

SPINAL CORD INJURIES

Health care providers and medical scientists are undertaking research to upgrade care of spinal cord patients and some of their efforts are yielding beneficial results

BY JOAN AREHART-TREICHEL

In 1966, Robert Heist, a Tufts University graduate, was in a motorboat accident that broke his neck and left him paralyzed from the neck down. The first time nurses helped him sit up after his accident, it took three hours of preparation. "Oh my God," Heist thought, "I'll never be able to do even this for myself! All my life I'll be completely helpless and dependent on other people." But Heist survived his tragedy and was successfully rehabilitated. By the fall of 1967 he was employed by the John Hancock Co., could drive himself to work, bowl and even handle a motorboat.

Heist's rehabilitation was not a miracle. It was the result of important medical research and health care advances that had taken place between the 1940s and the 1960s: the arrival of antibiotics to cure bladder infections (which used to kill spinal cord patients routinely), the arrival of rehabilitation as a medical specialty and the establishment of centers to rehabilitate spinal cord patients. Heist received his rehabilitation from the New York University Medical Center Institute of Rehabilitation Medicine, one of the first spinal cord injury centers to be set up in the United States.

As fine as Heist's care at NYU was, thousands of spinal cord patients still do not have access to treatment of this caliber. Many spend several months in hospitals until their insurance coverage runs out and then are discharged to nursing homes where few attempts are made to help them return to productive lives in society. And even when spinal cord patients do get the best rehab care, they can succumb to serious medical complications. These problems are causing health care providers and medical scientists to undertake research to upgrade the care of these patients.

One of the most notable efforts being made along these lines got underway in 1975. Fourteen of the nation's top spinal cord injury care centers are participating in a seven-year longitudinal study attempting to demonstrate that systematic, coordinated, quality care of spinal cord patients pays off, both in patient rehabilitation and in cost-effectiveness. The study is financed with government funds mandated by Congress and provided through



the National Institute of Handicapped Research (part of the Department of Health, Education and Welfare). The 14 model systems participating in the study are located at a variety of institutions, from Good Samaritan Hospital in Phoenix to the University of Alabama in Birmingham to New York University Medical Center in New York City to Santa Clara Valley Medical Center in San Jose. The care that patients receive at all these centers is essentially the same. That way it can be objectively measured and compared with spinal cord care being provided elsewhere in the United States.

For instance, patients receive emergency medical care within no more than a few hours — often within minutes — of their injuries. Then they get sophisticated, intensive, acute medical care that is effectively coordinated with a full range of comprehensive, coordinated rehabilitation services provided by a team of medical specialists—physicians specializing in spinal cord injury rehabilitation, rehabilitation-trained nurses, physical therapists and a team of social services and psychological experts. Patients engage in strenuous exercises to build up those parts of the body not paralyzed by the injury. They learn how to handle bowel and bladder functions no longer under bodily control, how to get in and out of wheelchairs and beds and how to dress themselves. They make plans for returning to school or to a job once they leave the center. They also receive sex counseling since they probably will have lost considerable sexual function through the injury. They view films and participate in group programs showing how spinal cord patients can achieve a fulfilling sex life with a sympathetic partner and creative techniques. But perhaps most crucially, they

A quadriplegic (above) controls his environment with a sip and puff mechanism. A paraplegic (right) is able to drive a car.



are helped in adjusting psychologically to the tragedy—to move through shock, denial and anger into acceptance and adjustment and to deal with unintentional cruelty from the outside world.

Although the study won't end until 1982, preliminary data from it document that systematic, quality care of spinal cord patients indeed pays off, both in terms of patient rehabilitation and economics, compared with what is otherwise available in the United States.

Still other research being pursued by health care providers and medical scientists consists of efforts to improve specific aspects of that care. Much of this research is being funded through the NIDH and as part of a 1978 congressional mandate.

Some of this research is aimed at finding ways of lessening spinal cord damage. For instance, scientists at the Walter Reed Army Institute of Research in Washington have found that in animals, the drug naloxone can prevent or lessen paralysis immediately following spinal cord injury (SN: 4/26/80, p. 260). Neurosurgeon Jewell Osterholm and his colleagues at Jefferson Medical College in Philadelphia are attempting to see whether bathing newly

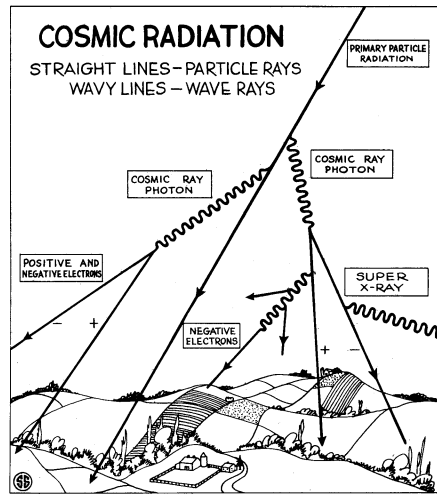
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NYU Medical Center

mechanics. In Dirac's talk dealing with the same years, the phrase "that was my mistake" runs like a Wagnerian leitmotiv.

