compounds, such as amino acids and carbohydrates, are attractive targets as biomarkers in extraterrestrial environments because they are central to terrestrial biochemistry and are widely distributed due to abiotic chemistries. It is, however, necessary to distinguish biological compounds from those of abiotic origin. Stereochemistry is an important piece of evidence in this determination because stereochemical specificity is a feature of virtually all known biocatalysis. We are developing sensors based on a family of proteins that microbes use to detect and capture nutrients in their surroundings. Each member of this family binds a specific analyte with stereochemical specificity and undergoes a conformational change on ligand binding. By attaching two different fluorophores to specific sites on the protein, analyte binding can be coupled to a spectral change through fluorescence resonance energy transfer (FRET). This spectral change can be detected using compact, inexpensive, off-the-shelf technology. We have produced sensors for L-amino acids and sugars using proteins derived from mesophilic and thermophilic organisms, and we are in the process of producing sensors for D-amino acids. This technology will make it possible to detect enantiomeric excesses in biological compounds that are indicative of past or present living organisms.