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## **Magnetic resonance without nuclei?**

P A Bottomley and W A Edelstein

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### Magnetic Resonance without Nuclei?

In his editorial in the November/December 1983 issue of *AJNR*, Dr. Taveras [1] suggests that we eliminate the word *nuclear* from the term *nuclear magnetic resonance* (NMR) imaging and refer simply to *magnetic resonance* (MR) imaging. The same suggestion is made by Dr. Meaney [2] in his editorial in the January 1984 issue of *Radiology*. *Radiology* seems to have adopted this nomenclature without discussion. However, contrary to these writers' assertion, "MR" is not a more descriptive and more accurate term for specific reference to NMR.

The authoritative *Encyclopaedic Dictionary of Physics* [3] has an entry *magnetic resonance spectra*, which is defined as "... absorption spectra of atoms or nuclei in the radio or microwave regions of the electromagnetic spectrum in the presence of a static magnetic field." Reference is then made to the entries *paramagnetic resonance phenomena* and *nuclear magnetic resonance*. The latter is defined as "... the name given to the resonant absorption of electromagnetic energy by a system of atomic nuclei placed in a magnetic field." Thus, NMR is a specific subset of magnetic resonance. The American Institute of Physics (AIP) style manual [4] lists NMR, ESR (electron spin resonance), and EPR (electron paramagnetic resonance, synonymous with ESR) as abbreviations that can be used without explanation. There is no such reference to "MR," presumably because the abbreviations above cover the field.

Drs. Taveras and Meaney mention that ESR may have clinical applications in the future. In that event, we can refer to "ESR imaging" and "ESR spectroscopy," as is already the convention [5-7]. At present, such applications are not extensive, and all the articles in the December and January issues of *Radiology* with the acronym *MR* in their titles are actually about NMR. If clinical use of ESR becomes widespread, confusion between NMR and ESR—which Drs. Taveras and Meaney imply—will surely occur in the terminology, if "MR" is accepted to refer to both.

One of Dr. Meaney's principal arguments, also cited by Dr. Taveras, rests on the wish to avert the public's apprehension about things "nuclear." Isn't it about time for the public to realize that their bodies and virtually all matter on Earth is made up of atoms with atomic nuclei at their centers, most of which are not about to explode or emit ionizing radiation? In fact, it is hydrogen nuclei that are operative in NMR imaging systems, and also nuclei of other elements such as phosphorus and carbon that are observed in NMR spectroscopy of living organisms. We believe that an explanation of the NMR detection process will allay any "nuclear" doubts and fears; we do not share the condescending attitude that the average person is too stupid to understand the differences among nuclear weapons, nuclear

reactors, and NMR. Moreover, the public already has accepted and presumably benefited from medical techniques described with the terms *x-rays* and *nuclear medicine*, which do involve ionizing radiation.

The term *nuclear magnetic resonance* was coined by the Nobel laureate I. I. Rabi and his collaborators over 40 years ago [8]. The word *nuclear* was used in the original papers on NMR in solid materials [9, 10], the Nobel Prize lectures of Bloch [11] and Purcell [12], and the Nobel citations for the prizes awarded to Bloch and Purcell. Subsequently, the field of NMR has expanded to include many applications in physics, chemistry, and biology. Thus, although NMR imaging may be a new technology, as Dr. Taveras indicates, its origins are deeply rooted and its application broad-based.

We therefore urge retention of the freedom to use the term *nuclear magnetic resonance* (and its acronym *NMR*) when appropriate. It does not seem sensible to change a term that is both so descriptive and so well established in the scientific realm.

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#### Editor's Reply

All the points raised by Drs. Bottomley and Edelstein are well known to all of us. However, I strongly disagree on one point: namely, that it is possible to educate the public to overlook the word *nuclear*.

It is true that the term *nuclear medicine* is in common use; nevertheless, I don't believe that the patients who have any knowledge of it or those who have antinuclear sentiments appreciate the idea of undergoing any procedure involving a radioactive compound. Nuclear medicine is definitely associated with radioactivity, and this is precisely the association we wish to avoid. It is virtually impossible to eradicate such an idea or association from the minds of the lay public, once it has been established.

On the other hand, it is within the realm of possibility to educate some learned groups, such as radiologists and other medical specialists who use radiologic imaging, to change their manner of thinking and become accustomed to a slightly different terminology and corresponding abbreviation. This is what I have proposed.