But "mistake" in the popular sense is perhaps too strong a word. One of Dirac's mistakes was a strong fascination with the symmetry of Niels Bohr's model of the atom. Dirac's work — he has said it on numerous occasions — has been a search for mathematical beauty, and he was slow to realize that the beauty of the Bohr model had to be supplanted, that "a new mathematics was necessary." Werner Heisenberg provided this in matrix mechanics, and Dirac now thinks that that was the great turning point of physics in that time: Heisenberg supplanted the commutative algebra of classical physics with the noncommutative algebra of the new physics. There was thus continuity and analogy to the past (all formally algebra) and revolution (non-commutative algebras had been a curiosity, not a piece of practical activity).

The counter to Dirac's ultimate mathematicism is provided somewhat surprisingly by Schwinger. The relativistic quantum electrodynamics that he is famous for is often presented as a beautiful mathematical enterprise unfortunately marred by the necessity of accommodating reality. If one writes the theory in its most mathematical form, the masses and electric



Schematic roughly contemporary with the photos on p. 10 illustrates cosmic-ray production of positrons but not "mesotrons."

charges of electrons come out either zero or infinite. Not only is this difficult for calculation, it is physically absurd: Experiment shows finite values for both those quantities. Schwinger says the theorists were continually inspired by experiment. Much of their effort was devoted to making the theory yield predictions that corresponded to actuality. They weren't forced to; they wanted to.

The historians probe and question.

They look for turning points: The most dramatic change of direction due to unexpected discovery? Dirac says Heisenberg's substitution of noncommutative for commutative algebra. Weisskopf agrees: quantum mechanics. The others are not sure that alone stands out among the others. Considering the many instances of the opposition between holding on to old ideas and embracing the new, is there some rule of thumb about when you should be bold and when conservative? The physicists hem and haw. Finally Dirac sums it up with a forthright equivocation: "There are no rules about whether one should be bold or not."

So it goes. There is material here for a book or several books. Whether they will be history or at best biography depends on the answer to the question: Is physics some kind of hard, multifaceted crystal suspended perhaps in Dirac's infinitely dimensioned Hilbert space, and all we have to do to perceive it is to unwrap it properly? Or does the essence of physics have to do with the essences of the people who have worked on it? Most physicists have tended professionally and formally, if not in their heart of hearts, to state the former. Many who have observed them for years tend to the latter opinion. Perhaps the professional historians should decide — and convince. □

... Spinal cord

damaged spinal cords in an ice solution will reduce swelling and the damage it causes. Initial results in a few patients look promising, and the researchers now want to set up a multicenter trial to test the technique as scientifically as possible.

Some studies are attempting to find ways of optimizing patients' rehabilitation. For example, Terry Carle, a physician specializing in physical medicine and rehabilitation at Northwestern Memorial Hospital in Chicago, and colleagues have been measuring spinal cord patients' progress in activities of daily living such as washing their faces, combing their hair, getting out of their wheelchairs and so forth. They have found that paraplegics (spinal cord patients paralyzed from the waist down) make quicker progress while undergoing rehabilitation at the hospital than do quadriplegics (patients paralyzed from the neck down), probably because the former patients' injuries are less severe. However, the quadriplegics go on to make more progress in the months after they return home than do the paraplegics because, as Carle explains, "they are refining techniques they have been taught at the hospital."

Yet other investigators are trying to better understand physiologic disturbances resulting from spinal cord injury with an eye to correcting them. E. Eric Naftchi and his colleagues at New York University Medical Center have found that while male sex hormones are temporarily

impaired in male paraplegics, they may be permanently disturbed in male quadriplegics. The researchers have also found that spinal cord injury interrupts sensory stimuli to the brain and in turn the release of adrenal hormones. The interrupted release of adrenal hormones may partly explain patients' drastic weight loss following spinal cord injury.

Still other research is aimed at exploiting current technology to make the lives of spinal cord patients easier and more fulfilling. Philip Fine and colleagues at the University of Alabama in Birmingham have developed a technological assist for the handicapped that they call "C2E2." Using a computer, the Alabama group wrote a series of special programs and put a voice link in it. A quadriplegic can talk to the computer, and it will perform various functions — switch appliances on and off, write letters on a typewriter, answer the phone. Says Fine, "The computer is a fun thing, but also a very helpful thing. There's a lot of international interest in it. It represents a significant breakthrough in the daily living of the handicapped."

The ultimate scientific challenge as far as upgrading the treatment of spinal cord patients goes, of course, is to find some way of regenerating central nerves in patients' severely damaged spinal cords so that the nerves will function again, and the patients will no longer be paralyzed. Some authorities in the spinal cord injury field, such as Paul Thomas, medical scientific

administrator of the National Institute of Handicapped Research, think that spinal regeneration will probably not become functionally effective for many years. Others, such as Donald Tower, director of the National Institute of Neurological and Communicative Disorders and Stroke, are more sanguine (SN: 10/27/79, p. 277).

Whether regeneration ever becomes possible or not, though, there is no doubt that research efforts to improve the care of spinal cord patients are already leading to beneficial results. The encouraging preliminary data from the 14-model spinal cord care system study have led to the establishment of similar spinal care centers at numerous medical schools and hospitals throughout the United States.

And the greatest benefits from research to upgrade the care of spinal cord patients are probably still to come. As Thomas predicts: "Ongoing clinical research and demonstrations are going to influence the national medical community into better recognizing spinal cord patients' potential and to more fully meet their needs. There will ultimately be a nationwide network of high-quality spinal cord injury treatment centers. In addition, our social and community agencies will be more responsive to the community needs of the spinal cord injured in terms of family adjustment programs, independent living activities, recreational programs and work. So I feel very confident about the future for spinal cord patients." □