SEARCH

Scientists Who Serve God

From Atom Smashing to Nuclear Medicine

John A. McIntyre's research career in physics has spanned forty years. For roughly the first half he worked with several different kinds of particle accelerators, huge machines that probe the tiniest details of matter by hurling highly energized subatomic particles at atoms or other particles. His work with an electron accelerator at Stanford and a heavy-ion accelerator at Yale led to his present position as professor of physics at Texas A&M University in College Station. He moved to Texas in 1963 to help get A&M's brand new cyclotron operating. Studying collisions with it eventually led to the second phase of his career: applied medical physics. Pure research is fun, he says, but "this kind of physics can do ordinary people some good." Besides, it may open up new jobs for his physics students.

Being in the Right Place at the Right Time

It's not hard for "Jack" McIntyre to see the hand of God guiding his life. He was born in 1920 in Seattle, where his father was a mechanical engineering professor at the U. of Washington (and head of the university committee on athletics). Jack, the oldest of three boys, was too slight for football but loved playing basketball in a city youth league. In 1943 he received a B.S. in E.E. from U.W. with high academic honors. World War II disrupted many plans at the time, including his. After a year teaching electrical engineering at Carnegie Tech in Pittsburgh he began working on airborne radar for Westinghouse Corporation in Baltimore.

With the end of the war in 1945, the radar project was cancelled and Jack found an engineering research job at Princeton University. He thus "fell into one of the best physics departments in the world," when top-notch scientists were trying to understand the physics behind the atomic bomb. Shelving his plans to go to M.I.T., Jack stayed on as a grad student and met Madeleine Forsman, a teacher of French and English at Princeton High School. He married her in 1947 and received his Ph.D. in 1950. The couple moved to California, where Jack's Princeton professor had accepted a job at Stanford University.

After seven years of postdoctoral research at Stanford's High Energy Physics Laboratory, McIntyre was offered a physics position at Yale as assistant professor (1957-60), then associate professor (1960-63). From Yale he went to his present full professorship at Texas A&M. From 1965 through 1970 he was also associate director for research at A&M's Cyclotron Institute.

Acting on a Theory that Makes Sense

Jack McIntyre became a Christian some years after becoming a full-fledged physicist, approaching those two major life commitments in a similar way. In "The Appeal of Christianity to a Scientist" (*Christianity Today*, 15 Mar 1968; first published as "A Physicist Believes," *His* magazine, June 1961), he wrote that faith became real to him only after years of trying to make sense out of what he heard from various pulpits. His eyes were opened in a home Bible class "where the Bible was studied in the same critical manner that I was accustomed to in my daily work in physics. The class assumed the Bible to be consistent and understandable, just as the scientist considers nature to be consistent and understandable."

As in learning to swim, though, preliminary investigation can take one only part of the way. After "plunging in" to trust Christ, Jack McIntyre found new understanding, when "the most wonderful theory he could ever imagine" was "validated completely in the laboratory of life." Ω

Scientific Investigation

One Thing Leads to Another

What's a high-energy physicist doing trying to peer inside the human brain? To hear how Jack McIntyre got into medical instrumentation is to follow a trail of "one thing leading to another" with little hint of where the trail might end. Yet the groundwork for his current work on positron emission tomography (PET; see sidebar on "Brain Scans") was being laid all along.

For one thing, his PET work is now in an "engineering phase" and his first degree was in electrical engineering. At Princeton he did graduate work in physics under the late Robert Hofstadter. Jack had found optical theory hard to understand until he took Hofstadter's graduate course on optics; now he's making use of optical fiber technology. Further, in his Ph.D. research he used some of the first gamma-ray scintillation detectors, now at the heart of all PET instruments.

The young Ph.D. accompanied Hofstadter to Stanford in the first of Jack's three career moves to universities with newly built accelerators. Hofstadter used high-energy electrons from the Stanford accelerator to probe the size and shape of atomic nuclei, winning the 1961 Nobel Prize in physics for that work. McIntyre's research publications with a Nobelist were no doubt a boost to his own academic career in high-energy physics.

An End and a Beginning

With Texas A&M's cyclotron, McIntyre studied proton-deuteron collisions, which send particles off in all directions. To account for all of them required a large number of expensive detectors. While thinking of ways to simplify that system, Jack was also wondering how long pure research on nuclear structure could absorb young Ph.D.s interested in nuclear physics.

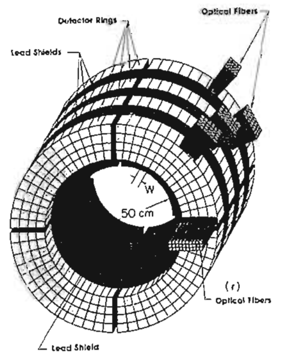
Realizing that more precise measurement of nuclear radiations inside the human brain could have great medical benefits, McIntyre thought of using optical fibers to sharpen PET images with less expensive and less cumbersome equipment. He improved detection of positron collisions by utilizing cheaper plastic scintillators to convert gamma rays into optical signals. His optical-fiber encoding system feeds the signals into a smaller number of photomultipliers than in presently available tomographs.

