

Interview with Dr. Raymond V. Damadian

By Constance Shames, M.D. '63, Editor

On July 3, 1977, the first human images using MRI were produced in Downstate's Basic Sciences Building. Dr. Damadian has stated, "How many people get the chance to build something that is theoretically impossible?" "The Indomitable", as he called the first scanner was invented and has dramatically changed the practice of medicine. "The MRI is a window into the entirety of the human body. It is just as though one were at the anatomy table."

THE VOYAGE BEGINS

Dr. Damadian's voyage into the impossible began at the Julliard School of Music where he studied violin for 8 years. He was a Ford Foundation Scholar 1952-1956 and received a BS



Dr. Raymond V. Damadian, at his induction into the National Inventors Hall of Fame.

in Mathematics from the University of Wisconsin and an MD from the Albert Einstein College of Medicine. He served as an intern and assistant resident in Medicine at Kings County Hospital where he also formed a study group which evolved into a Journal Club. Dr. Ludwig Eichna would also attend these meetings and was so impressed with Dr. Damadian that he encouraged him to consider an academic career. Dr. Damadian credits Dr. Eichna with impressing him with the necessity of doing post doctoral training. He taught him that science and research could eventually be brought to the bedside and that something "good would happen."

PRELIMINARY WORK

Since Dr. Damadian had a long standing interest in the physiology of the kidney, he applied to study with Dr. Neal S. Bricker at Washington University School of Medicine. The work at that time was to isolate and purify a "sodium pump." Dr. Damadian felt that he needed a very sophisticated lab to continue this type of study; he applied and became a Fellow in Biophysics at Harvard University. While there, he attempted to isolate a sodium pump in bacteria. This was interrupted by service in the Air Force where he served in the School of Aerospace Medicine — Physiological Chemistry Section.

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After several years of work he concluded there was no evidence for a pump and pursued an alternate explanation. His theory was called the "Ion exchanger resin theory." He questioned, "What is metabolism doing?" "How does the resin matrix choose K+ and exclude Na+?" He measured all the ions in the bacterial cell. He looked at the role of the water molecule in physiology. While attending an Experimental Biology meeting in Atlantic City he met other scientists working with ideas similar to his and among them, Dr. Freeman Cope, who was using new technology of nuclear magnetic resins. Cope had used it to measure Na+ and had ambition to measure K+.

THE GERM OF AN IDEA

Dr. Cope worked on pulsed NMR machines which he used to infer properties of molecules. Dr. Damadian obtained bacteria from the Dead Sea which have 20 times the amount of K+ in them (halobacter halobium). He went to Pittsburgh to grow the organisms because the NMR specialty company made machines there for chemists. This was the first time in the world that Cope was able to measure K+ by NMR in a few milliseconds. Dr. Damadian said to Dr. Cope, "it is possible just with antennae you could get the chemistry of the sample. If you could do this on a human body,

TIMELINE of MRI



Raymond V. Damadian, M.D.



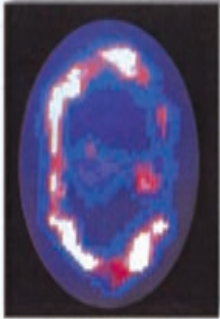
Dr. Damadian makes original discovery that makes MR scanning possible.



Dr. Damadian with his post-doctoral research fellows, L. Minkoff and M. Goldsmith, and first MR scanner, Indomitable...



...The team built Indomitable at Downstate in the former animal labs across from BS-302.



First MR scan (image) of the human body, a cross-section of Minkoff's chest near the level of T7/8. Completed 4:45 a.m., July 3, 1977.