JMT

#### Reply

It should be reemphasized that the recommendation of the American College of Radiology's commission to use the term *magnetic resonance* was based on numerous requests for a change in terminology. These requests came from the medical and scientific communities as well as certain segments of the industrial community participating in the development of this new technology. In making its recommendation, the commission believed it was reflecting the consensus of these various groups and individuals.

By referring to (nuclear) magnetic resonance *imaging*, Drs. Bottomley and Edelstein show that they may have missed a major point in my editorial: Its thrust was to eliminate qualifiers such as "imaging" as being restrictive.

As noted in my editorial, the Society of Magnetic Resonance in Medicine omitted the word *nuclear* from the society's name; there seemed to be no serious objection to this omission when the society was formed. This society publishes a scientific journal, *Magnetic Resonance in Medicine*, also omitting the term *nuclear*. Drs. Bottomley and Edelstein are both members of this society, and Dr. Bottomley serves as a member of the journal's editorial board.

I applaud their call for educational efforts designed to overcome the fears of the public about things "nuclear." This is an important responsibility for all in the medical and scientific disciplines. Pragmatically, however, it seems unlikely that such efforts could be successful in the near future.

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#### Reply

The *AJR* is understandably sympathetic to the position taken by Drs. Bottomley and Edelstein. Terms dating to the inception of major scientific advances are certainly to be respected even if later developments prove them less than ideal. *Roentgenology* is such a term; the *AJR* persists in using it in its title, even though many laypersons ask, "What is roentgenology?" Of course, the subject matter of the *AJR* is radiology, a term which over time has become much more explicable to the public and, moreover, more encompassing of the technology of our imaging specialty than *roentgenology* could ever

be. The *AJR* shares with Drs. Bottomley and Edelstein some reverence for the historical even if it is anachronistic.

For purposes of medical imaging terminology, *nuclear magnetic resonance* may already be anachronistic. This is not so much because of the widespread use of alternatives but because influential groups have shown preference for the less cumbersome term *magnetic resonance* (MR). The Society of Magnetic Resonance in Medicine, made up of most of the active investigators in the field, has chosen to drop the word *nuclear*. Similarly, the American College of Radiology's Commission on NMR, after thorough deliberation, offered its recommendation that *magnetic resonance* be the preferred term. Many authors already are beginning to adopt it.

Accordingly, the *AJR* henceforth will accept *magnetic resonance* as sufficient and will not use the modifier *nuclear*. In due course we anticipate common use also will favor *magnetic resonance*. The issue seems to have been decided by authorities larger than our editorial office. Notwithstanding our respect for historical priorities, it seems only sensible to accept the inevitable.

Melvin M. Figley  
Editor, *AJR*

### Pseudocyst of Spinal Cord on Metrizamide CT

In the January/February 1984 issue of *AJNR*, Quencer et al. [1] reported the results of intraoperative spinal sonography in patients with prior spinal cord trauma. In two cases, metrizamide-enhanced computed tomography (CT) demonstrated findings strongly suggestive of a syrinx. Intraoperative sonography failed to confirm the finding, showing only an area of abnormal echogenicity within the spinal cord. The authors stated that "although these zones were not explored, we are confident they do not represent cysts."

It is distressing that the apparent cyst demonstrated in their figure 6 (case 8) was a false-positive finding. Perhaps the authors will share with us their reason(s) for being so confident that this was true even though the area was not explored at surgery. Did they consider the possibility that the cyst was collapsed at surgery, either from the position of the patient or as a result of the anesthesia?

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#### REFERENCE

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#### Reply

We remain convinced that these were indeed false-positive metrizamide CT findings for the following reasons:

1. Both the surgery and the preoperative metrizamide CT scanning were performed with the patient recumbent (surgery: prone; preoperative metrizamide CT: supine); thus, the cerebrospinal fluid (CSF) dynamics and the transmitted pressure to the spinal cord were equivalent. Since surgery was not performed with the patient erect, there is no positional reason why a syrinx, had it been present, would have collapsed.
2. The subarachnoid space was not entered before intraoperative sonography was performed (note the intact dura-arachnoid layer and the CSF beneath it in our fig. 6). As a result, there was no escape of CSF from the subarachnoid space that could have collapsed a cyst indirectly, had one been present.
3. The identical size and shape of the spinal cord on metrizamide