MRVector

Newsletter of the:

American Registry of Magnetic Resonance Imaging Technologists

Phone: 718-347-8690 Fax: 718-347-8691 E-mail: *ARMRIT@msn.com* ***Web page:*** www.armrit.org

Winter 2004 Special Edition

In this issue:

MAKE ARMRIT PART of YOUR MRI HIRING POLICY

To date ARMRIT certified MRI Technologists work in Hospitals and free-standing MRI facilities in 34 States including Puerto Rico and Guam. These institutions include well-known University Hospitals. Many of these Hospital institutions and MRI facilities have included ARMRIT as a part of their requirements in their hiring policies.

These institutions include:

- **Wuesthoff Health Systems, Inc., Rockledge, Florida.– Qualifications: ARRT or ARMRIT in MR.**
- **Hilo Medical Center, Hilo, Hawaii – Licensure: Registered with the ARMRIT preferred.**
- **Oregon Health Sciences University, Portland, Oregon – Must be ARRT registered in Radiologic Technology or ARMRIT registered.**

Since ARMRIT technologists undergo focused training in both didactic and hands-on clinical training, they have performed very well in both private and institutional surroundings based on feed-back from institutions who have hired them. Thus ARMRIT members because of their clinical hands-on exposure make good MRI technologists.

James F. Coffin, ARMRIT
President, Bellerose, NY

ARMRIT – GI BILL APPROVED

In a letter from James R. Bombard, Chief, Bureau of Veterans Education, as of December 12, 2003 the "certification test offered by American Registry of Magnetic Resonance Imaging Technologists-ARMRIT is approved for the reimbursement of test fees for veterans and other eligible persons in accordance with the provisions PL 106-419."

NOMINATIONS and APPOINTMENTS

At the December 12, 2003 Board of Directors and Examination Committee meeting appointments to Executive Director, Examination Committee Chair and Public Member were made.

The new Executive Director is Wilfrido M. Sy, MD, the Examination Committee Chair is Thomas Vullo, Ph.D. and the Public Member is Colonel Richard Arold, Chaplain, U.S. Army (retired).

ELIGIBILITY – MEMBER RESPONSE

"You Can Learn the Most from Both"

I am all for keeping the classroom requirement a part of being eligible to sit for the ARMRIT MRI Tech exam. I have met many competent techs that came over from X-ray or other modalities who couldn't tell you the resonance (Larmor) frequency of a hydrogen proton. With today's computers it is all too easy to fall out of the role of technologist and into the role of button pusher.

I was very lucky to have a great MR Physics teacher who drilled into me the need for "attention to detail", something I have never forgotten. The classroom knowledge I gained was every bit as valuable to me in my career as my clinical internship was. You can learn a lot from an internship and you can learn a lot from a classroom setting but you can learn the most from both. (Over)

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One last thought; would proponents of eliminating the classroom requirement feel the same about keeping the classroom and eliminating the clinical experience requirement?
Bob Resch, RA # 1397
Nottingham, MD

"Go to MRI School Like I Did"

Regarding eligibility to sit for the ARMRIT registry examination, I will be blunt. Simply put, only those who have a degree in MRI Technology and have accrued extensive supervised clinical scanning time (criterion #1) should be allowed the privilege of sitting for the exam. Providing for an "equivalency clause" or for "cross trainers" is an insult to anyone who qualified to sit for the exam via criterion one. Disagree? Well there are numerous reasons for this statement. Here are just a salient few:

Regardless of how much experience or skill an X-ray Tech might have as an MRI Technologist, they should not be allowed to sit for an exam that others have spent a year or two and thousands of dollars in order to be eligible. The ARRT would never allow such a thing, so why in the world does the ARMRIT? To give the ARMRIT gravitas? Does it legitimize us by having X-ray Techs in our registry? Think I'm way off? Come on people, I'm sure we've all, at one time or another, told the X-ray techs we've worked with that we have them in our registry so as to validate the ARMRIT in their eyes. And by the way, why would an X-ray Tech who is working, with or without being ARRT registered in MR, want to sit for our exam? I'll tell you, to use the ARMRIT in order to quickly and economically obtain another credential in order to enhance their curriculum vitae.

