# Muscle from a Wink or Twitch

Techniques learned by medical engineers are being put to work by industry. Prosthetic techniques which enable the bioengineers to give a useful second arm to a man who'd lost one, can also give a third arm to a worker who needs one.

All the worker has to be able to do is wriggle his ears, wrinkle his nose, or otherwise be able to control face, neck or shoulder muscles.

A research project currently under way at Litton Systems in Toronto, Canada, is trying to find out if people can use such otherwise idle muscles accurately enough to direct small electrical impulses which they generate through electrodes and amplifiers to operate various types of machines or equipment, without any direct assistance from their hands and arms.

Work being done has already resulted in major advances in the science of "myoelectric control" (the word is derived from the Greek "my" or myo, meaning muscle.

### A Third Hand

Since muscles give off tiny electrical pulses, the pulses can be utilized to perform useful functions. In the defense field these pulses could help give a tank commander a "third hand" or help an astronaut handle a wider array of switches than is now possible.

While the research work in myoelectrics is not new, the Canadian team's effort is unusual since it is exploring new directions.

Researchers in the U.S. and in the Soviet Union have chiefly focused on the use of myoelectric control as applied to artificial limbs; where the electrical pulses trigger motors in the artificial limbs. David Lewis and Alfred Stein, the two scientists at Litton Canada, explain that most researchers are interested primarily in the exclusive use of myoelectric power for prosthetic appliances.

The Litton researchers think that their research may well have significant results for this medical field as well, but its initial direction has been a search for the extension of normal physical capabilities.

### One or Many

To establish to what extent humans can control machines by applying the electrical impulses of muscles, the pulses are translated into electrical signals which activate a switch or control, or a number of them, to operate machines or equipment.

While in most myoelectric work, electrodes are placed under the skin of the person to make contact with the muscular voltage sources, the Litton team attaches the electrodes only to the skin surface, to establish contact with the muscles' electrical output.

Using myoelectrical impulses the subject can activate an arm and hand with the satisfying incentive of seeing the specific movements of the arm. By using a number of control channels the unit can be moved in various directions, and by using more sophisticated control the wrists can be turned, and fingers of the unit can be activated.

Up to the present time the project has concentrated primarily on the problems of technique—the ways in which the myoelectric potential can be determined and developed.

Now, the researchers point out, most of the problems of technique have been sorted out and the next logical step is a much more concentrated testing program and the seeking out of specific applications.

### Myoelectric Programming

For industry, Mr. Stein visualizes the use of recorded signals for myoelectric programming of machines. In this case a person might work out a sequence of movements for a specific operation, and then program a machine to carry on with the particular production or assembly process.

Just as this new control source could extend the capabilities of people in the armed services and in industry, it is also expected to be of help in the medical field. Mr. Stein, for example, points out that it should be possible to develop a myoelectrically controlled cart, which a handicapped person could control to assist him or her to lean back, lie down, or even get in or out of it. An arm associated with such a cart could provide even greater versatility.

The Litton project has already proved that accurate use of myoelectric pulses is possible and that training can bring about a high degree of efficiency. Now the two researchers seek other answers: such as can people become so proficient in controlling their muscular voltages that the technique becomes almost automatic? Can they learn to use these myoelectric capabilities without stopping to think about them, just as they now do with so many normal movements?