

ANNUAL SUMMARY REPORT ^a ACTIVITIES FOR YEAR ENDED JUNE 30, 1967

COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT
DIVISION OF ENGINEERING—NATIONAL RESEARCH COUNCIL
NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING

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CHAIRMAN'S NEWSLETTER

Following is the *Annual Summary Report* of the Committee on Prosthetics Research and Development covering the 1966-67 year. As you will see, the past year has been a busy one indeed.

In keeping with the plan of rotation of membership of CPRD and its subcommittees, Drs. Robert L. Bennett and James B. Reswick, and Mr. Charles W. Rosenquist retire from CPRD. Dr. Allen S. Russek, Mr. Alvin L. Mulenburg, and Prof. Charles W. Radcliffe have been appointed to fill the vacancies.

Drs. Yoshio Setoguchi and Fred Leonard have been appointed to the Subcommittee on Child Prosthetics Problems to fill the vacancies created by the retirement of Dr. Richard E. King and Mr. Carl Sumida.

Mr. William M. Bernstock has been appointed a member of the Subcommittee on Evaluation.

In December 1966 a Conference on Prosthetics and Orthotics was held at the request of the Vocational Rehabilitation Administration to develop information for use in planning research for the next five to ten years. A comprehensive report has been prepared and will be available in the near future.

With special fiscal support from the Veterans Administration, the Subcommittee on Sensory Aids organized a Conference on Sensory Aids which was held in March. The purpose for the conference was to make a comprehensive inspection and inventory as to the types of research that should be carried out in the field of sensory aids for the blind.

The highlight in prosthetics has been the introduction of immediate postsurgical fitting techniques into the prosthetics curricula at the University of California in Los Angeles and at Northwestern University. The three courses held to date have been well received. New York University will begin offering similar courses during the next academic year. We feel that the immediate postsurgical fitting program is an excellent example of the benefits to be gained by cooperation of various research groups and Government agencies both here and abroad.

Less than four years after this revolutionary concept was introduced to this country, formal training in its basic features has been made available to clinical teams. Not only does immediate postsurgical fitting offer the patient improved treatment, but it provides significant economic savings to both the patient and the country. With acceptance of the basic technique has come the necessity for careful evaluation of the results achieved and continued study of the numerous basic principles involved.

For several years *Human Limbs and Their Substitutes* has been out of print. Since its publication in 1954 progress has been rapid and should eventually result in a revised edition. In the meantime the large number of requests which have been received must be satisfied and arrangements have been made for reprinting by the Hafner Press at no charge to the Government. The reprint issue will contain a new foreword and bibliographic additions summarizing recent advances.

Under the guidance of the Subcommittee on Evaluation a pilot program in clinical evaluation was initiated in September. The Engen Plastic Hand Orthoses and the Veterans Administration Prosthetics Center Patellar-Tendon-Bearing Brace were selected for study. Clinic teams have been trained in the techniques of using these devices, and fittings have been undertaken in the field.

The Subcommittee on Fundamental Studies has recommended that the Committee sponsor a Seminar on the Human Foot and Ankle and arrangements will be made for such a conference to be held in Washington sometime this fall. The objectives will be to set forth what is known and what needs to be investigated about the biomechanics of the foot and its influence on the integrated locomotor mechanism,

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with emphasis on the application of this knowledge to the management of patients with orthopedic impairments. Dr. Verne T. Inman will be chairman of the Seminar. It is expected that a useful document will be published as a result of the Seminar.

The publication of both issues of *Artificial Limbs* scheduled for the past fiscal year was delayed because of a lack of funds. However, both issues are currently in press and it now appears quite possible that future issues can be published on schedule.

The next meeting of the Committee is scheduled to be held in Washington on October 21, 1967.

HERBERT ELFTMAN,
Chairman, CPRD.

PURPOSE

The Committee on Prosthetics Research and Development undertakes activities serving research in the fields of prosthetics, orthotics, and sensory aids when such activities are accepted by the National Academy of Sciences as a part of its functions.

The Veterans Administration, the Department of Defense, and several agencies within the Department of Health, Education, and Welfare have responsibilities to amputees and others with physical and sensory impairments. In addition, a number of private foundations are similarly concerned.

Because the volume of business in the fields of artificial limbs, orthopaedic appliances, and sensory aids for the blind and the hard of hearing is not sufficiently great to support the types of research necessary to maintain progress commensurate with other technical fields, it has become necessary for these Government agencies and private foundations to support research and development either within their own organizations or by contracting with universities and industrial laboratories, or by both means.

