

ANNUAL SUMMARY REPORT^a
ACTIVITIES FOR YEAR ENDED JUNE 30, 1968

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

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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 function.

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, orthopedic 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 Social and Rehabilitation Service (formerly 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 3-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,

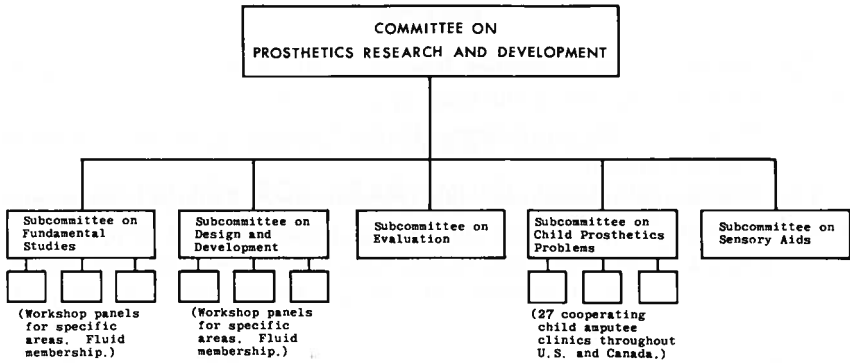


FIGURE 1

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 27 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.

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.

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 Social and Rehabilitation Service, 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, 1967, through June 30, 1968, 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 made specific recommendations on 26 proposals for research and development projects, and conducted four site visits.

CPRD Meetings

The seventeenth meeting of the Committee was held in Washington, D.C., on October 21, 1967. All members and two past members were present. Liaison representatives from the Children's Bureau, the Social and Rehabilitation Service, and the Veterans Administration participated in the meeting. The work of the previous year was reviewed in detail, and recommendations for future activities were made. A comprehensive report was prepared, and 37 copies were distributed.

The eighteenth meeting of CPRD was held in Washington, D.C., June 12, 1968. Emphasis of the meeting was on plans for Fiscal Year 1968-69. A number of special conferences and workshops were recommended. Subjects included are human locomotion, spinal orthotics, externally powered elbow units, bracing of fractures, spina bifida, cerebral palsy, and the effect of pressure on tissues. A comprehensive report on the eighteenth meeting is being prepared.

Subcommittee on Fundamental Studies

In keeping with its major purpose of renewing familiarity with work that has been done in basic research and stimulating investigations in areas where knowledge is limited or lacking, the Subcommittee on Fundamental Studies conducted a Workshop on the Human Foot and Ankle, March 1-2, 1968. It is hoped that the workshop, the first to be sponsored by the recently established Subcommittee, will set a pattern for other

workshops to follow. Hoped-for outcomes of such workshops are documents calling attention to gaps in present knowledge and delineating specific problems where research is required, as well as pointing out new techniques for management of patients with certain musculoskeletal impairments.

The Subcommittee met in New York City, May 27, to formulate plans for the coming year.

Subcommittee on Design and Development

The seventh meeting of the Subcommittee on Design and Development was held in Washington, D.C., on October 20, 1967. The work of the various panels sponsored by the Subcommittee was reviewed. It was thought it would be desirable to hold future meetings of the Subcommittee at least three or four times per year, at major research and development centers.

The eighth meeting of the Subcommittee was held at the Ontario Crippled Children's Centre, Toronto, Canada, June 3-4, 1968. Plans for workshops for the next fiscal year were formulated for presentation to CPRD.

Panel on Lower-Extremity Orthotics

At its fifth meeting, which was held in Atlanta, Ga., April 3-4, 1968, the Panel on Lower-Extremity Orthotics reviewed all the work that had been carried out during the past year. In addition, research groups were briefed on the "definition of disability" scheme developed by the American Academy of Orthopaedic Surgeons with CPRD and the American Orthotic and Prosthetic Association, so that they will be prepared to use it in the development of design criteria when the charts are available.

Panel on Upper-Extremity Prosthetics Components

The fifth meeting of the Panel on Upper-Extremity Prosthetics Components was held in Santa Monica, Calif., March 9-10, 1967. Because a relatively large number of items were to be considered, the items were classified in four groups according to their development status: 1. "old" hardware items which now seemed ready for evaluation, 2. "old" items still in the prototype stages of development at the previous meeting, 3. electrical power and myoelectrical control systems which had been developed or advanced since the previous meeting, and 4. items relating to design concepts which had not yet resulted in prototypes. The panel decided that, for the future, an effort would be made to advance items in the first two groups more rapidly so that more attention could be given to the items in the last two groups.

