



Nuclear Magnetic Resonance Spectroscopy (NMR)

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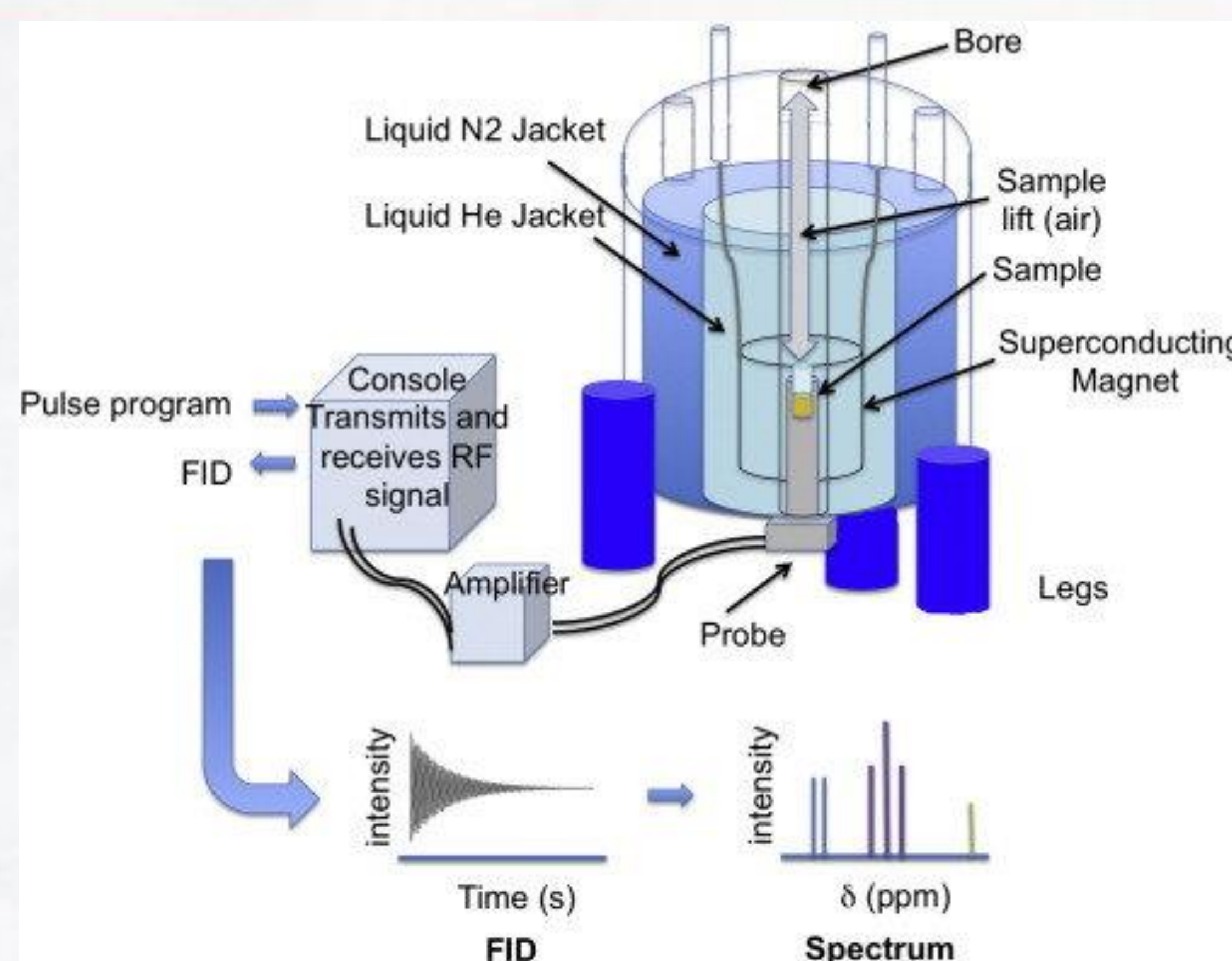
INTRODUCTION :

Nuclear magnetic resonance spectroscopy (NMR spectroscopy) is one of the most widely used techniques by chemists and biologists to identify molecular structures. It relies on the phenomenon of nuclear magnetic resonance, which means the intramolecular magnetic around an atom in a specific molecular changes the resonance frequency. Thus, different atoms within one molecule could have different resonance signals and could be detected by the equipment.