The objectives of the Committee on Prosthetics Research and Development are: to correlate and coordinate prosthetic and sensory aids research sponsored by the Veterans Administration, the Vocational Rehabilitation Administration, the Children's Bureau, the Army, the Navy, and others; to develop information by means of special reports, periodic reports, and personal liaison, which will enable the National Academy of Sciences—National Research Council to advise the sponsors concerning the scope of the program and the progress made; to ensure that successful new devices and techniques are made available promptly to the organizations concerned with the education of medical and paramedical personnel in the fields of prosthetics and orthotics; and to provide wide dissemination of the results of research by the publication of the program journal ARTIFICIAL LIMBS and other technical reports.

ORGANIZATION

The Committee on Prosthetics Research and Development is a part of the Division of Engineering. The Committee membership is drawn from the engineering and medical professions and from other disciplines interested in furthering the development and utilization of prosthetic and orthotic devices and sensory aids. The appointments to the Committee, which are normally for a three-year period, are made by the Chairman of the Division of Engineering, subject to the approval of the President of the National Academy of Sciences.

The Committee on Prosthetics Research and Development utilizes 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).

The Subcommittee on Fundamental Studies is responsible for organizing small working panels of persons directly interested in basic studies for the exchange of ideas and the stimulation of research.

By arranging frequent meetings of groups of persons directly concerned with the design and development of prosthetic and orthotic devices at the working level, the Subcommittee on Design and Development stimulates an active interchange of information and ideas between the various design and development groups, provides leadership in attacking critical problems, evaluates new ideas and suggestions from the standpoint of engineering feasibility, and encourages competent designers.

Evaluation, always a difficult task, is a major continuing responsibility of the Committee on Prosthetics Research and Development. To enable the Committee to fulfill this responsibility more efficiently, the Subcommittee on Evaluation was created to study evaluation problems in detail in order to advise the Committee on Prosthetics Research and Development concerning the status of specific devices and techniques and to coordinate the activities of laboratories engaged in evaluation.

The Subcommittee on Child Prosthetics Problems stimulates studies and disseminates the results of research in prosthetics for child-amputee patients. Under the auspices of this subcommittee, the Child Amputee Research Program is carried on through some 26 participating child-amputee clinics. The subcommittee publishes, through New York University, a monthly *Inter-Clinic Information Bulletin*, the material for which is assembled and edited by the Assistant Executive Director of the Committee on Prosthetics Research and Development.

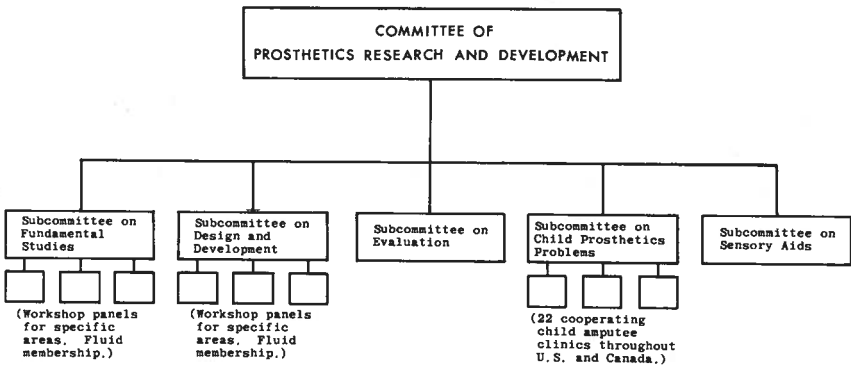


FIGURE 1

The Subcommittee on Sensory Aids exists to provide advisory service to interested agencies—governmental and private—concerning the development of sensory aids for the blind and the hard of hearing.

The Committee on Prosthetics Research and Development is served by a staff of full-time personnel employed by the Academy—Research Council, consisting of an executive director, an assistant executive director, a staff editor, an administrative assistant, and a secretary.

OPERATIONAL CONCEPT

General

The responsibilities of the Committee on Prosthetics Research and Development are carried out in a variety of ways, depending upon requirements and circumstances. Generally, Committee business is conducted by the Committee as a whole and its subcommittees which report fully to the Committee. The work of certain of the subcommittees is closely interrelated; for example, Design and Development, and Evaluation; Design and Development, and Child Prosthetics Problems. Liaison is maintained by a degree of inter-digitating membership.

