

# DR. RAYMOND DAMADIAN—ORIGINATOR OF THE CONCEPT OF WHOLE-BODY NMR SCANNING (MRI) AND DISCOVERER OF THE NMR TISSUE RELAXATION DIFFERENCES THAT MADE IT POSSIBLE

## A VISION FOR THE FUTURE

Early in his medical training, Damadian chose internal medicine because of its analytical nature. By the time he graduated, he decided to do his detective work in the research laboratory rather than the clinic because of the prospects that his research, if successful, might help millions of people rather than the thousands he could reach dispensing medical treatments. "I didn't know if anything would come of any research I might do, but I knew I wanted the chance to try to help many more than I could personally reach in a lifetime."

### **Damadian, the First to Conceive of the NMR Whole-Body NMR Scanner (1969) and the First to Construct It (1977)**

The first step across the vast terrain to be traversed from the practice of clinical medicine to the physics of NMR before the new medical scanner envisioned by Damadian could become a reality came in 1969, four years before Lauterbur's first paper appeared in *Nature* in 1973. In a letter to the Health Research Council of the City of New York where Dr. Damadian had been chosen for the "Career Scientist" award, he wrote, "I am very much interested in the potential of NMR spectroscopy for early non-destructive detection (emphasis included in original document) of internal malignancies".

The second step towards the new scanner came in March 1971, two years before Lauterbur's March 1973 *Nature* paper, when Damadian proved the reality of his vision by showing that the NMR signal from cancer tissue was different from normal, that there were also marked differences among the healthy tissues, and that these differences could provide the basis for the new body scanner he envisioned. In this paper, published in *Science*, he wrote: "In principle, nuclear magnetic resonance (NMR) techniques combine many of the desirable features of an external probe for the detection of internal cancer."

The third step came very shortly thereafter in the Spring 1971 issue of the *Downstate Reporter*, also two years before Lauterbur's first publication in *Nature*. In an article entitled, "Basic Research Leads to Radio Signals from Cancer Tissue," science reporter Ed Edelson spelled out Dr. Damadian's inten-

tions to use that signal to build his new scanner:

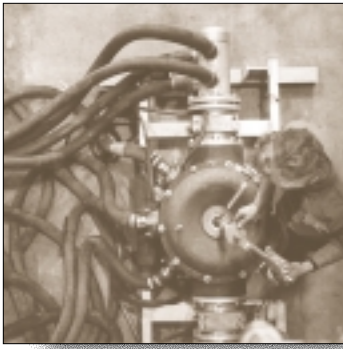
"Already, Dr. Damadian is planning to build a much larger nuclear magnetic resonance device, one that will be big enough to hold a human being. That machine, Dr. Damadian believes, will prove that nuclear magnetic resonance (NMR) is the tool that doctors have been looking for in their quest for a method of detecting cancer early, when treatment is most effective."

The article also shows, two years before Lauterbur's first 1973 *Nature* paper, Dr. Damadian taking the first step towards his "sweet spot" technique for achieving the spatial localization needed for scanning. It reported:

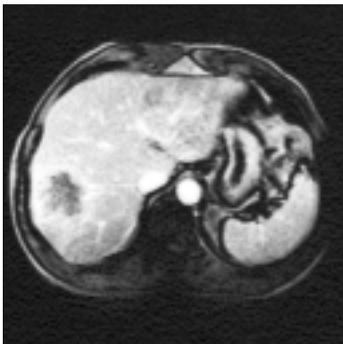
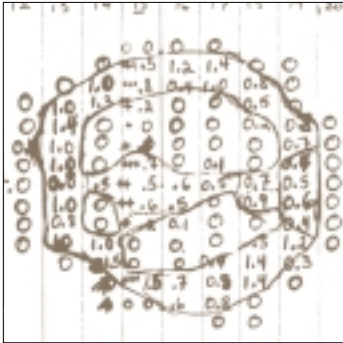
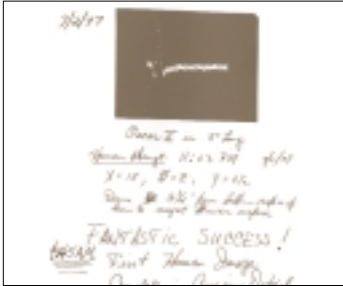
"The proposed NMR device for detecting cancer in humans would not have to be highly elaborate, Dr. Damadian says. It would consist of a large coil to emit radio waves and a movable magnet to create the magnetic field required. The coil would be wrapped around the patient's chest, while the magnet passed back and forth across the body. A detector would pick up NMR emissions for analysis."