Panel on Upper-Extremity Fitting, Harnessing, and Power Transmission

The fourth meeting of the Panel on Upper-Extremity Fitting, Harnessing, and Power Transmission was held in Santa Monica, Calif., March 10,

1967. Although not a joint meeting with the Panel on Upper-Extremity Prosthetics Components, the meeting permitted a stimulating interchange of information between the two groups, and it was decided that more meetings of the two panels should be synchronized to some extent. A major item of business before the Panel on Upper-Extremity Fitting, Harnessing, and Power Transmission was a detailed consideration of the progress being made on the revised *Manual of Upper-Extremity Prosthetics* by a group at the University of California, Los Angeles. The schedule calls for the revised manual to be ready for use in the Prosthetics-Orthotics Education Program during the academic year 1968-1969.

Panel on Lower-Extremity Prosthetics Fitting

The Panel on Lower-Extremity Prosthetics Fitting held its seventh meeting at Rancho Los Amigos on January 6, 1968.

Major topics considered included air-cushion sockets, patellar-tendon supracondylar sockets, and Münster sockets—all for the below-knee amputee, pressure studies, alignment studies, fluid-lined sockets, the direct forming of sockets, transparent sockets, and the fitting of knee-disarticulation cases. Informal commitments were made by individual panelists to carry on further work with specific items. It was recommended that a special symposium on the latest developments in below-knee prosthetics be held early next fiscal year.

Workshop on Immediate Postsurgical Fitting of Prostheses

On May 18, 1968, research workers, educators, and clinicians participated in a workshop on immediate postsurgical fitting of prostheses. Techniques based on earlier research in this procedure had been taught to clinics at the prosthetics schools. The purpose of the workshop was to review the experiences of the clinics in order to determine whether any further steps in research and education should be undertaken. It was brought out that the technique was amazingly successful where there was an excellent relationship between surgeon and prosthetists. It was also agreed that immediate postsurgical fitting will be integrated into the regular lower-extremity courses.

Panel on Lower-Extremity Prosthetics Components

The Panel on Lower-Extremity Prosthetics Components held its third meeting in Miami Beach, Fla., December 17, 1967. Major topics considered by the panelists were foot-ankle units, torque absorption units, modular construction, components for immediate postsurgical fitting, cosmetic covers, knee devices, prostheses for hip-disarticulation and hemipelvectomy cases, and the "get it into production" problem.

Subcommittee on Evaluation

The Subcommittee on Evaluation met in Winnipeg, Manitoba, August 17-18, 1967. The major item of business of the meeting was a considera-

tion of the clinical evaluation program. Items in process of evaluation by the Subcommittee on Evaluation were the Engen plastic hand orthosis, and the VAPC patellar-tendon-bearing brace. Items requiring clinical evaluation were the VAPC below-knee pylon with cosmetic covers, the VAPC below-elbow Polysar socket, the Northwestern University polycentric knee, the Winnipeg below-knee prosthesis, the UC-BL pneumatic swing-control system, the UC-BL subtalar brace, the AMBRL resilient hand, the AMBRL velocity lock for elbow unit, the Swedish knee cage, the Winnipeg molded foot, AIPR pneumatic units, and a knee-disarticulation unit with DuPaCo hydraulic unit attached. It was considered that, for the immediate future, the evaluation program should continue essentially as at present until a better approach can be developed; that is, a program of clinical evaluation conducted by the staff of the Committee on Prosthetics Research and Development supplementing the evaluation program of the Veterans Administration and the Children's Bureau.

Subcommittee on Child Prosthetics Problems

The Subcommittee on Child Prosthetics Problems met in Washington, D.C., October 20, 1967, and again in Washington on June 14, 1968.

At the October meeting a detailed review of prosthetic devices and fitting techniques for children currently under development and evaluation in both the United States and Canada was conducted.

A major item considered involved a proposal to establish specialized fitting centers for severely handicapped children. The purpose of these centers would be to expedite the transition of advanced devices and procedures from developmental laboratories to amputee patients who would be benefited by such items. An *ad hoc* committee to consider the detailed planning of such centers was established.

Another decision of significance related to plans for a meeting of the chiefs of the clinics participating in the cooperative research program. This meeting was held in Washington, D.C., June 13-14, and was attended by more than 50 surgeons and 25 others. The central theme was the management of children with proximal femoral focal deficiencies. A definitive report on the subject will be published.

Cooperative Clinical Program

Twenty-seven clinics specializing in the treatment of the limb-deficient child are now participating in this program. In addition, contact is being maintained with some 18 additional centers which have developed specialized programs for the child amputee. It is anticipated that some half dozen of these additional centers will qualify as participants in the program during the next year. The Assistant Executive Director maintains close liaison with clinics participating in this program and is frequently able to assist in the development of newly established centers.