Tenacity—and Tenure

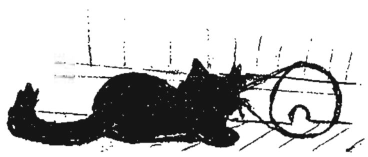
After a grant from the National Institutes of Health in 1976 enabled McIntyre to build a small prototype machine, new technology made that first project obsolete before it could be tested. Jack hung on, pouring what he had learned into an improved design, under a major grant from the American Cancer Society in 1980. After that, Texas A&M continued to support the project. By then his academic tenure was almost as important as financial support, with years going into exploratory design work with little opportunity to publish.

At last a series of papers on John A. McIntyre's design for an "80-Ring Optical-Fiber PET" is flowing from his lab into the *Journal of Computer Assisted Tomography*, *IEEE Transactions on Nuclear Science*, and other technical journals. Using less than a 300th the number of expensive photomultipliers, the A&M tomograph design should yield PET images as sharp as those from CAT scans, with little increase in cost.

Ω



Left: General layout of the A&M Positron Emission Tomograph. Each quarter ring contains over eight miles of plastic fiber optics. For a brain scan, the patient's head fits into the center aperture.
Below: CAT scan of mouse aperture.



BRAIN SCANS

Most people have heard of the CAT scan (Computer Assisted Tomography), a special kind of X-ray photograph. A CAT scan shows structures in a single layer or "slice" of a living human brain without interference from structures in nearby layers. Removing those extraneous images is what the computer assists in doing. The word *tomography* comes from the same Greek root for "cutting off a slice" as does the word *atom.* (An "a-tom" is the smallest piece into which an element can be divided.)

PET (for Positron Emission Tomography) is based not on X-rays but on gamma rays generated *inside* living tissue by positron collisions. Positrons are positively charged "anti-electrons" emitted when certain radioisotopes (such as carbon-11) decay. A normal body chemical tagged with C-11, say, is injected into the patient. Emitted positrons immediately collide with electrons abundant in body chemicals. Each collision produces two gamma rays, detectable when they penetrate to the outside of the body. Gamma rays are slightly more penetrating than X-rays. With the rapidly decaying isotopes used, there is no more radiation damage to tissue than when X-rays are used.

Unlike CAT scans, a PET scan can measure biochemical activity going on in a brain. Clinicians expect the new technique to foster breakthroughs in various brain disorders: schizophrenia, epilepsy, Huntington's chorea, and Parkinson's and Alzheimer's diseases. PET may also aid research on such circulatory disorders as ischemic heart disease and stroke.

Mild-mannered Professor McIntyre can express himself quite strongly about issues he really cares about. One such issue is the failure of the Christian community to counsel its brightest young people into scholarly pursuits.

An invitation to a banquet honoring "the 48 American Jews who have won a Nobel Prize in science" made him realize that he couldn't think of even *one* evangelical Christian who had won a Nobel Prize in any field. American evangelicals, who may outnumber American Jews by as many as four or five times in the general population, have accomplished far less in science.

The Evangelical "Seal of Approval"

In "Calls of Ivy" (*Christianity Today*, 5 Nov 1990), John McIntyre expressed concern that although there are plenty of bright Christian students, most are diverted from going on to graduate school to become the professors and researchers of the future. Why? Despite talk of "redeeming the secular world," evangelicals still place a far higher value on "full-time Christian service" (i.e., as pastors and missionaries) than on training to enter the academic professions.

One price paid for such restriction has been a diminished Christian influence in the universities and consequently in American culture as a whole. Ironically, after praying for the gospel to bear fruit in China, Christians now find U.S. universities inundated by over 40,000 Chinese scholars. Such scholars have not heard that science developed in a Christian culture, or that it is reasonable for a scientist to have a mature faith in Christ. How many Christian professors will they encounter?

A Physicist Prescribes a Cure

The evangelical church may show symptoms of anti-intellectualism, but the prognosis need not be grim. If the disease is "a tradition that some works are better than others," McIntyre suggests that the cure lies "in a return to the insights of the Protestant Reformation," which should have broken down distinctions between clergy and laity. With the Reformation's rediscovery of salvation by faith, consecrated Christians became free to devote their lives to any lawful pursuit and find satisfaction in it. Science in particular was enriched by the new Christian freedom. Johann Kepler (1571-1630) regarded his astronomical work as unfolding "the admirable wisdom of God."

Jack McIntyre in his Texas A&M University laboratory, running tests on his "PET Project." Foreground: Quarter ring of the scanner designed and constructed in the lab. (Read his lips: "This thing is going to work!")

McIntyre quotes that phrase from John Calvin's comments on astronomy. The Reformer regarded the study of astronomy as a pleasing and important pursuit: "Wherefore, as ingenious men are to be honored who have expended useful labor on this subject, so they who have leisure and capacity ought not to neglect this kind of exercise."

