Abstract:

Our research uses the principles and techniques of organic chemistry to solve problems of relevance to biology.

Recently, we have been collaborating with the Bacterial Signaling group in the synthesis of AI-2, a quorum sensing autoinducer, well known for its ability to mediate inter-species communication regulating important bacterial group behaviors. We developed a new efficient synthesis of DPD ((S)-4,5-dihydroxypentane-2,3-dione), which is the precursor of AI-2. Our strategy also permits the synthesis of a variety of analogues, that can modulate the quorum sensing behaviour of bacteria, especially important in the case of pathogenic bacteria. A good DPD antagonist could lead to the development of new therapies to control bacterial infections as an alternative to antibiotics, among other applications.

Hypersolutes are natures way of helping microorganisms survive under extreme conditions. Natural hypersolutes are often based upon carbohydrate moieties. One of our aims is to synthesise carbohydrate derived hypersolute analogues using solid supported synthesis. This will provide us with a wide range of new compounds that will be tested by the Cell Physiology and NMR group for their ability to prevent protein aggregation and for protein thermostabilisation. The comparative study of all the results obtained for each solute will enable us to understand their mode of action, the important chemical features for protein stabilisation activity. Also some clues for the design of even better solutes.

Most enzymes do not contain a metal and their mode of action is essentially organocatalytic. This concept is now being used for the synthesis of a wide range of compounds and can be utilised for the construction of enantiopure complex organic molecules. The most successful organocatalysts have been L-proline (pyrrolidine) based. Our studies in this area will also be presented, namely the synthesis and testing of new organocatalysts.