Inter-Clinic Information Bulletin

The Assistant Executive Director continued to serve as editor of the publication *Inter-Clinic Information Bulletin*. This magazine, now in its seventh year of publication, is sponsored by the Subcommittee on Child Prosthetics Problems and is printed and distributed by New York University. More than 2000 copies of each issue are distributed monthly to physicians, therapists, prosthetists and others interested in the care of the child amputee. A major development during the past year has been the offer of contributions to the Bulletin from clinicians in Germany, France, Scotland, and Japan. It is anticipated that these contributions will enhance the contribution of the *Inter-Clinic Information Bulletin* both nationally and internationally.

Booklet on Embryology

The proceedings of a symposium on Normal and Abnormal Embryological Development were published as a numbered series report of the National Academy of Sciences. The symposium, which was sponsored by the Subcommittee on Child Prosthetics Problems, involved the presentation of papers by outstanding authorities in the field. One thousand copies of the proceedings were printed with approximately 550 copies already distributed to clinicians, medical centers, and other interested groups.

*Ad Hoc Committee on the Planning of
Specialized Child Amputee Fitting Centers*

Action taken by the Committee on Prosthetics Research and Development on a recommendation made by the Subcommittee on Child Prosthetics Problems resulted in the establishment of an *Ad Hoc* Committee on the Planning of Specialized Child Amputee Fitting Centers, which held its first meeting in Washington, D.C., on February 23, 1968. Liaison representatives from the Children's Bureau and the Social and Rehabilitation Service participated in the meeting. Although no precise figures for the entire population are available, analyses based upon various surveys indicated that there are some 3,600 to 4,000 severely handicapped children under treatment in the United States, of whom perhaps 900 require more specialized treatment than they are now receiving. In its development of a plan for the establishment of specialized centers for the treatment of extremely handicapped children, the *Ad Hoc* Committee considered the following items in detail: criteria, engineering personnel, therapists, prosthetists, prosthetics and other shop facilities, medical personnel, in-patient facilities, surgical facilities, differentiation between specialized centers and standard child amputee centers, administrative and other supporting personnel, the purchase of prototypes, and inter-center relationships. The *Ad Hoc* Committee presented its plan at the Conference of Child Amputee Clinic Chiefs where it was accepted unanimously.

International Activities

At its meeting during October 1967, the Committee on Prosthetics Research and Development decided to participate with the Veterans Administration and the Social and Rehabilitation Service in organizing an exhibit for the XI World Conference of the International Society for Rehabilitation of the Disabled to be held in Dublin during 1969.

At the request of the Social and Rehabilitation Service, the Assistant Executive Director of the Committee on Prosthetics Research and Development spent 6 weeks in Yugoslavia developing a program for the evaluation of an electrically powered hand.

Artificial Limbs

The Autumn 1966 issue of the journal *Artificial Limbs* was distributed during October 1967, and the Spring 1967 issue was distributed during March 1968.

The Spring 1967 issue contains an article entitled "Limb Prosthetics—1967" by the Executive Director. This article is an updated version of "Limb Prosthetics Today" which appeared originally in *Artificial Limbs* for Autumn 1963. This article was reprinted in "Physical Therapy" and in the Danish Journal of Physical Therapy, soon after it appeared in *Artificial Limbs*, and the printers of *Artificial Limbs* received orders for about 15,000 reprints.

Orders for more than 10,000 copies of the reprint of the revised version have already been given by the prosthetics schools, the American Orthotic and Prosthetic Association, and the Committee on Prosthetic-Orthotic Education.

The Autumn 1967 issue was distributed in June 1968, and the manuscript for the Spring 1968 issue was completed in the same month.

Prosthetics and Orthotics

Prosthetics and Orthotics, the report of a Conference held under the sponsorship of the Committee on Prosthetics Research and Development during December 1966, appeared as an unnumbered National Academy of Sciences publication during 1967. This 41-page publication has had to be reprinted because of widespread demand. The Conference reported on was held at the request of the Vocational Rehabilitation Administration for the purpose of developing information for use in planning research and development activities in prosthetics and orthotics for the next five years and longer.

Normal and Abnormal Embryological Development

Normal and Abnormal Embryological Development, National Academy of Sciences Publication 1497, the proceedings of a symposium held in Chicago during January 1966 under the auspices of the Subcommittee

Bulletin of Prosthetics Research—Fall 1968

on Child Prosthetics Problems, an 82-page, illustrated report, appeared during 1967 and has attracted widespread interest in medical circles.