Problems requiring special or technical knowledge are referred to selected *ad hoc* committees for study and report. Appointments to such *ad hoc* committees are not restricted to the membership of the Committee on Prosthetics Research and Development, but are chosen for their special knowledge of the problem at hand. For such *ad hoc* committee assignments, the Committee on Prosthetics Research and Development has available a large number of persons affiliated with the prosthetics research program who are qualified for appointment and willing to serve.

The recommendations of the subcommittees and the *ad hoc* committees are reviewed by the Committee on Prosthetics Research and Development, which meets twice a year, or as necessary, to conduct its business.

Governmental Relationships

The Committee on Prosthetics Research and Development is responsible for advisory services through the Academy—Research Council to the Veterans Administration, the Children's Bureau, and the Vocational Rehabilitation Administration, the last two being agencies of the Department of Health, Education, and Welfare. Liaison representatives have been designated by these Government agencies and take part in Committee deliberations. The Army Medical Biomechanical Research Laboratory, the Navy Prosthetics Research Laboratory, and the Veterans Administration Prosthetics Center are among the participating laboratories cooperating with the Committee on Prosthetics Research and Development. From time to time these laboratories are represented on the Committee.

Interdivisional Relationships

Liaison with the Committee on Prosthetic-Orthotic Education, Division of Medical Sciences, National Academy of Sciences—National Research Council, is achieved by naming the chairman of that Committee as a liaison member of the Committee on Prosthetics Research and Development, and through persons who are members of both committees. Copies of all Committee on Prosthetics Research and Development publications are transmitted to the Committee on Prosthetic-Orthotic Education. The journal *Artificial Limbs* is a joint undertaking of the two committees.

ACTIVITY REPORTS

General

During the period July 1, 1966, through June 30, 1967, the Committee on Prosthetics Research and Development continued to advise and assist in the coordination of Government-sponsored and privately sponsored research in the fields of prosthetics, orthotics, and sensory aids.

At the request of the sponsoring agencies concerned, the Committee during the past year made specific recommendations through Academy—Research Council channels on some 16 proposals for research and development.

One meeting of the Committee on Prosthetics Research and Development was held during the past fiscal year, and a comprehensive report has been prepared and distributed to those concerned. In addition, there have been numerous meetings of subcommittees, working panels, and various other groups sponsored by the Committee. Reports of these meetings have been distributed to those concerned and have been appended, or will be appended, to the minutes of the appropriate meetings of the parent Committee.

A limitation of funds curtailed the activities of the Committee during part of the year.

Subcommittee on Fundamental Studies

The newly formed Subcommittee on Fundamental Studies met twice during the past fiscal year. At its initial meeting, the subcommittee established its objectives as coordinating, encouraging, and proposing investigations which clearly contribute to the development of human abilities and disabilities. The subcommittee envisioned its activities as being complementary in nature to those of the Subcommittee on Design and Development and the Subcommittee on Evaluation. At its second meeting, the subcommittee planned in some detail a seminar on the biomechanics of the human foot to be held at the National Academy of Sciences during October 1967.

Subcommittee on Design and Development

The Subcommittee on Design and Development met once during the past fiscal year for the purpose of reviewing the work of its various workshop panels and outlining work for the next ten months or more. Virtually all the work of the subcommittee goes on in the panels, and the impact of their activities has become increasingly apparent.

The subcommittee's Workshop Panel on Lower-Extremity Prosthetics Components met once and considered in detail all lower-extremity components under development. Among the items reviewed were a hydraulic ankle with automatic lock and a number of hydraulic, pneumatic, and mechanical knee units.

The Workshop Panel on Lower-Extremity Prosthetics Fitting met once for the presentation and review by developers of new materials and experimental fitting techniques for lower-extremity amputees. Considerable attention was given to the possibility of eliminating the use of plaster casting through the technique of suspension casting with malleable plastic and the utilization of standard preforms. Also under development are various types of adjustable sockets which are capable of being adapted to changes in the amputee's stump.

The Workshop Panel on Upper-Extremity Prosthetics Components and the Workshop Panel on Upper-Extremity Fitting, Harnessing, and Power Transmission met concurrently to review the current status of devices and techniques under development. Particular attention was given to a revision of the *Manual on Upper-Extremity Prosthetics for Prosthetists* now being prepared at the University of California, Los Angeles.

The Workshop Panel on the Control of External Power and the newly formed Workshop Panel on Upper-Extremity Orthotics also met concurrently and reviewed development in progress in these areas.

The Workshop Panel on Lower-Extremity Orthotics met once during the past fiscal year. Major topics considered by the panel included the effectiveness of unweighting systems, foot-pressure distribution, mechanical linkages of the foot, brace structures, functional leg braces, and crutches and canes.