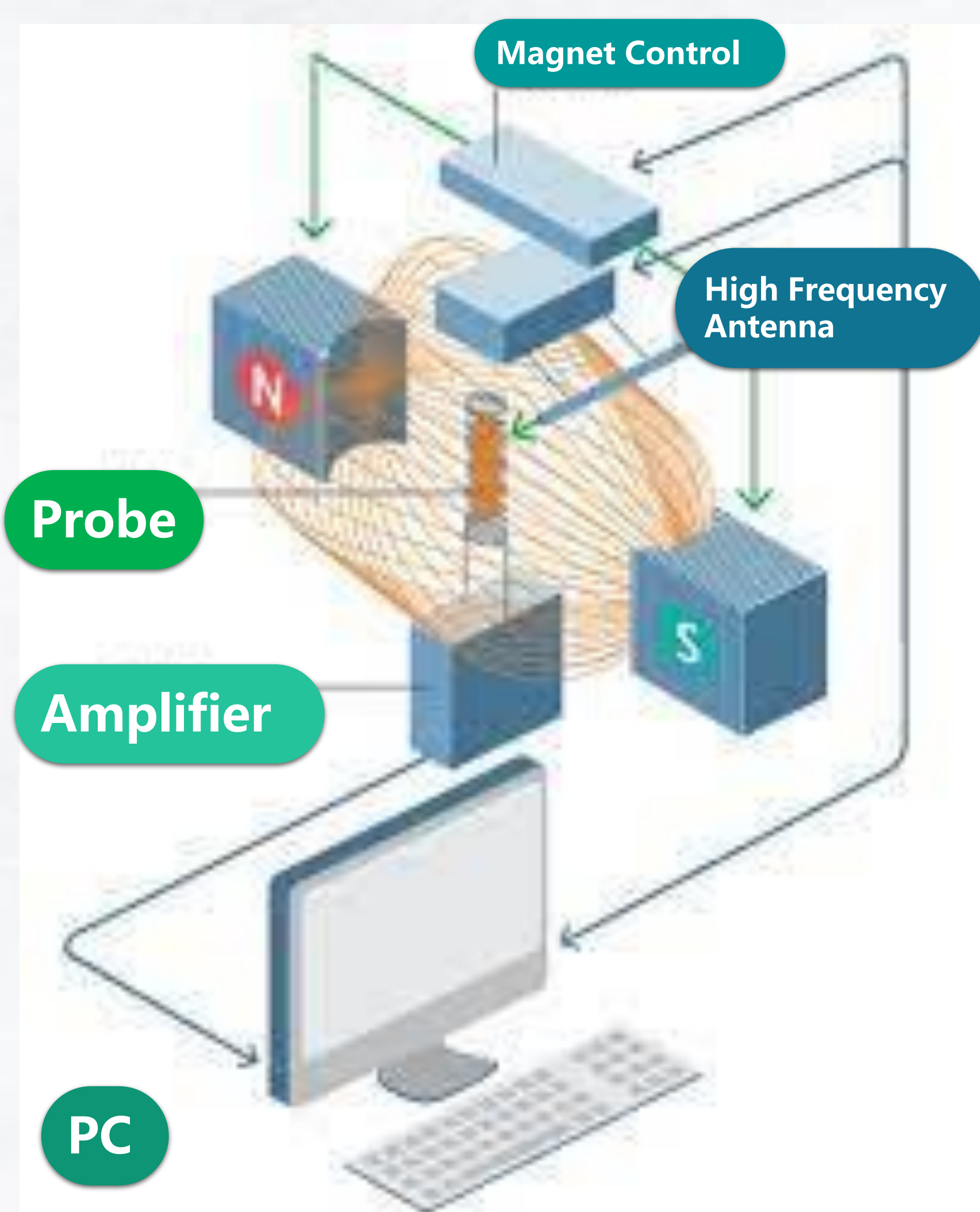
Operation :

For NMR study, samples should first dissolve in deuterated solvent and prepared in a thin-wall glass tube (NMR tube). Then the NMR tubes should be installed with a spinner and put into the NMR spectrometer. Typical high resolution NMR spectrometers are relatively large and expensive, which have a liquid helium-cooled superconducting magnet to generate up to several Tesla magnet fields (Figure 1 source). They are controlled by a computer, which has a great number of pre-designed methodologies. After selecting the analytic method, such as 1H standard test, the spectra will be automatically generated.



Components :

- 1- RF source, gate, amplifier, oscillator.
- 2- Filter pulse programming.
- 3- Probe.
- 4- Magnets.
- 5- Control Unit.
- 6- PC
- 7- Power Supply.
- 8- High-Frequency Antenna.

