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Young I R, Bailes D R, Burl M, Collins A G, Smith D T, McDonnell M J, Orr J S, Banks L M, Bydder G M, Greenspan R H & Steiner R E. Initi.' clinical evaluation of a whole body nuclear magnetic resonance (NMR) tomograph. *J. Comput. Assist. Tomogr.* 6:1-18, 1982.
[Central Research Labs., Thorn-EMI Ltd., Hayes, Middlesex; Depts. Medical Phys. and Diagnostic Radiol., Royal Postgrad. Medical Sch., Hammersmith Hosp., London, England; and Dept. Diagnostic Radiol., Yale Univ. Sch. Med., New Haven, CT]

This paper describes the techniques used and initial results obtained from the first whole body NMR imaging system to be installed for clinical work in a hospital. It outlines the various sequences used, sh' 's the first human use of externally supplied paran.ag-netic material to affect tissue time constants, and provides illustrations of normal and pathological tissues from all the major organ systems. [The *SCI®* indicates that this paper has been cited in over 215 publications.]

First Specifications and Results of NMR Whole Body Imaging

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In many ways this paper set the pattern for much of what followed in the evaluation of both whole body NMR imaging and spectroscopy, not always to the advantage of either. In particular it established the format of the mix of technical and clinical material in the same paper, which frequently resulted in a more superficial treatment of both than would be acceptable in an article devoted to either. The machine itself was the first imager to use a whole body cryogenic magnet, which was capable of providing a field of 0.3 tesla. It was originally set up and operated at 0.26 T, in an attempt to improve on the signal-to-noise ratio performance of its direct predecessor (a 0.1 T resistive unit). Part funded by the Department of Health and Social Security, the criterion for its acceptability for transfer to the hospital site at Hammersmith Hospital was that its performance should match that of the 0.1 T resistive machine (not exceed it!). In practice, because we had no idea of the changes in the spin lattice relaxation time constants (T_1) with field, we simply could not achieve the gray/white matter contrast at 0.26 T that we had earlier obtained routinely in the brain and, in desperation, dropped the field to 0.1 T. Satisfactory results were obtained, and the machine was moved from EMI Central Research Laboratories to the hospital. At Hammersmith the field was set at 0.15 T (with the intention of working back up to 0.3 T in 0.05 T steps, as we found out the T_1 field dependency), but there, as patients were scanned within days of the machine being operational and reported shortly after,[1] it has remained.

The observations on flow phenomena were qualitatively useful,[2] but it awaited the development of the phase measuring methods[3,4] before they were of practical use. Likewise the use of oxygen as the paramagnetic agent was academically interesting but the real relevance of paramagnetic components had to await the development of the first genuine NMR contrast agent (gadolinium-DTPA).[5] Interestingly, the multisequence approach to NMR went into something of a decline thereafter with the publication of initial results from the University of California, San Francisco, machine,[6] though, more recently, users have become much more adventurous in their use of differing methods.

In many ways it was always going to be easy to write the first paper describing a reasonably well-developed machine and its results because, at the time, NMR images were such rarities, and almost any result was a new finding. Since the latitude for creative machine design is proscribed to such a large degree by the form of the magnet, all devices have a close family resemblance to each other, and any initial priority was almost bound to persist. The mix of clinical observations and physics made the paper itself much more comprehensive than it would otherwise have been in claiming priorities.

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