Subcommittee on Evaluation

The Subcommittee on Evaluation met twice during the past fiscal year. The attention of the subcommittee was focused on a pilot clinical evaluation program undertaken for the study of a number of selected prosthetic and orthotic devices. As a preliminary step in the clinical evaluation program, an instructional course in the Engen plastic hand orthosis was conducted at Baylor University for orthotists and physicians participating in the evaluation project. Later in the fiscal year a similar instructional course was conducted in New York on a patellar-tendon-bearing brace developed by

the Veterans Administration Prosthetics Center. Following the instructional courses, the participating clinics proceeded to use the items under evaluation, with the staff of the Committee on Prosthetics Research and Development maintaining close liaison.

Subcommittee on Child Prosthetics Problems

The Subcommittee on Child Prosthetics Problems held one meeting during the past fiscal year. Four more child-amputee clinics were approved as participating members in the subcommittee's cooperative clinic program, making a total of 26 clinics now participating in the program. The clinics joining the program are Children's Hospital, Denver, Colo.; Children's Hospital, Akron, Ohio; Shriners Hospitals for Crippled Children, Springfield, Mass.; and Shriners Hospitals for Crippled Children, St. Louis, Mo. Fifteen additional clinics were noted as being in various stages of development, indicating the potential future growth of the program. The goal of the Subcommittee on Child Prosthetics Problems—to have an approved child-amputee clinic conveniently available to every major population center throughout North America—appears to be approaching realization. While most of the clinics are solely concerned with patient service, several clinics combine research and service. An annual meeting of the participating clinic chiefs and the subcommittee's monthly publication—the *Inter-Clinic Information Bulletin*—aid in the coordination of the program. In addition, site visits are made to the clinics.

Evaluation projects considered by the subcommittee at its meeting included an electric feeder arm, a pneumatically powered upper-extremity prosthesis, an adjustable pylon, porous sockets, an electric elbow, a friction shoulder joint, an electric hook, myoelectric control units, a disk-friction knee, an electric linear actuator, and Münster-type below-elbow prostheses. Developmental projects considered included an electric wrist unit, an electric elbow, a swivel walker, a piezoelectric hand, an electric hand—Size No. 3, an electric elbow unlock, and a resilient hand. Possible new field studies considered by the subcommittee were the immediate postsurgical fitting of prostheses to children and a survey of sports participation by amputee children.

Subcommittee on Sensory Aids

A Conference on Sensory Aids, organized by the Subcommittee on Sensory Aids, met at the National Academy of Sciences during March 1967. There were some 35 participants, including representatives from the Vocational Rehabilitation Administration, the National Institutes of Health, the Veterans Administration, the Children's Bureau, the Office of Education, and the Library of Congress. The purpose of the conference was to make a comprehensive inspection and inventory of what research should be done to ameliorate the problems of the blind. In its development of a start toward long-range plans, the conference concerned itself with devices and tech-

niques to help persons who are already blind rather than the prevention of blindness. Position papers were presented on research and development, evaluation, and deployment. Following general discussion, the participants met separately as panels to consider each of these topics.

Important among the general recommendations of the conference were:

1. Organization of the scientific, technological, and financial resources of the nation into an effective and sustained program for the blind.
2. Emphasis on the reading problem because of the present promise that devices and techniques now under development will be beneficial.
3. Continued attention to the mobility problem.
4. Development of technical aids to widen the vocational horizons of the blind.

Conference on Prosthetics and Orthotics

At the request of the Vocational Rehabilitation Administration, the Committee on Prosthetics Research and Development organized and held a Conference on Prosthetics and Orthotics at the National Academy of Sciences during December 1966. The purpose of the conference was to develop information for use in planning research and development activities in prosthetics and orthotics for the next five years and longer. Some 35 participants, chosen for their experience in these fields, were supplied with reference material well in advance of the conference.

The work of the conference was undertaken by seven panels, as follows: lower-extremity prosthetics and orthotics, upper-extremity prosthetics and orthotics, surgical and medical considerations, engineering problems, fundamental studies, design and development, and evaluation.

In its conclusions, the conference found that great progress has been made in prosthetics during the past two decades and continues today. This has been the result of the utilization of fundamental studies of function to provide criteria for design and fitting and the continual adaptation to prosthetics of technological advances, including the availability of new materials.