Why allow our registry, ourselves, to be used like this and thus derogated? Consider how an X-ray Tech would feel if on the day of his or her X-ray certification exam, he or she realized that ARMRIT Techs were taking the same X-ray exam. However, the ARMRIT Techs learned Radiography via on-the-job training only with little or no formal instruction or education on the subject. The X-ray Techs who devoted two years of their time and spent thousands of dollars in order to sit for the X-ray exam would justifiably be utterly incensed.

Some might say "what about other Techs? It's not only about the ARRT and X-ray Techs!" Well, the same argument stands. Go to MRI school like I did! Think that's harsh? Well no other profession's credentialing apparatus would allow for such an absurdity. One can't become a schoolteacher, lawyer, accountant, doctor, engineer, et cetera, without having received a degree in their respective fields in order to qualify to sit for their respective exams. Do I elevate ARMRIT Techs to the status of these professions? You bet I do! ARMRIT Techs are highly specialized professionals and we should respect our registry and guard it with the same standards. Case closed!
Paul Rizzo, MS, ARMRIT, RA# 1570
Hilo, Hawaii

DOCTOR RAYMOND DAMADIAN - THE "HENRY FORD" OF MRI *(reprint)*

When Raymond Damadian was a boy, he lost his Grandmother to a slow death by cancer. This loss affected him greatly. Young Damadian vowed to find a way to detect this dreaded disease in its early stages, when it is still treatable, so that other lives could be saved. Thus, a lifetime goal was set at an early age.

Of Armenian descent, Damadian grew up in Forest Hills, Queens, New York. (Over)

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In his childhood years Damadian attended the Julliard School and became very proficient playing the violin. He also played tennis and won many junior championships.

Damadian was introduced to NMR by Edward Purcell at Harvard University when Purcell drew an NMR spectrum on a blackboard as part of a course he was teaching. This subject sparked Damadian's interest immediately.

After a tour of duty in military service and medical school at Albert Einstein College of Medicine in New York., Damadian joined the faculty of Downstate Medical Center in Brooklyn, New York. About this time Dr. Damadian began to experience persistent abdominal pain. He had rarely been sick. The possibility of cancer entered his mind. Although the pain subsided eventually, this was the spark which ignited the interest in developing a method to view the human body's interior for early detection of disease.

Using a primitive NMR machine, Dr. Damadian found that he could distinguish between normal tissue and cancerous tissue in rats implanted with tumors. During testing, he found that T1 and T2 relaxation times for healthy and unhealthy tissue were noticeably different. Discovering that the NMR machine was useful in detecting cancer, Damadian envisioned its use in the detection of heart and kidney, as well as mental disease.

After publishing his article in "Science" magazine in 1971, many individuals in the scientific and NMR community considered Damadian's ideas to be far out in left field. They saw NMR as a test for high resolution sampling only. Test tube samples are spun at about one hundred rotations per minute in order to create a stronger and clearer signal from a more homogeneous sample. To put a person in the NMR machine seemed totally outlandish. When Dr. Damadian, during his various lecture tours, mentioned his desire to build an NMR machine that was large enough to scan a human, it seemed as if someone from the audience always asked, "How fast are you going to spin the patient?" Needless to say, he had few supporters at this time.

Writing to President Nixon, after many attempts to obtain grant money for research, Damadian received a grant from the National Institute of Health (NIH) in 1971, to continue his work. He proposed to use whole body scanning by NMR for medical diagnosis in a patent application in 1972.

During experimentation, Dr. Damadian found that cancerous tissue had a relaxation time two to three times that of normal tissue. Being an outsider to the well-entrenched NMR community, Damadian felt that people, like Dr. Paul Lauterbur were trying to subvert his efforts to obtain funding for research. Damadian found an ally in his Brother-in-law who spent long hours trying to raise money for Dr. Damadian to continue when he was almost depleted of funds. In February, 1974, Dr. Damadian was issued a patent for his "Apparatus and Method for Detecting Cancer in Tissue."

By February 1976, Dr. Damadian, using his FONAR method - field focusing nuclear magnetic resonance, was able to scan the interior of a live mouse with the NMR signal. Many such experiments were performed using mice. The first one was called "Pioneer Mouse". Coils were placed around the mouse. In an attempt to get a clearer focus, the current was increased continuously. Unfortunately this cooked "pioneer mouse". On March 11th, 1976, Dr. Larry Minkoff, an assistant to Dr. Damadian, was able to produce (Over)

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a crude image of a tumor on the anterior chest wall of the second pioneer mouse.

