POWER FOR PROSTHESSES

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Attempts to utilize electric power to operate prostheses were begun as early as the close of World War I when workers in Germany developed experimental artificial hands actuated by an electromagnet. Because of the operating characteristics of electromagnets, especially those available at that time, very little success was achieved, and the experiments turned out to be of academic interest only.

From 1945 to 1952 the International Business Machines Corporation, with funds of its own and of the Veterans Administration, carried out an extensive development program on complete electric arms with emphasis on devices for the more severely handicapped. Evaluation showed that excellent engineering had produced devices that provided the functions sought, but the patient could not operate the prosthesis subconsciously, even though a number of ingenious control systems were used. Because of the need for funds for projects considered to be of higher priority, it was decided to curtail the engineering program and concentrate on the control problem. This function was assumed by the Bioengineering Laboratory, University of California, Los Angeles. It was also hoped that developments in the military and space programs would eventually help in the development of powered artificial limbs.

About the time the IBM project was terminated, work at the University of Heidelberg began to produce promising artificial arms powered by compressed carbon dioxide. The American Institute for Prosthetic Research (New York City), with the cooperation of the Heidelberg group, began experiments to refine the German design and adapt it for American use. The two projects have collaborated ever since. AIPR has been supported continuously by the Vocational Rehabilitation Administration.

Under the auspices of VRA, research and development projects were also initiated during the 1950's at Rancho Los Amigos Hospital (Downey, Calif.), Baylor University, and the University of Michigan, primarily for the purpose of applying external power to braces for paralyzed upper extremities.

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Some work in external power was going on in England and Europe (besides that in Heidelberg), notably the Vaduz hand (Liechtenstein and later Paris), the work of the late Dr. A. Nightingale in England, and the work of Kobrinskii in Russia. But it remained for the thalidomide tragedy to spur efforts in the field to their present level.

The work in Great Britain has been greatly intensified. An ambitious program has been launched in Sweden. The University of Heidelberg has received increased fiscal support. Several projects have been launched in Canada. Work has been initiated in Italy and Yugoslavia, though these efforts can hardly be attributed to the thalidomide tragedy.

Because of the mounting activity in external power in 1960, the National Academy of Sciences, through its Committee on Prosthetics Research and Development, and with support from VRA and the Veterans Administration, organized the Conference on the Application of External Power in Prosthetics and Orthotics which was held at Lake Arrowhead, Calif., in September 1960 (NAS Publication 874 is the report of this conference).

To update the benefits of that conference to cover increased activity in the area of external power since 1960, VRA and VA sponsored a followup conference at Airlie House, Warrenton, Va., April 8–10, 1965, on "The Control of External Power in Upper-Extremity Rehabilitation." Dr. John Lyman, project director, Biotechnology Laboratory, University of California at Los Angeles, long known for his interest in control aspects of external power, served as chairman.

The purpose of the conference was to develop an expert summary of the state of all aspects of the control problem and their possible solutions, as related to upper-extremity functional regain. Besides providing an interchange of up-to-date information among persons directly concerned with the development of externally powered prosthetic and orthotic devices and the application of such devices to patients, the conference, it is hoped, will develop long-range goals and guiding principles useful to governmental agencies—chiefly VRA and VA—sponsoring work in the field through grants and contracts.

Dr. George T. Aitken, an orthopedic surgeon of Grand Rapids, Mich., who is Chairman of the Committee on Prosthetics Research and Development, National Academy of Sciences—National Research Council, gave an overview of all the interrelationships concerned with the problem in a lecture entitled "The Man-Machine." Dr. Aitken pointed out that at present the severely handicapped person equipped with an upper-extremity prosthetic or orthotic device cannot operate the device and perform some other task, such as mental arithmetic, at the same time. He expressed the hope that, with the application of modern knowledge and technology, it will soon be possible to have prosthetic and orthotic devices which will not require the full attention of their users.
More than 100 persons from seven countries in Europe and North America participated in the full 2 1/2-day session. Because of time limitations, it was not possible for each project to report directly. Panels, each consisting of a chairman and four or more members appointed in advance, covered the following major subjects of conference discussion: (1) Sources of Control Signals, (2) Transducers, (3) Actuators, (4) Signal Processing, (5) Sensory Feedback, (6) Selection and Training of the Patient.

At the end of the second day, at the conclusion of the panel presentations, the conference was divided into three discussion groups which assembled after dinner. The three groups charged with developing recommendations for future action, were: (1) The engineering viewpoint—Chairman, R. H. Blackmer, General Electric Advanced Technology Laboratory, Schenectady, N.Y.; (2) the clinical aspect—Chairman, Dr. D. S. McKenzie, senior medical officer of Queen Mary's Hospital, Roehampton; and (3) the interests of the basic scientists—Chairman, Dr. Irving H. Wagman, research physiologist at Biomechanics Laboratory, University of California at San Francisco. These sessions not only produced useful recommendations but also provided an opportunity for interchange of information and views not possible during the more formal sessions.

It was apparent throughout the conference that much progress has been made since the time of the Arrowhead Conference, almost 5 years ago. It was also apparent that more progress is to be made before we develop truly useful externally powered devices and know enough to use them efficiently.

A complete report of the conference will be published by the National Academy of Sciences—National Research Council.