

# THE ROLE OF THE COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT AND THE COMMITTEE ON PROSTHETIC-ORTHOTIC EDUCATION

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Early in 1945, at the request of the Surgeon General of the Army, the National Research Council sponsored a conference of surgeons, engineers, physicists, and prosthetists to consider the feasibility of effecting improvements in artificial limbs. Conclusions that emerged from the conference were that virtually no organized research of significance had been conducted in the field of limb prosthetics, and that application of technology already in existence should produce improved devices.

## ORGANIZATION OF RESEARCH PROGRAM

Subsequently, at the request of the Surgeon General, the NRC established the Committee on Prosthetic Devices (later the Committee on Artificial Limbs) to organize a research program. (The members of the Committee on Prosthetic Devices were: Paul E. Klopsteg, Ph.D., Chairman; Harold R. Conn, M.D.; Roy D. McClure, M.D.; Robert R. McMath, D.Sc.; Mieth Maeser; Paul B. Magnuson, M.D.; Edmond M. Wagner; and Philip D. Wilson, M.D. Consultants: Robert S. Allen and Charles F. Kettering, Sc.D.) Subcontracts were entered into with 16 universities, industrial laboratories, and foundations:

Adel Precision Products Corp., Burbank, California  
Armour Research Foundation, Chicago, Illinois  
C.C. Bradley and Sons, Inc., Syracuse, New York (Catranis, Inc.)  
Goodyear Tire and Rubber Co., Akron, Ohio  
A.J. Hosmer Corp., Los Angeles, California  
International Business Machines Corp., Endicott,\*New York  
Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania  
National Research and Manufacturing Co., San Diego, California

Northrop Aircraft, Inc., Hawthorne, California  
Northwestern University, *Evanston, Illinois*  
Research Institute Foundation, Detroit, Michigan  
Sierra Engineering Co., Sierra Madre, California  
United States Plywood Corp., *New Rochelle, New York*  
University of California, Berkeley and San Francisco  
University of California, Los Angeles  
Vard, Inc., Pasadena, California

Funds were initially supplied by the Office of Scientific Research and Development. With the impending disestablishment of OSRD shortly after World War II, the Office of the Surgeon General of the Army for a short time assumed fiscal responsibility for the program. Then, for fiscal year 1947, the Army and the Veterans Administration shared the support. The Army, the Navy, and the Veterans Administration cooperated by establishing laboratories within their own organizations.

In some laboratories, development of components and application of new materials were begun, but it soon became clear to the committee that more knowledge of the patients' requirements was needed if significant progress was to be made. This in turn required a more detailed knowledge of the biomechanics of human extremities, and thus projects in this area were started. Also, anthropometric data were obtained with the idea of selecting rationally a series of standard sizes of components.

The activities of the various groups were initially coordinated by the Committee on Artificial Limbs, and considerable progress was made during the first two years. By the spring of 1947, the committee felt that it had completed its task of establishing an organized program and suggested that contracts between the government and the research laboratories be made directly, and that the committee be reconstituted as an advisory group to the sponsoring agency. At that time, the majority of service-connected amputees had been discharged from the armed forces, and their medical care had become the responsibility of the Veterans Administration. Therefore, new contracts were effected between the VA and those laboratories in which promising developments were identifiable (1947: Catranis, Inc.; Northrop Aircraft, Inc.; University of California, Berkeley and San Francisco, and Los Angeles; 1948: New York University). At the request of the VA, the NRC established the Advisory Committee on Artificial Limbs to continue the coordination and the correlation of the program. The Army, the Navy, and the VA continued to operate their own laboratories.

The general feeling at the beginning of the program was that the solution to the problem of providing better prostheses lay in developing new devices, and rapid advances were made by applying new materials and fabrication methods. It was apparent, however, that fit, suspension, and control were at least as important as components were in the suc-

cessful use of an artificial limb, and perhaps even more so. Letters of inquiry were sent by the committee early in its history to all known limb manufacturers, and one of the first subcontracts was made with the Research Institute Foundation, a laboratory operated by the Orthopedic Appliance and Limb Manufacturers Association.

In the spring of 1946, arrangements were made with certain prosthetists to fit experimental suction-socket above-knee limbs, with cooperation from local surgeons and assistance from the committee staff. Studies to establish the principles of socket configuration, fitting, and alignment were initiated as supplements to the existing projects. Both fitting and harnessing of artificial arms were studied at other projects.

