The success of synthetic chemistry in the last century was built on the development of a set of design rules that allowed the quantitative prediction of reactivity and conformation based simply on chemical structure. The goal of our research is to establish a comparable set of rules that can be used for the design of non-covalent systems with equal reliability. Research projects are available in different areas and can be tailored to involve combinations of different techniques: organic synthesis; coordination chemistry; structural and thermodynamic characterisation of intermolecular complexes using NMR spectroscopy, mass spectrometry, X-ray crystallography; high-throughput physical organic chemistry; molecular design and molecular modelling.

**Physical Organic Chemistry: Quantitative Non-Covalent Chemistry**

Synthetic supramolecular systems are ideally suited for the systematic study and quantitative determination of the thermodynamic properties of non-covalent interactions. We are developing new experimental methods for quantifying the relative contributions of different factors that influence the behaviour of complex systems. By characterising the relationship between chemical structure and thermodynamic properties, we aim to develop rules of thumb (and software) for predicting the properties of molecular systems based on a quantitative fundamental understanding of non-covalent interactions. This project will involve some synthetic chemistry, but the focus will be on quantitative physical measurements using a variety of spectroscopic techniques and instrumentation as well as mathematical model building.

**Synthetic Supramolecular Chemistry: Synthetic Information Molecules**

We are working on the development of new oligomeric systems that form sequence selective duplexes and that are able to template their own synthesis – synthetic analogues of DNA. The most promising system that we have developed to date is shown below. This project will involve the development of a synthetic route to a new type of monomer, which is equipped with a H-bond recognition site and two functional groups that can be coupled efficiently to prepare oligomers. In addition to synthesis, here will be opportunities to make an input into the molecular design of the monomer and to study the duplex formation of the oligomers that you prepare.