With respect to orthotics, the conference concluded that although persons in need of braces are much more numerous than those requiring prosthetic replacement, only minimal progress has been made in providing orthotic devices capable of giving functional rehabilitation. Also, the entire field of orthotics is cluttered with a multitude of devices, varying in use from region to region, and from practitioner to practitioner. It was considered that there is an imperative need for a survey of the braces now in use to select those which have some merit and to allow their redesign in accordance with modern engineering practice. Such a survey would also disclose the need for new devices and lead to their design and development.

The report of the conference is being published for distribution by the Committee on Prosthetics Research and Development.

Immediate Postsurgical Prosthetics Fitting

The Committee on Prosthetics Research and Development has continued to coordinate the projects involved in fitting lower-extremity amputees with prostheses immediately after surgery. The Executive Director of the Committee assisted Dr. Ernest M. Burgess, Principal Investigator at the Prosthetics Research Study, Seattle, Wash., in writing and publishing a preliminary report entitled *Management of Lower-Extremity Amputees Using Immediate Postsurgical Fitting Techniques*. This publication was used as the basis for a conference sponsored by the University Council on Orthotic-Prosthetic Education and the Committee on Prosthetics Research and Development during July 1966. During December 1966 a supplement describing the latest techniques for handling above-knee amputations was prepared. The two documents were made available for a meeting of the University Council on Orthotic-Prosthetic Education during January 1967, where it was decided that immediate postsurgical fitting will be included in the curricula of the University of California at Los Angeles, New York University, and Northwestern University. The Executive Director of the Committee on Prosthetics Research and Development also assisted in the preparation of *Immediate Postsurgical Prosthetics in the Management of Lower-Extremity Amputees* for the Prosthetic and Sensory Aids Service of the Veterans Administration, and this manual is now available from the Government Printing Office.

Dissemination of Information

In foregoing portions of this report, reference has been made, in connection with other items, to a number of positive actions taken in the dissemination of information. Throughout the year there continued to be a steady demand for reports of major conferences sponsored by the Committee on Prosthetics Research and Development in previous years, for example, *The Geriatric Amputee* (1961), *The Application of External Power in Prosthetics and Orthotics* (1961), *Orthotics Research and Development* (1962), and *The Control of External Power in Upper-Extremity Rehabilitation* (1965). In fact, the demand has been so great that it has been necessary to order reprints of a number of these publications.

In addition to the demand for the reports of the various workshop panels, there were numerous requests for the reports of earlier workshop panels.

Because of a large number of inquiries concerning the book *Human Limbs and Their Substitutes*, published in 1954 by the McGraw-Hill Book Company under the sponsorship of the National Academy of Sciences and out of print for several years, the Committee on Prosthetics Research and Development arranged for reprints to be made by a commercial concern, and this classic reference will soon become available again at a moderate price.

The Spring 1966 issue of *Artificial Limbs* was distributed during August.

Because of a shortage of funds during the latter part of 1966 and the beginning of 1967, publication of the Autumn 1966 issue and the Spring 1967 has been delayed. The Autumn 1966 issue was in press at the end of the fiscal year, and the Spring 1967 issue was ready to go to press. Expressions of interest in this journal come from its readers all over the world, and there is a continuing abundance of material that merits publication.

The *Inter-Clinic Information Bulletin* now has a circulation of more than 1600. Twelve issues were distributed during the past fiscal year. The Bulletin contains material of special interest to physicians, surgeons, prosthetists, therapists, nurses, and others directly engaged in the care and management of child amputees.

During the year, the office of the Committee on Prosthetics Research and Development responded to more than 750 requests for technical information.

International Activities

The Committee on Prosthetics Research and Development has consistently made every effort to cooperate with international groups concerned with prosthetics and orthotics research and development.

During the past fiscal year, the Executive Director of the Committee participated in the Tenth World Congress of the International Society for Rehabilitation of the Disabled in Wiesbaden, Germany, particularly with the International Committee on Prosthetics and Orthotics. He also served as a faculty member of the First Polish Seminar on Prosthetics and Orthotics in Konstancin, Poland. En route to these meetings, he visited the newly established Prosthetics Research Center at Dundee, Scotland, and met with the Director of Prosthetics Research at Queen Mary's Hospital, London.

Also during the past fiscal year, an engineer member of the Committee spent two weeks in Russia as a guest of the Russian Academy of Science and four days in Poland as a guest of the Polish Institute for Control Application. In addition, he participated in an International Symposium on the External Control of Human Extremities in Dubrovnik, Yugoslavia.

Another engineer member of the Committee visited prosthetics research activities in Sweden, and a prosthetist member visited a number of hospitals and limbshops in Poland.

In general, it was gratifying to the Committee on Prosthetics Research and Development to note that the United States artificial-limb program was exerting an influence on the care of amputee patients throughout the world.

