I would like to discuss with you the role of the clinical engineer in the care of the person with spinal cord injury. I use the word “person” rather than “patient” because the former helps us maintain a proper focus on the meaningful relationship that should be established between the engineer and the individual who has suffered a spinal cord injury. Of course, in our system of care, we must use the label of “patient” for administrative reasons. But the “person” with spinal cord injury knows only a daily life in which there is severe, overwhelming physical disability of paralysis of the legs (paraplegia) or paralysis of the arms and legs (quadriplegia).

Those we care for in the Veterans Administration are all adults. They have known in the past what it was like to be healthy, physically active, and independent. Then suddenly one day they found themselves unable to move their arms or legs. In over two-thirds of the instances, no other associated injuries to head, chest, abdomen, or fractures of the limbs were incurred. Due to an accident of some sort, instantly they found they could not move their arms or legs, and the skin of the involved part was without sensation. Not even a pin prick could be felt. The arms and legs appear normal and show no signs of injury, yet the person cannot voluntarily move them. The limbs simply will not respond. The trauma to the spinal cord has interrupted the transmission of messages from the brain to the muscles of the limbs.

Some persons with spinal cord injury are fortunate in that the paralysis disappears partially or completely, permitting physical independence. However, most persons who are completely paralyzed immediately after injury, and who do not recover any function within a few hours or days, remain permanently paralyzed. This person must therefore learn how to plan a lifestyle of coping with this physical and functional disability. The clinical engineer, by getting to know the spinal-cord-injured person and having some appreciation of his goals.
can help him help himself to greater functional independence and a meaningful life.

In the United States today there are estimated to be from 100,000 to 200,000 persons with spinal cord injury. The annual incidence is thought to be approximately 10,000 to 20,000 cases. Spinal cord injuries result from developmental defects of the spine and spinal cord in children, various diseases, and a significant number from traumatic injury to the spinal cord, resulting in quadriplegia or paraplegia.

Beginning in the 1940's, during World War II, the VA began organizing special bed sections in selected hospitals to care for these spinal-cord-injured persons when hospital care became necessary. At the present time, there are 16 such spinal-cord-injury treatment centers in various parts of the country. Their size ranges from 20 beds to 204 beds, with the Long Beach VAH as the largest spinal-cord-injury service in the world. The Veterans Administration has now on its roll approximately 20,000 veterans with spinal cord injury.

At the time of World War I, 90 percent of the spinal-cord-injured patients died within the first few years after injury. After World War II, with the development of antibiotics to combat infection, over 90 percent lived for many years after injury. At present, the patient who survives to reach a hospital after sustaining injury has a life expectancy almost equal to that of the noninjured.

The highest incidence of spinal cord injury occurs in young males between the ages of 15 to 35 years. These young men have a long lifetime ahead of them. Roughly, about 50 percent are paraplegics and 50 percent are quadriplegics. However, due to the fact that the quadriplegics are more severely handicapped and have more difficult complications, the quadriplegics quite often outnumber the paraplegics in the hospital setting. There is also an actual increase in the number of quadriplegic patients because more high level quadriplegics, i.e., injury at the fourth cervical segment and above (C1 through C4), are surviving the injury due to improved methods of medical care and transport immediately after injury. These high level quadriplegics have a more pronounced disability. They are able to use their head and neck, but have no voluntary movement of any muscles of the shoulders, arms, hands, trunk, or legs.

We usually expect the paraplegic (paralyzed from the waist down) to become virtually independent in activities of daily living. He can move about quite fully by wheelchair and automobile without any assistance. Many such persons travel about this country each day by car and plane unaccompanied by any assistant.

The quadriplegic, however, faces a much greater challenge. In addition to the loss of some or all voluntary movement of the arms and hands, there is paralysis of the chest and back muscles, causing impair-
ment in breathing and difficulty in maintaining body balance, even in wheelchair stability.

Although, the quadriplegic appears to be in need of appreciable assistance, it has been estimated that 80 to 90 percent of all spinal-cord-injured patients can be discharged from the hospital, including quadriplegics. Moreover, even with the present state of the art, at least 50 to 60 percent of spinal-cord-injured persons can be employed in some gainful occupation, and many additional persons can develop significant avocational activities. The thrust of these statements should encourage expectancy in the spinal-cord-injured patient and family that there can be a discharge from the hospital to a meaningful life in the community. The clinical engineer can significantly assist this progressive course of rehabilitation all along the way, and ultimately into the home and the community.

The clinical engineer must be continually sensitive to the fact that most of the persons with spinal cord injury have not suffered any brain damage. Nor is there any significant change in the personality of the individual. Therefore, the most significant resource available to the patient is still present—his mind. The person with spinal cord injury is usually mentally alert and often has strong will power. Our task and responsibility is to utilize this cerebral talent together with whatever motor and sensory capabilities remain to bring about a satisfactory restoration to community living, if at all possible. We assist the patient to develop an expertise which enables this satisfactory living pattern.

The clinical engineer should be an integral part of the treatment team from the initial phase of treatment through the rehabilitation phase, and into the outplacement period. Further, this ongoing contact should be maintained throughout the life of the individual. The Veterans Administration assumes that it has an obligation to the spinal-cord-injured veteran throughout his lifetime, not only in times of emergency, but also in such a way as to prevent the need for hospital care. Further assistance is also extended this person to help him achieve his selected goals.

During the past few years, the Spinal Cord Injury Service of the Veterans Administration has initiated a program of home care after the patient is discharged from the hospital, which has proven successful. Predischarge evaluation and planning for the selected patients enable a multidisciplinary team to effectively outplace and care for patients who otherwise would not be considered suitable for outplacement away from the hospital premises. Unexpectedly, approximately 50 percent of those outplaced have been quadriplegics, many with severe physical disability, and including some who had been hospitalized for 10 to 15 years and had been previously considered noncandidates for outplacement.

We have had the clinical engineer visit the home of the spinal-cord-injured person to assist in devising ways to make life worth living. The
engineer should also assist in devising a suitable interface between the spinal-cord-injured person and the environment by following the trail from home to school, or job, or recreation.

Just 30 years ago, during World War II, spinal-cord-injured persons received their first expectation of surviving the trauma. This fresh hope resulted from the newly introduced initial antibiotic drugs and better systems of care. However, in the intervening years, little organized help was given to the spinal-cord-injured person in terms of his expecting to regain independence and return to a full life in the community. Meanwhile, technology has continued to make large, rapid strides. Today, we are still receiving some technological fallout from the "moon" program. The clinical engineer can and should assist in applying some of this available technology to the needs of the person with spinal cord injury. Perhaps one day a paraplegic might also travel to the moon. After all, in a gravity-free environment, much that is considered physical disability on earth disappears.