Of his own Christian vocation, McIntyre says, "I am immersed in physics because I am fascinated by the insights that physics has obtained about God's world. I find in physics an esthetic appeal that enriches human existence and gives the same kind of satisfaction that is experienced by hearing great music or viewing unspoiled nature." He recalls that he became a Christian because he saw the same aesthetically satisfying patterns in Scripture. Ω

Theological Reflection

Rekindling the Reformation

BRAIN SCANDAL?

Dr. McIntyre is not alone in recognizing that evangelicals have often "betrayed the Reformation" by failing to utilize our brains in wholehearted academic pursuits. This little publication, SEARCH, is one effort to remind the church and the world at large that *some* Christians are already reversing the trend. Some have done outstanding scientific work. One or two have even come close to that prestigious Nobel Prize.

The year 1991 marks the 50th anniversary of the founding of the American Scientific Affiliation (ASA), which now numbers over 2,500 men and women who consider science their Christian vocation. Other societies have sprung up since 1941 to stimulate evangelical scholarship and encourage Christians in secular academic fields. The Affiliation of Christian Geologists and Affiliation of Christian Biologists are two ASA-related groups in specialized fields of science. Such groups often meet in conjunction with national scientific meetings.

Para-church groups serving college and university students, such as Campus Crusade for Christ and InterVarsity Christian Fellowship, have begun to extend their ministry to include graduate students and faculty. IVCF, for example, has provided financial support for a new quarterly journal produced for and by graduate students: *The Crucible* ($8/yr, c/o David Lines, Dept of Computer Science, U. of North Carolina, Chapel Hill, NC 27599-3175).

Jack McIntyre is very much an experimental physicist, though as a boy he was more of a reader than a "tinkerer." What one needs in order to do good experimental work, he says, is a basic understanding of the subject and a lot of common sense. Common sense and the interplay of theory and practice seem to be important characteristics of scientific work.

Many Christian writers have stressed the importance of both *orthodoxy* (teaching what is right) and *orthopraxis* (doing what is right). Maybe it is the common-sense aspect that is most commonly neglected in the Christian life.

Adventures in Physics and the Christian Life

Jack McIntyre's calling as a physicist has included teaching the subject to over 5,000 students and engaging in both pure and applied research. He has published over 50 scientific papers and holds eight patents. (He's one scientist who should already know how to say "Thank you very much" in the appropriate language if ever handed the Nobel Prize. Both his wife Madeleine and their adopted son John F., in construction engineering, were born in Sweden.)


Jack & Madeleine McIntyre

The McIntyres have wanted their Christian witness to make sense in the context of their surroundings. Madeleine has published articles in Texas *Tempo* magazine about two of their adventures. One described their 1965 trip to the Soviet Union, where Jack was a guest lecturer for ten days at the Institute for Nuclear Research in Dubna, and their return trip in 1968. Stressing the friendly openness that made Russians seem very much like Texans, she mentioned befriending their official guide and later sending him his first copy of the New Testament.

Trying an Experiment; Pressing On Toward the Prize

In a 1970 *Tempo* article ("Experiment in Black and White") Madeleine told how Jack's meeting with a black high school physics teacher led the McIntyres (active in a Presbyterian church) to make a series of visits to the African Methodist Episcopal Church in still highly segregated Bryan, Texas. Everyone was a little tense at first, but once the McIntyres' motives were recognized as a sincere desire to worship with fellow believers, color didn't seem to matter.

When the outcome of an experiment is uncertain, it's important to put in a lot of thought beforehand. But if one is absolutely sure how something will turn out, Jack says, it's no longer an experiment. He'd like to see more Christians tinkering with new patterns—not recklessly, but with careful thinking about goals. That seems to be the route to "the prize":

> *. . . I press on to make it my own, because Christ Jesus has made me his own. Beloved, I do not consider that I have made it my own; but this one thing I do: forgetting what lies behind and straining forward to what lies ahead, I press on toward the goal for the prize of the heavenly call of God in Christ Jesus. Let those of us then who are mature be of the same mind; and if you think differently about anything, this too God will reveal to you. Only let us hold fast to what we have attained.*

(Philippians 3:12-16) Ω

Thoughtful Worship

Thinking and Tinkering

SEARCH

This issue of SEARCH (No. 12) was prepared by Walter R. Hearn of Berkeley, California. Design by Nancy C. Hanger; layout by ASA managing editor Rebecca Petersen. Opinions expressed in SEARCH are those of individuals and may not be representative of the entire ASA membership. Scripture quotations are from the New Revised Standard Version (1989) unless otherwise noted.

SEARCH brings scientific questions to the attention of pastors and the Christian public by focusing on the work of Christians in science. SEARCH is an occasional publication of the American Scientific Affiliation (ASA), Robert L. Herrmann, executive director. To obtain a free single copy, send stamped, self-addressed envelope to: ASA, P.O. Box 668, Ipswich, MA 01938. Be sure to state the number of the issue being requested. Multiple copies to one address: 15 cents/copy plus $1.50 postage and handling charge; prepaid orders only, please.