### **PUBLIC LAW 729**

In 1948, the Eightieth Congress, recognizing the need for continuity in a program of this kind, passed Public Law 729, which authorized the expenditure of \$1,000,000 annually for research in limb prosthetics and sensory aids (amended by P.L. 85-56, Eighty-fifth Congress, to remove the \$1,000,000 limitation). The Veterans Administration was designated as the appropriate agency for the administration of the funds, and the Administrator of Veterans Affairs was authorized and encouraged to make the results of the proposed program widely available, so that all disabled persons might benefit.

### **SUCTION-SOCKET "SCHOOLS"**

By October 1948, experience in a number of experimental settings indicated that the suction socket provided significant advantages over other methods of fitting and suspension for above-knee amputations, and that the technique should be released for general use. Because of the many factors which enter into the successful application of the suction socket, however, the publication of a teaching manual was not considered sufficient to ensure success. Therefore, with the assistance of the Orthopedic Appliance and Limb Manufacturers Association (now *the American Orthotic and Prosthetic Association*) and a distinguished group of surgeons, the NRC organized a series of regional workshops to teach surgeons and prosthetists the proper application of the suction socket. The University of California at Berkeley was assigned the initial responsibility for this program. The regional workshops were continued under VA auspices with cooperation of OALMA through 1952, by which time it was felt that the suction-socket technique had become established. During the entire program, approximately 40 workshops were held.

## PROSTHETICS EDUCATION PROGRAM

Through the findings of the UCLA case study and other endeavors, a considerable body of knowledge in upper-extremity prosthetics had been accumulated by 1952. Hence, the development was undertaken of a medium through which knowledge about the greatly improved devices and techniques that were available could be disseminated throughout the nation. Since the new developments involved the use of plastic laminates for all upper-limb amputation levels, the time required for thorough instruction in fabrication of prostheses ruled out the use of regional teaching sessions. The Veterans Administration therefore financed the organization and operation of the Prosthetics Education Program at the University of California at Los Angeles. Following a pilot school in 1952 for teams from the Chicago area, participation in the UCLA courses was ultimately extended to surgeons, physicians, occupational and physical therapists, and prosthetists from all over the United States. Prosthetists attended for 6 weeks; they were joined by the therapists for the last 3 weeks, and by the physicians and surgeons for the final week, during which these disciplines worked together as a clinic team.

The upper-limb courses proved to be extremely popular and very successful. During the initial, intensive phase of the program (1953-55), 12 courses were conducted. As a result of these efforts, personnel constituting 75 specialized amputee clinics, and representing 30 states and the District of Columbia, were trained. Twenty-eight of these clinics were held at Veterans Administration installations, while 47 were at other public and private institutions. Concomitant with the upper-limb education program, the VA funded a nationwide field study, conducted by New York University, to assess the value not only of specific devices but also of the treatment program taught at the schools. This study gathered much useful information and also served to reinforce the instructional material.

This combined education-research program not only served to introduce new improved concepts in the management of upper-limb amputees, but also was a tremendous stimulus to the formation of amputee clinics and clinic teams throughout the nation. Today, more than 400 amputee clinics staffed with trained personnel are in operation in the United States. This treatment concept has also spread to other countries throughout the world.

The education program at UCLA proved to be so successful that the VA sponsored the establishment of a similar education program at New York University in 1956 to meet the needs of clinic personnel. Subsequently, the Vocational Rehabilitation Administration funded an additional prosthetics school at Northwestern University in 1959. As new

devices and techniques emerged from the research program, additional courses were developed at all three schools, so that today every aspect of amputee management is covered.

### **PRESENT PROGRAM ORGANIZATION**

By 1953, the Advisory Committee on Artificial Limbs recognized that child amputees had special problems and began to work with the Michigan Crippled Children Commission to determine what might be done to solve some of these problems. The Children's Bureau supported the establishment of several research centers, and in 1955 the committee created the Sub-committee on Child Prosthetics Problems.

From the beginning, the committee had felt that much of the experience gained in research in limb prosthetics was applicable to the field of orthopedic bracing, but it recognized that problems in orthotics were even more complex. Therefore, work was initially concentrated on prosthetics. About 1960, the Committee on Prosthetics Research and Development took steps to assist in the development of improved orthotic devices and techniques. At the present time, an active program in orthotics, supplementary and complementary to the prosthetics program, is underway.

