Editorial
Volume 13:1, 2022

Journal of
Nuclear Medicine & Radiation Therapy

ISSN: 2155-9619

Open Access

An Editorial on Introduction to Nuclear Magnetic Resonance

Shailja Rani*

Department of Medicine, The Johns Hopkins University School of Medicine, Baltimore, United States

Editorial

Nuclei in a strong constant magnetic field are agitated by a weak oscillating magnetic field (in the near field and respond by creating an electromagnetic signal with a frequency characteristic of the magnetic field at the nucleus. When the oscillation frequency matches the intrinsic frequency of the nuclei, which is determined by the strength of the static magnetic field, the chemical environment, and the magnetic properties of the isotope involved, this process occurs near resonance; in practical applications with static magnetic fields up to ca. The frequency (60–1000 MHz) is similar to VHF and UHF television broadcasts at 20 tesla. NMR is caused by the magnetic characteristics of certain atomic nuclei. Nuclear magnetic resonance spectroscopy is frequently used to research molecular physics, crystals, and non-crystalline materials, as well as to determine the structure of organic molecules in solution. NMR is also commonly employed in advanced medical imaging techniques like magnetic resonance imaging (MRI) (MRI). The resonance frequency of a specific sample substance is usually directly proportional to the strength of the applied magnetic field, which is a significant aspect of NMR. This property is used in imaging techniques; when a sample is placed in a non-uniform magnetic field, the nuclei's resonance frequencies vary depending on where they are in the field. Because the magnitude of the magnetic field gradient determines the imaging technique's resolution, various efforts are made to generate enhanced gradient field strength.

The NMR concept is usually broken down into three steps:

The polarisation (alignment) of magnetic nuclear spins in a constant magnetic field B0: A weak oscillating magnetic field, commonly referred to as a radio-frequency (RF) pulse, disrupts this alignment of nuclear spins. The frequency of oscillation necessary for considerable disruption is determined by the static magnetic field (B0) and the observation nuclei. The voltage created in a detecting coil by precession of the nuclear spins around B0 causes the NMR signal to be detected during or after the RF pulse. Precession normally occurs with the inherent Larmor frequency of the nuclei after an RF pulse and does not involve transitions between spin states or energy levels. The two magnetic fields are normally arranged to be perpendicular to one other in order to optimise the strength of the NMR signal. In NMR spectroscopy and magnetic resonance imaging, the frequencies of the time-signal response by the total magnetization (M) of the nuclear spins are investigated. Both use high-intensity applied magnetic fields (B0), which are often generated by large currents in superconducting coils, to achieve response frequency dispersion and very high homogeneity and stability in order to deliver spectral resolution, which is described in detail by chemical shifts, the Zeeman effect, and Knight shifts (in metals). Hyperpolarization, as well as two-dimensional, three-dimensional, and higher-dimensional approaches, can improve the information offered by NMR. In low-field NMR, NMR spectroscopy, and MRI in the Earth's magnetic field (referred to as Earth's field NMR), as well as in numerous types of magnetometers, NMR phenomena are used. Isidor Rabi, who received the Nobel Prize in Physics in 1944 for this work, was the first to describe and detect nuclear magnetic resonance in molecular beams in 1938 by expanding the Stern–Gerlach experiment. Felix Bloch and Edward Mills Purcell improved the technique for use on liquids and solids in 1946, winning the Nobel Prize in Physics in 1952 for their work [1-5].

References

1. Hoult, David I., Balram Bhakar. "NMR signal reception: Virtual photons and coherent spontaneous emission." *Concepts Magn Reson A: Bridg Edu. Res* 5 (1997): 277-297.
2. Rabi, Isidor Isaac, Jerrold R. Zacharias, Sidney Millman, and Polykarp Kusch. "A new method of measuring nuclear magnetic moment." *Physical review* 4 (1938): 318.
3. Filler, Aaron. "The history, development and impact of computed imaging in neurological diagnosis and neurosurgery: CT, MRI, and DTI." Nature precedings (2009): 1-2.
4. Lee, W. David. From X-Rays to DNA: How engineering drives biology. MIT Press, (2013).
5. Vandersypen, Lieven MK, Matthias Steffen, Gregory Breyta, and Costantino S Yannoni, et al. "Experimental realization of Shor's quantum factoring algorithm using nuclear magnetic resonance." *Nature* 414 (2001): 883-887.

How to cite this article: Rani, Shailja. “An Editorial on Introduction to Nuclear Magnetic Resonance.” J Nucl Med Radiat Ther 13(2022): 470.

***Address for Correspondence:** Shailja Rani, Department of Medicine, The Johns Hopkins University School of Medicine, Baltimore, United States, E-mail: rani.shail@gmail.com*

Received 20 January, 2022, Manuscript No. jnmrt-22-22-52582; **Editor Assigned:** 22 January, 2022, PreQC No. P-22-52582; QC No.Q-52542; **Reviewed:** 25 January, 2022; **Revised:** 30 January, 2022, Manuscript No. R-52582; **Published:** 04 February, 2022, DOI:10.37421/2155-9619.2022.13.470