1969	Original Concept Damadian conceives of whole body MR scanner for the first time. (Doc:30, 30a)	1970	Key Discovery Makes MR Scanner Possible Damadian identifies T1/T2 differences between cancer and normal. He was seeking an MR signal difference in an important disease (cancer) that would prove his idea of an MR body scanner a goal worth pursuing. Submits paper. (Doc:1,1a)	
1971	First Published Article T1/T2 findings and scanner proposal published in Science, March 19, 1971. High pixel contrast provided by dramatic T1/T2 differences overcomes x-ray's century-old inability to see detail in vital organs. (Doc:1,1d, 1c)	1971	March/71	First Filed Damadian files '832 patent for 3-dimension voxel-by-voxel scan method and T1/T2 method. Issued in '74. (Doc:7, 30a,20.1, 20.1a,45)
1971	Scanning Method Proposed Damadian outlines voxel-by-voxel scanning method. (Doc:6,6c; Doc:4,4a)	1971	Sept./71	Gradient Method Proposed Lauterbur notebook proposal of gradient methods of Gabillard, Purcell & Carr for 1-dimension (incomplete) scan method. (Doc:3.1, 22,40)
1971	Spring/71	20 Paper Published Lauterbur paper published in Nature, March 16, 1973 (Doc:5,5b)	March/73	20 Paper Published Lauterbur paper published in Nature, March 16, 1973 (Doc:5,5b)
1974	3D Scan Method Proposed Garroway, Grannell & Mansfield publish 3-dimension scan method.*	1974	3D Scan Method Proposed Garroway, Grannell & Mansfield publish 3-dimension scan method.*	
1975	Phase Coding Introduced Kumar, Welli & Ernst introduce phase coding to scan method.**	1975	Phase Coding Introduced Kumar, Welli & Ernst introduce phase coding to scan method.**	
1977	First Human Scan Achieved Damadian and coworkers, Minkoff and Goldsmith, achieve first scan (image) of the human body utilizing voxel method of patent. (Doc:17,17.5, 26,27,46)	1977	First Human Scan Achieved Damadian and coworkers, Minkoff and Goldsmith, achieve first scan (image) of the human body utilizing voxel method of patent. (Doc:17,17.5, 26,27,46)	
1980	Phase Coding Applied Aberdeen group introduces spin warp method....	1980	Phase Coding Applied Aberdeen group introduces spin warp method....	
1980	First Commercial MRI Damadian and FOMAR introduce first commercial MRI scanner utilizing voxel method of patent.	1980	First Commercial MRI Damadian and FOMAR introduce first commercial MRI scanner utilizing voxel method of patent.	
1997	Patent Upheld High Court on U.S. Patents and U.S. Supreme Court enforce Damadian '832 patent. (Doc:43)	1997	Patent Upheld High Court on U.S. Patents and U.S. Supreme Court enforce Damadian '832 patent. (Doc:43)	



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CAMPUS EXHIBIT

First MR Scanner, Indomitable
September, 2002



President Reagan and Dr. William Graham, Science Adviser to the President (center), present Dr. Raymond Damadian, President and Chairman of the FONAR Corporation with the National Medal of Technology.

what a wonderful non-invasive approach this would be.” Cope thought this was very farfetched and wondered, “how would one go about it?” “How would one convince one’s peers?” “How would you use giant magnets?” Dr. Damadian’s concept would be derided, ridiculed, mocked and snickered at by many in the scientific community.

A MAN WITH A VISION

In spite of this, a man with a vision, a genius with an overwhelming desire to meet a challenge would not be discouraged. Dr. Damadian decided to try to show this concept could be useful in a very important disease. He tried to get support to show that the NMR signal could differentiate cancer from the normal. The theory that each part of the body is composed of atoms led to the idea that by using a magnetic field these atoms give off radio signals at their own frequency. One can get an “atomic broadcast of what is going on inside the tissues of the body.”

Since cancer cells are very deranged in water content, and has increased Na⁺ and decreased K⁺ content it would produce zero (0) millivolts instead of voltage.

Dr. Damadian grew rats with sarcomas and measured decay time in normal and cancer tissue. The differences were dramatic. Decay times varied by 130%. He took more rats with Hepatomas and

the differences were 180%. He published his findings in Science which set up a firestorm of controversy among scientists around the world. At this time he was in the Departments of Biophysics and in Medicine at Downstate and both Dr. Eichna and then President Plimpton as well as NIH supported his research, and eventually the first human scanner was built.

THE CULMINATION

It was the culmination of years of research of ridicule and of persistence of a dream. Honors and awards have come from all over the world. He was made an honorary alumnus by the alumni Association of the College of Medicine in 1999. At a White House Induction into the National Inventors Hall of Fame in 1989, President George Bush said, “I have seen Dr. Damadian at work, captivating young imaginations with a fire of his own. I would not be surprised to see him joined in the Hall of Fame by some of these promising young minds. All it takes is imagination and encouragement, and he is the ideal source of both. He is living, reassuring proof that the spirit of invention continues to thrive in our great Nation.” ■



New Magnet Styling commencing shipment March, 2003.