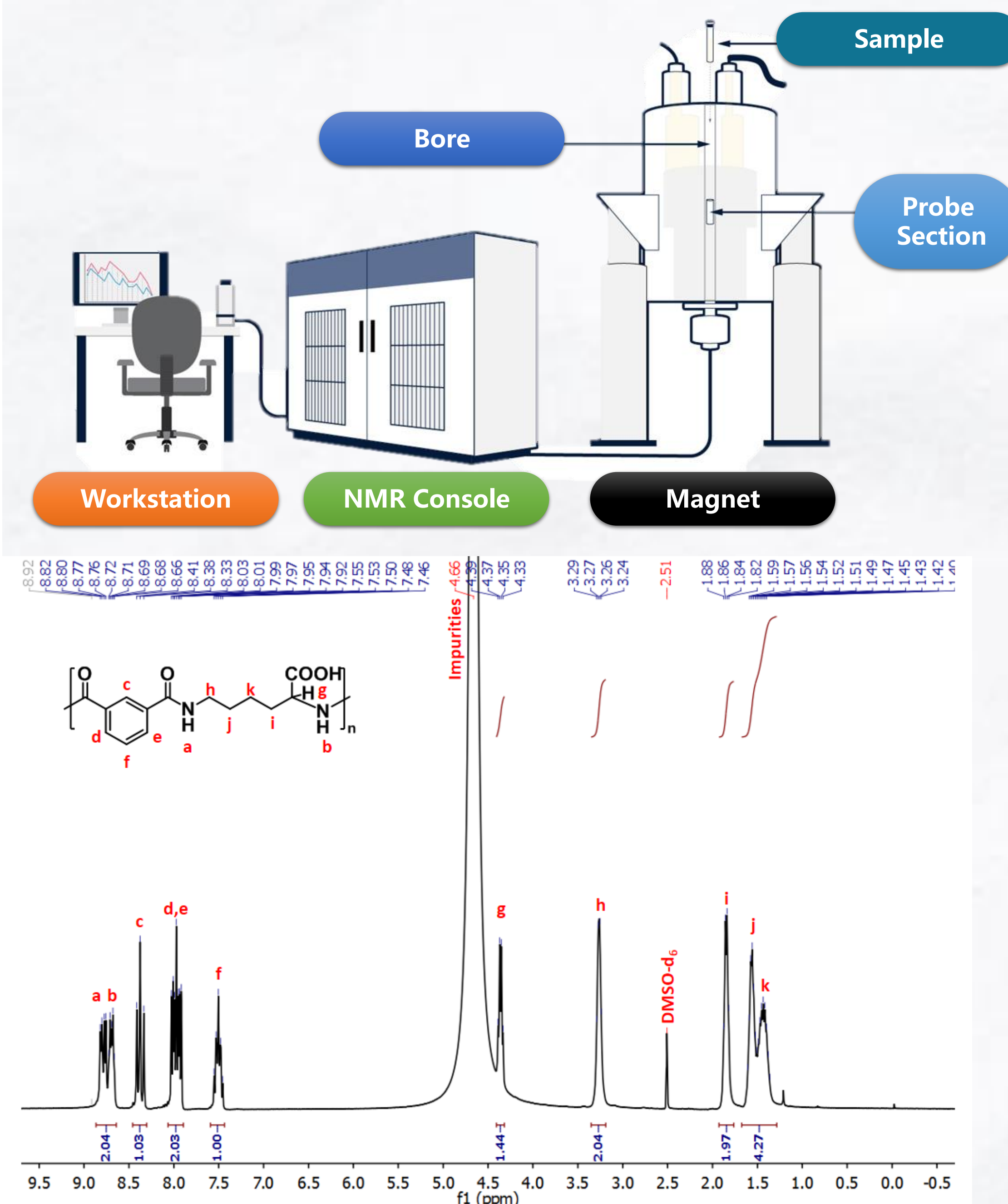


Uses :

To study the physical, chemical, and biological properties of matter. Chemists use it to determine molecular identity and structure. Medical practitioners employ magnetic resonance imaging (MRI), a multidimensional NMR imaging technique, for diagnostic purposes.

NMR Signal :

The figure shows that every specific peak (or peaks) with different chemical shift and unique shape is corresponding to a H atom (or H atoms in the same chemical environment). In this way, we can deduce the molecular structure by NMR



spectra. Sometimes, when the target molecule is quite complex, we need more information from 13C spectra or even 2D NMR spectra. In my study of hyperbranched polymers, NMR could be a useful tool to demonstrate the structure details, such as branching degrees or grafting density.