FUTURE PLANNING

General

The Committee on Prosthetics Research and Development proposes to continue to coordinate and correlate governmentally and privately sponsored research projects in the fields of prosthetics, orthotics, and sensory aids, particularly attempting to bring about a more organized program in ortho-

tics and sensory aids; to continue its efforts to stimulate and maintain a balanced program in those areas; to ensure that the prosthetics and orthotics education schools, the University Council on Orthotic-Prosthetic Education, and the American Orthotics and Prosthetics Association are promptly informed of developments within the program; and to ensure widespread dissemination of information by publication of *Artificial Limbs*, the *Inter-Clinic Information Bulletin*, and appropriate reports.

The Committee on Prosthetics Research and Development plans to meet a minimum of twice yearly for the conduct of its business and to receive the reports of its standing subcommittees (Fundamental Studies, Design and Development, Evaluation, Child Prosthetics Problems, and Sensory Aids).

Subcommittee on Fundamental Studies

The Subcommittee on Fundamental Studies will conduct a Seminar on the Human Foot at the National Academy of Sciences during the fall of 1967. Its objectives will be to present what is known and not known about the foot, its effect on the proximal musculoskeletal structure, and demonstrate how this knowledge can be applied. It is planned that a useful document will result from the Seminar.

Subcommittee on Design and Development

To guide and stimulate the design and development of prosthetic and orthotic devices, the Subcommittee on Design and Development will sponsor frequent meetings of small groups of persons actively engaged in prosthetics design at the working level. Membership in these groups will be kept small and appropriate to the particular tasks to be considered.

Subcommittee on Evaluation

The Subcommittee on Evaluation will continue to focus its attention on the pilot clinical evaluation program now under way, with a view toward development of an evaluation program that will be truly useful to designers in improving their devices and techniques, and to clinicians in becoming acquainted with new developments.

Subcommittee on Child Prosthetics Problems

The Subcommittee on Child Prosthetics Problems has established a well-defined pattern of work which will continue in the year ahead. As in the past, it will coordinate the activities of the cooperating child amputee clinics, employing them as a means for obtaining information concerning the amputee population and as a medium for evaluating new methods of treatment and bringing new devices and techniques into use. The monthly *Inter-Clinic Information Bulletin* will continue to serve as an important means of communication to practitioners.

Subcommittee on Sensory Aids

The Subcommittee on Sensory Aids will continue its efforts to bring about the establishment of a national program for blindness, analogous to the National Heart Program and the National Cancer Program. In the immediate future, it will continue its review of research in sensory aids sponsored by the Veterans Administration.

International Activities

In general, the Committee on Prosthetics Research and Development will continue its efforts to keep abreast of developments in prosthetics and orthotics research abroad and cooperate with research groups in other countries.

PUBLICATIONS

- Annual Summary Report of Activities for Year Ending June 30, 1966.* (Report to the Veterans Administration, the Vocational Rehabilitation Administration, and the Children's Bureau from the Committee on Prosthetics Research and Development.)
- Report of Meeting of Subcommittee on Evaluation, July 12, 1966*
- Report of Second Workshop Panel on Lower-Extremity Prosthetics Components, July 14, 1966.*
- Report of Sixth Meeting of Subcommittee on Design and Development, August 10, 1966.*
- Report of First meeting of Subcommittee on Fundamental Studies, October 12, 1966.*
- Minutes of the Sixteenth Meeting of the Committee on Prosthetics Research and Development, October 13-14, 1966.*
- Report of Conference on Prosthetics and Orthotics, December 12-13, 1966.* (In press at end of fiscal year.)
- Report of Workshop Panel on Lower-Extremity Orthotics, March 6-8, 1967.* (In preparation.)
- Report of Workshop Panel on Upper-Extremity Prosthetics Components, March 9-10, 1967.* (In preparation.)
- Report of Workshop Panel on Upper-Extremity Fitting, Harnessing, and Power Transmission, March 9-10, 1967.*
- Report of Meeting of Subcommittee on Child Prosthetics Problems, March 20-21, 1967.*
- Report of Conference on Sensory Aids, March 30-31, 1967.* (In preparation.)
- Report of Second Meeting of Subcommittee on Fundamental Studies, April 25-26, 1967.*
- Report of Workshop Panel on Lower-Extremity Prosthetics Fitting, May 1-2, 1967.*
- Report of Workshop Panel on Control of External Power, May 15-17, 1967.* (In preparation.)
- Report of Workshop Panel on Upper-Extremity Orthotics, May 15-17, 1967.* (In preparation.)
- Progress Report on Pilot Study in Clinical Evaluation.*
- Inter-Clinic Information Bulletin.* (Monthly publication of the Subcommittee on Child Prosthetics Problems. 12 issues.)
- Artificial Limbs, Vol. 10, No. 1, Spring 1966.*
- Artificial Limbs, Vol. 10, No. 2, Autumn 1966, in press at end of Fiscal Year 1966-1967.*
- Artificial Limbs, Vol. 11, No. 1, Spring 1967, in preparation at end of Fiscal Year 1966-1967.*

