Introduction to NMR

NMR involves the detection of radiofrequency signals from several types of atoms placed in a magnetic field. It is used to reveal the three dimensional structures of proteins, which are composed of thousands of atoms uniquely arranged in space in order to perform a specific biological function within an organism.

The nuclei of hydrogen, carbon-13 and nitrogen-15 atoms precess and absorb energy at a specific frequency when placed in a strong magnetic field, generating a NMR signal. This is called nuclear magnetic resonance and occurs due to the weak magnetic properties of the nuclei of these atoms.

The specific frequency of each atomic nucleus depends on its interactions with other atoms in the molecule. By measuring the frequencies of hundreds of nuclei within a protein, its molecular structure can be deduced. This structure reveals the 3D shape of the protein and the chemical properties of pockets which bind other molecules and communicate biological information. These pockets can then be used to screen for and design inhibitors that block unwanted binding events involved in cancer or other diseases.

Powerful NMR spectrometers provide more information by separating and detecting the frequency signals of nuclei within even very large molecules. The 900 MHz magnet provides an extremely strong and stable field that yields stronger and better separated signals, allowing more accurate structures to be determined.

The strength of the NMR spectrometer is specified in terms of the resonance frequency of the hydrogen atoms within its magnetic field, and is expressed in megahertz (MHz). The 900 MHz spectrometer is equipped with a 21 Tesla magnet and is used to characterize demanding targets such as enzymes, membrane proteins and receptors.

To yield even better data, sensitivity is boosted by cryogenic probes which reduce the thermal noise when detecting the NMR signals. In addition, liquid handling robots are used to automatically prepare and inject samples, increasing the speed of the experiments. Together these advances have made NMR an invaluable tool for metabolomics and drug screening where low concentrations of biological and drug-like molecules can be rapidly assessed.

NMR has several unique advantages. It is a non-destructive technique, allowing samples to be regenerated for additional experiments. It is a versatile method, being used to determine concentrations, dynamics, folding, interactions and structures of a wide variety of molecules. NMR experiments are typically performed in liquids which resemble the cellular environment, allowing biologically relevant states to be observed.

- **Read more about NMR on wikipedia (http://en.wikipedia.org/wiki/NMR)**