The fourth step toward fulfillment of Damadian's NMR body scanner vision came on





March 17, 1972, one year before Lauterbur's publication appeared in *Nature* on March 16, 1973, with the filing of his patent entitled "Apparatus and Method for Detecting Cancer in Tissue". Figure 2 of the patent depicts a man standing in an electromagnet, showing a mobile radio-frequency assembly to accompany the movement of the patient across the magnet's "sweet spot" for scanning. Shaping of the transmitted radio-frequency field is added in the patent to provide further spatial localization to the magnet's "sweet spot." The complete description of Damadian's "sweet spot" method of NMR scanning precedes Lauterbur's report of his completed scanning method by seven months. Lauterbur's manuscript describing his completed scanning method was received for the first time at the publishers on October 30, 1972.



The fifth step in the final realization of Damadian's vision came in 1977 when he and his team constructed the first human scanner and used the "sweet spot" technique

of his patent to accomplish the first human scan and prove to the world that whole-body NMR scanning was achievable. Lauterbur did not take this step.

It is thus unambiguous that Damadian is the originator of the NMR body scanner concept, preceding Lauterbur's first conceptualization of an NMR scanner by years. Moreover, Damadian was the first to supply the tissue NMR signal differences that made the concept reality. While history has shown

the Lauterbur method superior to the Damadian method in speed and efficiency, there is no doubt that Damadian is the originator of the NMR scanning concept and that he uncovered the tissue NMR signals that made it possible.

The contributions of both pioneers to the creation of MRI have been essential to its genesis. The President of the United States, for example, in a ceremony at the White House on July 15, 1988, awarded the nation's highest honor in technology, the National Medal of Technology, jointly to these two pioneers. He cited them "for their independent contributions in conceiving and developing the application of magnetic resonance technology to medical uses included whole-body scanning and diagnostic imaging".

Today, because of Damadian, thousands of MR scanners around the world are producing millions of images that exquisitely depict both health and diseased tissue without the need for invasive procedures and without the ionizing radiation of X-rays.

## BIOGRAPHY

Dr. Damadian was born in Queens, New York. An avid violinist and tennis player, he played Junior Davis Cup as a teenager and attended Juilliard School of Music. He attended Forest Hills High School, majoring in science. While a student there, he won the Ford Foundation Scholarship, a series of competitive examinations designed to choose the 200 students with the highest aptitude and achievement scores nationally, for advanced placement without completion of high school at Columbia, Wisconsin, Yale and Chicago. He chose Wisconsin. Dr. Damadian received his M.D. Degree from the Albert Einstein College of Medicine in 1960; he took his residency at Downstate Medical Center from 1961-1962.

From 1962 to 1967 he conducted postdoctoral studies at Washington University School of Medicine in St. Louis, Mo., and at Harvard Medical School. In 1967 he was appointed to the faculty of Downstate in the Biophysics Section of the Department of Medicine. Today he is the president of the Fonar Corporation, the MRI scanner manufacturing concern that he founded in Melville, Long Island, after leaving the Health Science Center. For his pioneering contributions, Dr. Damadian has received: the National Engineers' Special Recognition Award (1985), The Lawrence Sperry Award (1984), the National Medal of Technology (1988), induction into the National Inventor's Hall of Fame (1989), and selection of the first human MRI scanner, Indomitable, for permanent exhibit in the Smithsonian Institution, Washington, DC (1986), among others. He received an Honorary Doctor of Science

Degree from Downstate in 1995.

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## READ MORE ABOUT IT

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