Everywhere Dr. Damadian spoke about NMR and its possible application to detect cancer in humans; it seemed everyone was talking about Paul Lauterbur's technique called Zeugmatography. Damadian was fearful that Lauterbur would get credit for his ideas and receive recognition that was rightfully his.

By February 1976, Damadian's team, consisting of Larry Minkoff and Mike Goldsmith were ready to construct a machine large enough to scan a human. Finding that their funds were insufficient to buy a magnet, they decided to build their own.

At the same time, two groups in the physics department of the University of Nottingham in England were working to produce clear NMR images. One group, led by Waldo Hinshaw and Raymond Andrew, the other group, led by Peter Mansfield. Hinshaw evolved his own scanning technique, thinking that Lauterbur's was too complicated. Instead he used oscillating gradients to isolate a point or plane in space. This way Hinshaw was able to focus the scan on one area, wiping out all other signals in the sample. Images of a lemon and a human wrist were eventually produced employing this method.

In 1974, Mansfield discovered a method to image a "selective slice" of tissue. He had scanned chicken legs (dead) and later produced scans of a human finger with amazing detail. Another group, EMI, in Aberdeen, Scotland also had ongoing research in NMR imaging.

The design of a human NMR scanner slowly began to take form. The heart of the machine was a very large magnet. With the help of the Physics Department of Brookhaven National Laboratory, Dr. Damadian received information on the construction of a superconducting magnet. The design was called the "Helmhotz Pair". It consisted of two hoops of Niobium-titanium wire wrapped around many times to produce a solenoid. When attached to a power source, the magnet would have a field strength of five thousand gauss (0.5T). All other magnets of this size were part of nuclear accelerators.

One concern was the effect of having two extremely powerful magnets in the same room. There was the possibility that the supporting structure would not be sufficient to keep the magnets apart and could slam together with tremendous force. A scary prospect indeed.

By a stroke of good luck, the team was able to obtain superconducting wire for pennies on the dollar from Westinghouse when the company decided to get out of the superconducting wire business. At the same time, it was learned that Paul Lauterbur had ordered a resistive magnet with a bore large enough to place a human inside. Upon delivery it was discovered that the opening was too small!

Mike Goldsmith spent many weeks wrapping the superconducting wire into hoop shaped coils for the new machine. He was worried that the joints holding the wire together might be faulty. Goldsmith used an ohmmeter to check the coils, luckily all connections were good. Damadian and Minkoff built the cryostats to contain the liquid helium and nitrogen.

Each container was about 10 feet tall and weighed over a ton. Many long hours were spent in the lab, fearing that Lauterbur would be the first to scan a human. Sometimes they would work through the night and home was only a place to sleep.

The doughnut-shaped dewar (cryostat) took nearly a year to construct. (Over)

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Leaks were a major problem, even a hole the size of a molecule had to be sealed; cryogen could leak right through the pores of the aluminum. The entire structure had to be covered by the welding torch. Minkoff learned to weld through a three-part series featured in a science magazine.

The completed structure weighed close to a thousand pounds, requiring a block and tackle to hoist it in position. With time ticking away Dr. Damadian decided to junk the second dewar even though the magnet would not have as controllable a field.

In a quest for much needed funding, Dr. Damadian attempted to meet with President-elect, Jimmy Carter in Plains, Georgia. Unfortunately, the President was not approachable at that time. Just when the funds were running out, a Benefactor supplied enough money to finish the project. With the new funding, the large storage container and dewar were completed. Still, small leaks were costing thousands a week in lost liquid helium.

A coil to wrap around the patient was still needed to complete the machine. It was found that the equations for determining capacitors were faulty. While they were accurate enough to build very small antennas, they were useless for anything larger. Goldsmith built fifteen coils before an adequate one was constructed, yet he couldn't understand why a fourteen-inch coil worked and a sixteen-inch coil wouldn't.

When completed, the machine was christened "Indomitable", for all the work and unyielding spirit it took to build. It resembled the slowly turning wheel at an amusement park that turned while people tried to walk through. Across the center of the wheel was a wooden plank with the coil attached.

