Electric hands

A ten-year-old child, her arms deformed since birth because her mother took thalidomide during pregnancy, contracts a muscle in her stunted arm.

Electrical impulses, generated by her own body, flow from the muscle to an artificial hand. The fingers, fashioned by technicians in a workshop, pick up coins, grasp a fork, offer a pencil.

It is unlikely medical science ever will be able to make her whole. However, because of the work of the Rehabilitation Institute of Montreal, under the direction of Dr. Gustave Gingras, many of Canada's 125 thalidomide children, as well as amputees and others with limb deformities, can lead comparatively normal and useful lives.

Since 1964, Dr. Gingras, a world-renowned figure in medicine and rehabilitation, the Institute staff, and researchers at Northern Electric Company in Ottawa have been refining an artificial hand activated by the body's own electrical currents. They succeeded in improving the hand originally designed in the Soviet Union, known technically as a "myoelectric upper extremity prosthesis".

When it was brought to Canada for study at the Institute, the device was already an improvement over conventional artificial limbs. Its operation required no muscular effort; nor did support equipment have to be harnessed to the body.

However, the hand was limited to use by adult males, primarily amputees. Dr. Gingras sought to adapt the myoelectric principle to devices for females and particularly for children.

Canadian improvements

To this end, the Institute engaged the assistance of engineers at the Northern Electric Research and Development Laboratories in Ottawa. Northern Electric also received grants totalling $67,000 for the period 1966 to 1971 from the National Research Council of Canada to support this research on improving the prototype electric arm. Components were made much smaller, almost all wiring was made internal, and a wrist unit was added. This wrist, though not controlled myoelectrically, could be rotated by the wearer turning it with his other hand.

The greatest improvement, however, was to build into the hand a system of "proportional control" which gave it a grip-force proportional to the muscle electricity activating it. The control system also gave the hand a "pinch force," a "sense of feeling" which, for instance, allows the hand to pick up a cigarette without crushing it.

The hand can pick up objects varying in diameter from one-quarter to 3¾ inches. A cosmetic glove increases the friction between the hand and the object grasped. The increased friction improves the grip, making it firm enough to hold a knife and cut a steak.

How it works

The electric hand functions through surface electrodes attached to a muscle that pick up the electrical signal involved in muscle-contraction. An amplifier, which the Institute developed and built into the device, increases the strength of the signal and turns it into a direct current.

When the current is strong enough, a motor is switched on to run in the direction dictated by the muscle impulse. Another electrode picks up the signal to run the motor in the opposite direction. The hand can thus open and close.

The absence of a harness or vest encasing the torso is one advantage of the myoelectric system, for it allows greater freedom of movement. Also, activation of the myoelectric device does not require muscular exertion.

And, unlike most conventional devices, the appendage is a "hand" rather than a hook, an improvement in cosmetic appearance that may be psychologically important to the wearer.

However, myoelectrically-controlled limbs are heavy. Persons whose arms are both deformed may experience difficulty in putting them on. In addition, the electrical signals sometimes get mixed up, closing the hand when it should open or opening the hand when it should close.

In future prosthesis, Institute researchers hope to see even smaller, more compact electronic devices.

Gingras, the "father of rehabilitation"

Camille Corriveau, a consultant in prosthetics and orthotics at the Institure, called Dr. Gustave Gingras "the father of rehabilitation of the physically handicapped in Canada". However, Dr. Gingras' contributions to physical medicine and rehabilitation have been international.

From 1953 to 1959 he worked with the United Nations in establishing a national rehabilitation centre in Venezuela. Similar projects were initiated in seven other South American countries.

In 1969 he opened a rehabilitation centre in Qui Nhon, South Viet-Nam. In the same year he co-ordinated an International Red Cross program that resulted in 8,000 of 10,000 Moroccans being totally cured of paralysis caused by contaminated cooking oil.

Dr. Gingras teaches physical medicine and rehabilitation at the University of Montreal, is a member of more than 20 national and international societies, has published over 145 articles and, in 1972, was elected president of the Canadian Medical Association.

On June 8, 1972, he was awarded the Royal Bank Award of $50,000 for his contribution to human welfare.

(The foregoing article was reprinted from The Mirrored Spectrum, *a publication of the Ministry of State for Science and Technology.)*

McGill professor wins U.S. political science award

A member of McGill University's Political Science Department, Professor Michael Brecher, has been awarded the Woodrow Wilson Foundation Award of the American Political Science Association. He is the first Canadian to win the award, which is recognized as the top honour for a member of the profession. The presentation was made on September 6 at the Annual Meeting of the Association in New Orleans.

The award is granted annually to the author of the best book published in the United States on government, politics or international affairs. Professor Brecher's book, entitled *The Foreign Policy System of Israel,* was published by the Yale University Press. The first of two volumes, it is an analytical exploration of a 20-year period (1948-1968) of Israel's foreign policy. The second volume, which will soon be published, examines in depth seven major decisions in Israeli foreign policy from 1948 to 1970.