In 1966, at the request of the Veterans Administration, CPRD formed the Subcommittee on Sensory Aids to advise the VA concerning its research program in aids to the blind.

The subcommittee also serves the Social and Rehabilitation Service in the same capacity, and recently both agencies have asked CPRD/CPOE to include problems of the hard of hearing.

Prior to 1954, most of the research, development, and education activities in prosthetics and orthotics in the United States were supported by the Veterans Administration. In 1954, Congress enacted the Vocational Rehabilitation Act, which for the first time authorized the Office of Vocational Rehabilitation (later the Vocational Rehabilitation Administration and now the Social and Rehabilitation Service of the Department of Health, Education, and Welfare) to support research and education in rehabilitation. The prosthetics and orthotics research and education programs of the VRA were initiated gradually, beginning in 1955—a significant milestone being the assumption of the fiscal responsibility for the three prosthetics schools.

Today the Veterans Administration, the Social and Rehabilitation Service, the Maternal and Child Health Service, and, to a limited extent, the National Institutes of Health, all support extramural research in these fields. The VA, the Army, and the Navy also operate research and development laboratories as part of their respective organizational endeavors.

The VA and SRS support the Committee on Prosthetics Research and Development and the Committee on Prosthetic-Orthotic Education within the National Academy of Sciences-National Research Council to correlate the various research, development, evaluation, and education *endeavors supported by government and private organizations*, to provide advice to various government agencies responsible for rehabilitation of the physically impaired, and to conduct a clinical evaluation program.

### ORGANIZATION OF CPRD

The Committee on Prosthetics Research and Development operates within the Division of Medical Sciences of the National Research Council. The Committee's membership includes physicians, engineers, and representatives of other disciplines who are actively interested in furthering the development of prosthetic and orthotic devices and sensory aids and in the expeditious utilization of these improvements. Appointments to the Committee, normally for a 3-year period, are made by the Chairman of the Division of Medical Sciences with the approval of the President of the National Academy of Sciences.

In seeking to achieve its objectives, the Committee on Prosthetics Research and Development has, over the years, established five permanent subcommittees: The Subcommittee on Fundamental Studies, the Subcommittee on Design and Development, the Subcommittee on Evaluation, the Subcommittee on Child Prosthetics Problems, and the Subcommittee on Sensory Aids (Fig. 1)

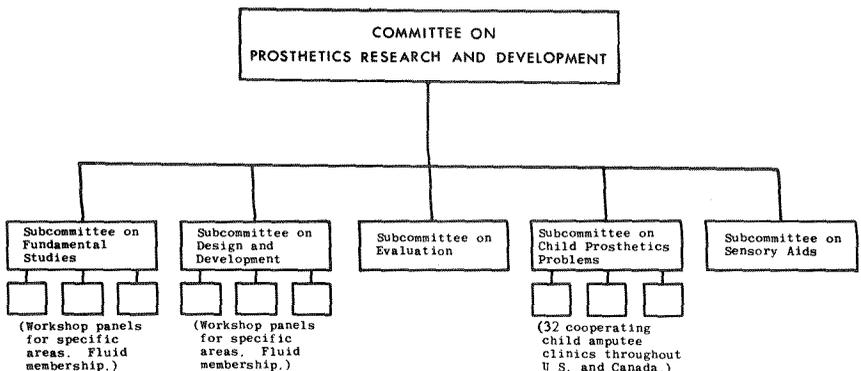


FIGURE 1.—Organization of CPRD

The *Subcommittee on Fundamental Studies* seeks to stimulate research which will provide basic information prerequisite in the design of improved prosthetic and orthotic devices. Basic research is also directed to obtaining data which will afford a better understanding of treatment processes. The subcommittee operates through small working panels which focus on specific subject areas and involve persons directly interested in and/or engaged in research in those areas. Identification and coordination of currently available information are correlative with the stimulation of research in areas where information is needed.

In pursuing its goal of encouraging and coordinating the design and development of improved prosthetic and orthotic devices, the *Subcommittee on Design and Development* arranges periodic meetings of individuals actively working in specific areas. The subcommittee promotes an active interchange of information between developers, provides leadership in attacking critical problems, provides a forum for the evaluation of new ideas and suggestions, and encourages the endeavors of competent designers. Much of the activity of the subcommittee on Design and Development is effected through so-called workshop panels. These panels now cover the entire spectrum of prosthetics and orthotics in discrete segments, *viz.*, lower-limb prosthetics, upper-limb prosthetics, lower-limb orthotics, upper-limb orthotics, and spinal orthotics.