Appendix A

PARTICIPATING AND COOPERATING PROJECTS

PROSTHETICS AND ORTHOTICS

(Listed below are major projects in the United States coordinated by the Committee on Prosthetics Research and Development.)

<i>Organization and principal investigator</i>	<i>Major area (or Areas) of investigation</i>	<i>Sponsoring agency</i>
American Institute for Prosthetic Research (AIPR)— Henry H. Kessler Edward A. Kiessling	Development of Pneumatic Prostheses	CB, VRA
Army Medical Biomechanical Research Laboratory (AMBRL)— Peter M. Margetis Fred Leonard	Development of Prosthetic and Orthotic Materials and Devices	U.S. Army
American Orthotics and Prosthetics Association (AOPA)— Herbert B. Warburton	Preparation of a Recruiting Film for Trainees for Careers as Orthotists and Prosthetists and Follow-up Studies of the Film's Effectiveness	VRA
	Preparation of Shop Manuals in Prosthetics and Orthotics	AOPA
Attending Staff Association of the Rancho Los Amigos Hospital, Inc. (RANCHO)— Vernon L. Nickel	Investigation of Externally Powered Orthotic Devices	VRA
	Application of Orthotic Devices in the treatment of Lower-Extremity Fractures and Degenerative Arthritis	VRA
Robert B. Pearson	Interval Measurements Applied to Skeletal Motor Units	VRA
Worden Waring	Investigation of Myoelectric Control of Functional Braces	VRA
Russell Forney	Development and Evaluation of Procedures for Selection of Students for an Orthotic-Prosthetic Training Program	VRA

<i>Organization and principal investigator</i>	<i>Major area (or Areas) of investigation</i>	<i>Sponsoring agency</i>
California, University of, San Francisco and Berkeley, Biomechanics Laboratory (UC-BL)— Verne T. Inman	Prosthetic and Orthotic Design and Studies of Human Locomotion	VA
Charles W. Radcliffe	Physiological Factors in the Occurrence and Modification of Human Spastic States	VRA
	Improved Prostheses and Improved Fitting Techniques for Lower-Extremity Amputees	VA
California, University of, Los Angeles, Biotechnology Laboratory (UCLA-BL)— John Lyman	Fundamental and Applied Research Related to the Design and Development of Upper-Extremity Externally Powered Prostheses	VA
California, University of, Los Angeles, School of Medicine (UCLA-P-OE)— Charles O. Bechtol Miles H. Anderson	Study of New Materials, Techniques, and Devices, and Preparation of Up-to-Date Manual on Upper-Extremity Prosthetics	VRA
	Application of Pneumatic Structures to Design and Development of Braces	VRA
California, University of, Los Angeles, Child Amputee Prosthetics Project (UCLA-CAPP)— Charles O. Bechtol Milo B. Brooks	An Interdisciplinary Research, Teaching, and Service Program in the Management of the Child Amputee	CB
Case Institute of Technology, Engineering Design Center (CIT)— James B. Reswick	Biomedical Research on Cybernetic Systems for the Disabled	VRA
Duke University Medical Center (DU)— J. Leonard Goldner	Use of Temporary Plaster or Plastic Pylons Preparatory to Fitting of a Permanent Above-Knee or Below-Knee Prosthesis.	VRA
Gasow Veterinary Hospital (ESSL)— John O. Esslinger	Semiburied Implants for the Attachment of External Prostheses	VA
Gilmatic (GIL)— Gilbert M. Motis	Development of Upper-Extremity Prosthetic Components	VA