Turning the magnet on, Damadian noticed that its field would drift, so the power was reduced. Tubs of water containing nickel chloride were used as phantoms to test for a detectable signal. A turkey (dead) was then tested and its interior was clearly outlined. Next Dr. Damadian tried to scan himself. As he sat in the machine, it was turned on but nothing happened. The antenna had to be adjusted due to too much interference in the signal-to-noise ratio.

On July 3, 1977, the first human image from the "Indomitable" was obtained. It was a cross-section of Larry Minkoff's chest. The image revealed the heart, lungs, vertebrae and musculature. Damadian's team was overjoyed! Wine was opened for the occasion. Damadian wrote "Fantastic success, first human image, completed in amazing detail." This first scan required Minkoff to be moved over sixty positions with 20 to 30 signals taken from each position. These signals were then averaged and produced an image on the screen.

Dr. Damadian quickly called a news conference. Congratulatory telegrams poured in from all over the world. Among them were messages from Purcell and Mansfield. However, Damadian's team had little time to savor the triumph. The next hurdle was to lower the time needed to produce an image. A major problem was the signal-to-noise ratio.

Throughout the fall of 1977 and early 1978, the time it took to produce a scan was brought down from hours to just 38 minutes. A representative from General Electric went to see the "Indomitable" and soon after word was that GE was building their own scanner. Johnson and Johnson also showed an interest though nothing ever came of it.

In early 1978 Dr. Damadian formed the FONAR Corporation. Damadian and his Brother-in-law set out to raise funds for the new company. Slowly, investors (Over)

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took stock in the company. Dr. Damadian decided that the company would build NMR machines using a permanent magnet instead of a superconducting type. He felt that superconducting magnets would be too much trouble for the hospitals to bother with. Both liquid helium and liquid nitrogen would have to be on constant supply, a very costly prospect.

In the latter part of 1978, Damadian completed the design of his first permanent magnet for an MRI machine, christened "Jonah". At five hundred gauss (0.05T) it was the first practical permanent magnet for imaging. In order to sell this model, Damadian knew he had to make it more aesthetically pleasing. An Italian sculptor was hired to design the shell as Dr. Damadian was impressed since he toured Italy. After many refinements to the electrical system, by early 1980 the QED 80 was completed, the first commercial MRI scanner.

In the spring of 1980, the QED 80 was shown to the world at a radiologic show. Four prototypes were built and by the end of the year were installed in Cleveland, Mexico, Italy and Japan. Since the FDA had not yet approved the scanner, they were only used for clinical testing at this point. A year later, at another radiological show, a competitor presented their new machine, a superconductor at over three thousand gauss (0.3T). The clarity of the pictures it produced had far better signal-to-noise ratio (SNR). Damadian knew he had to build a permanent machine of at least 0.3 Tesla. Since a permanent magnet of this size had not been built before, Damadian's team went back to burning the midnight oil. The new magnet weighed approximately 100 TONS (200,000 lb.).

Called the BETA 3000, FONAR's latest machine was given critical acclaim for its high resolution images. Orders began to arrive on a steady basis. At this time, the magnetic resonance imaging industry expanded rapidly with about thirteen different manufacturers. Dr. Damadian considered them all to be infringing on his patent since he had not given them license to use his technology.

While most companies produced superconducting magnets, FONAR alone was producing the permanent type. In 1983, FONAR introduced a mobile scanner, installed on a moving van size truck. Designed with a minimum fringe field to avoid elaborate shielding precautions which would be very expensive.

Today, FONAR Corporation's headquarters is in Melville, New York and has supplied MRI scanners worldwide. Dr. Damadian is still in the ring fighting the competition on patent infringement. The outcome of these cases should be very interesting and will set an interesting legal precedent for the MRI field.

Once scorned by the scientific community, Magnetic Resonance Imaging, pioneered by Dr. Damadian has become the most precise imaging modality in the diagnosis of pathology of the brain, spine, heart, abdominal and pelvic areas, etc... Indeed, it can be safely stated that MRI imaging is the internal imaging breakthrough of the century. It is surely the greatest advance in the imaging field since the invention of the X-Ray machine one hundred years ago. As Henry Ford revolutionized the transportation industry nearly eighty years ago, likewise, Dr. Raymond Damadian revolutionized the medical imaging field in our time. He is truly the "Henry Ford of MRI".

Thomas V. Doherty, New York

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