The difficult, but essential, realm of evaluation of new and revised prosthetic and orthotic devices and techniques is a major continuing concern of the Committee on Prosthetics Research and Development. The *Subcommittee on Evaluation* encourages and coordinates an orderly effort to determine the relative merits of individual items stemming from the research and development program. The findings are passed along to the education groups and clinicians.

The *Subcommittee on Child Prosthetics Problems* provides a strong stimulus for research in prosthetics related to the juvenile amputee population and disseminates the results of this research to clinicians and others engaged in the treatment of the child amputee. Under the auspices of this subcommittee, the Cooperative Child Amputee Research Program is carried on through 32 participating treatment centers which have met standards of practice established by the subcommittee. An important medium for the exchange of information within the clinic family is the *Inter-Clinic Information Bulletin* which is published monthly through New York University on behalf of the subcommittee. Material for the Bulletin is assembled and edited by the Assistant Executive Director of the Committee on Prosthetics Research and Development. In response to a charge from the parent committee, the Subcommittee on Child Prosthetics Problems is now in the process of enlarging its responsibilities to include orthotic needs of the juvenile patient. In this expansion of its activities, the subcommittee is focusing its attention

initially on the orthotic requirements of children with cerebral palsy, spina bifida, and Legg-Perthes disease.

In fulfilling its role of providing advisory services to interested agencies, both governmental and private, the *Subcommittee on Sensory Aids* endeavors to keep fully informed of current activities in the development of sensory aids for the blind and partially sighted, and the deaf and hard of hearing, and to encourage and coordinate meritorious research in these areas.

The Committee on Prosthetics Research and Development/Committee on Prosthetic-Orthotic Education is served by a staff of full-time personnel employed by the Academy-Research Council. It consists of:

A. Bennett Wilson, Jr., Executive Director  
Hector W. Kay, Assistant Executive Director  
Gustav F. Haas, Staff Engineer  
E.E. Harris, Staff Surgeon  
G.E. Sharples, Staff Officer  
Michael J. Quigley, Staff Prosthetist  
Margaret L. Young, Staff Therapist

#### OPERATIONAL CONCEPT

The Committee on Prosthetics Research and Development/Committee on Prosthetic-Orthotic Education endeavors to achieve its objectives in a variety of ways, depending upon the requirements and circumstances of a given project. The Committee meets twice a year or as necessary to review the recommendations of its subcommittees and ad hoc committees. The subcommittees, whose members, like those of the parent committee, typically are appointed for a period of 3 years, also usually meet two or more times per year. Since the work of certain of the subcommittees is closely related, for example, Design and Development and Evaluation, and Design and Development and Child Prosthetics Problems, members of one subcommittee frequently attend meetings of other subcommittees.

A rewarding *modus operandi* in dealing with special topics or areas of interest, particularly under the Fundamental Studies and Design and Development subcommittees, has been the use of so-called workshop panels. However, the participants in the workshops are selected for their special or technical knowledge in the area under review and hence may vary from meeting to meeting. Ad hoc committees for study of special problems are also freely used. Appointments to such ad hoc committees, as is true also of the workshop panels, are not restricted to the membership of the Committee on Prosthetics Research and Development/Committee on Prosthetic-Orthotic Education. Persons with the

specialized knowledge to serve on the workshop panels and ad hoc committees are selected from a large number of qualified individuals affiliated with the Prosthetics and Orthotics Program. Personnel from the Educational Programs are included in order that the Educational Programs can be kept up to date on developments and thus effect a compression of the time required between research and education.

### **GOVERNMENTAL RELATIONSHIPS**

Through the Academy-Research Council, CPRD/CPOE provides advisory services to the Veterans Administration and to the Social and Rehabilitation Service of the Department of Health, Education, and Welfare. Liaison representatives designated by these governmental agencies participate without vote in the deliberations of the Committee. Government laboratories cooperating with CPRD/CPOE include the Army Medical Biomechanical Research Laboratory, the Navy Prosthetics Research Laboratory, and the Veterans Administration Prosthetics Center. From time to time, individuals from these laboratories participate in the Committee's activities.