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<i>Organization and principal investigator</i>	<i>Major area (or Areas) of investigation</i>	<i>Sponsoring agency</i>
International Society for Rehabilitation of the Disabled (ISRDI)— Donald V. Wilson	International Prosthetics Information Service	VRA
Iowa College of Medicine, University of, Iowa City, Iowa (UI)— Carroll B. Larson	Study of Individuals Who Had Painful or Deformed Hips and Have Been Treated with Cup Arthroplasties	VRA
Mauch Laboratories, Inc. (MAUCH)— Hans A. Mauch	Research and Development in Lower-Extremity Prosthetic Devices	VA
Michigan, University of (UM)— James W. Rae, Jr.	Advanced Development of Upper-Extremity Orthoses	VRA
Michigan Crippled Children Commission (MCCC)— George T. Aitken	Clinical Testing of Prosthetic Devices and Techniques for Child Amputees; and the Development of Improved Clinical Management Procedures	CB
Navy Prosthetics Research Laboratory (U.S. Naval Hospital, Oakland, California) (NPRL)— Frank L. Golbranson	Immediate Postsurgical Fitting of Prostheses; and Lower-Extremity Prosthetic and Orthotic Development	U.S.
New York University, School of Engineering and Science, Research Division, Prosthetic Devices Study (NYU-PDS)— Renato Contini	Determination of the Pressure Distribution between Lower-Extremity Sockets and Stumps	VA
New York University, Post-Graduate Medical School, Prosthetic and Orthotic Studies (NYU-POS)— Sidney Fishman	Development of Devices and Techniques to Facilitate Diagnosis of Problems and Improve Fitting of Lower-Extremity Prostheses and Orthoses	VRA
	Exploration of Feasibility of Organization of Laboratory and Field Evaluation Program for Orthotic Devices and Techniques	VRA
	Evaluation of Prosthetic Devices and Techniques for Child Amputees	CB

<i>Organization and principal investigator</i>	<i>Major area (or Areas) of investigation</i>	<i>Sponsoring agency</i>
New York University Medical School and Post-Graduate Medical School (NYU-MS)— Allen S. Russek	Investigation of Immediate Prosthetic Fitting and Early Ambulation Following Amputation in the Lower Extremity	VRA
Northwestern University Prosthetic Research Center (NUPRC)— Clinton L. Compere Edward C. Grahn	Design and Development of Devices and Techniques for the Improvement of Prosthetic Practices, Especially for Geriatric and Problem Cases	VA
Prosthetics Research Study (PRS)— Ernest M. Burgess	Immediate Postsurgical Prosthesis Fitting and Ambulation	VA
Temple University (TU)— Bernard Sandler	Electromyographic Control of Protheses	VRA
Texas Institute for Rehabilitation and Research (Baylor University College of Medicine) (TIRR)— Thorkild J. Engen	The Development of Powered Upper-Extremity Orthotic Systems	VRA
Veterans Administration Prosthetics Center (VAPC)— Anthony Staros	Development and Testing of Prosthetic and Orthotic Devices and Techniques	VA
Virginia, University of (UV)— J. Hamilton Allan	A Medical-Industry Team Approach to Accelerate the Application and Production of Prosthetic and Orthotic Developments	VRA

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(Listed below are projects in the Dominion of Canada which cooperate closely with the overall program.)

Prosthetic Research and Training Program, Ontario Crippled Children's Centre— Colin A. McLaurin	Development of a Wide Variety of Upper-Extremity and Lower-Extremity Body-Powered and Externally Powered, Prosthetic Devices and Components for Children
Rehabilitation Institute of Montreal— Maurice Mongeau	Development of Externally Powered Upper-Extremity Prosthetic Devices, with Special Reference to Children
Prosthetics and Orthotics Research and Development Unit, Manitoba Rehabilitation Hospital— James Foort	Development of a Variety of Prosthetic Devices for Children, with Special Reference to Lower-Extremity Requirements
The University of New Brunswick Bio-Engineering Institute— R. N. Scott	Orthotics Systems Research with Special Emphasis on the Employment of Electromyographic Signals as Controls

SENSORY AIDS

<i>Organization</i>	<i>Major area (or Areas) of investigation</i>	<i>Sponsoring agency</i>
American Center for Research in Blindness and Rehabilitation	Clinical Determination of Performance Attainable by Blind Individuals with the Battelle Optophone Evaluation of the Ultrasonic Aid for the Blind	VA VA
Bionic Instruments, Inc.	Manufacture of 15-20 Obstacle Detectors for the Blind	VA
Center for Sensory Aids Evaluation and Development, Massachusetts Institute of Technology	Evaluation of a Wide Variety of Devices from the Very Simple to the Very Complex	VRA
Haskins Laboratories, Inc.	Fundamental Studies of Speech and Speechlike Sounds as Outputs for Various Types of Reading Machines for the Blind	VA
Mauch Laboratories, Inc.	Further Development of the Mauch Personal-type Reading Machine for the Blind	VA

Appendix B

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