Immediate Postsurgical Prosthetics

Immediate Postsurgical Prosthetics in the Management of Lower-Extremity Amputees, by Ernest M. Burgess, M.D., Principal Investigator, Prosthetics Research Study, Seattle, Wash.; Joseph E. Traub, Director, Prosthetics Research Study, Seattle, Wash.; and A. Bennett Wilson, Jr., Executive Director, Committee on Prosthetics Research and Development, is a 51-page, illustrated publication of the Veterans Administration's Prosthetic and Sensory Aids Service, available from the U.S. Government Printing Office. It appeared in April 1967. More than 15,000 copies have been sold to date and a second edition is under consideration.

Demonstration

The staff of the Committee on Prosthetics Research and Development arranged for a demonstration of the fabrication of transparent experimental sockets for research groups interested in such a technique. The demonstration was conducted by personnel of the Army Medical Biomechanical Research Laboratory who developed the method.

Visit to the University of Utah

At the request of the Advanced Research Projects Agency's project at the University of Utah, an *ad hoc* committee visited the group in order to advise them concerning the application of newly developed computer techniques in prosthetics and orthotics research and development.

Visit to Moss Rehabilitation Institute

At the request of the Bioengineering Group, Moss Rehabilitation Institute, Temple University, CPRD formed an *ad hoc* committee to advise that group on future work. One site visit was made in November 1967, a second in March 1968.

Liaison with the Atomic Energy Commission

Liaison was effected with the Atomic Energy Commission, who requested assistance in finding new uses for a recently developed steel with unusual qualities. Engineering drawings of parts that might be improved by use of the new steel were forwarded to AEC for fabrication of parts for testing. One set of parts is now being tested.

Thermography

The CRPD made arrangements for two groups of research personnel to visit Barnes Engineering Corporation, Stamford, Conn., to explore the feasibility of employing special heat-measuring equipment (Barnes Thermograph) in prosthetics and orthotics research.

Report from Yugoslavia

The Executive Director assisted in the editorial work for "External Control of Human Extremities," a report of an international symposium sponsored by the Yugoslav Committee for Electronics and Automation held in 1966, and published under the International Program of SRS.

Miscellaneous

The staff responded to some 900 requests for publications or technical information. It also maintained close liaison with the American Orthotic and Prosthetic Association and the American Academy of Orthopaedic Surgeons by participating in various committee meetings.

FUTURE PLANNING

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 orthotics 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 Orthotic and Prosthetic 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.

In addition to routine procedures established by CPRD, the Committee during the coming year proposes to conduct a conference on prosthetics and orthotics to follow up on the highly successful Conference on Prosthetics and Orthotics that was held in Washington, D.C., December 12-13, 1966. To make the conference even more effective, the Committee proposes that selected representatives of research groups from other parts of the world be invited. It is anticipated that such a conference will result in a report of current activities and recommendations for future action so that full advantage can be taken of all the work being conducted in prosthetics and orthotics.

PUBLICATIONS

Annual Summary Report of Activities for Year Ending June 30, 1967. (Report to the Veterans Administration, the Vocational Rehabilitation Administration, and the Children's Bureau, from the Committee on Prosthetics Research and Development covering the Fiscal Year 1967-1968.)

Report of the Seventeenth Meeting of the Committee on Prosthetics Research and Development, October 21, 1967.

Report of the Eighteenth Meeting of the Committee on Prosthetics Research and Development. (In preparation.)

Bulletin of Prosthetics Research—Fall 1968

- Report of Conference on Sensory Aids*, March 30–31, 1967. (In press.)
- Progress Report on Pilot Study in Clinical Evaluation*, July 10, 1967.
- Report of Meeting of Subcommittee on Evaluation*, August 17–18, 1967.
- Report of Meeting of Subcommittee on Design and Development*, October 20, 1967.
- Report of Meeting of Subcommittee on Child Prosthetics Problems*, October 20, 1967.
- Report of Workshop Panel on Lower-Extremity Prosthetics Components*, December 17, 1967.
- Report of Workshop Panel on Lower-Extremity Prosthetics Fitting*, January 6, 1968.
- Report of Ad Hoc Committee on the Planning of Specialized Child Amputee Fitting Centers*, February 23, 1968.
- Prosthetics and Orthotics*. Report of a conference held under the sponsorship of the Committee on Prosthetics Research and Development during December 1966. (The conference was held at the request of the Vocational Rehabilitation Administration for the purpose of developing information for use in planning research and development activities for the next five years and longer.)
- Normal and Abnormal Embryological Development*, National Academy of Sciences, Publication No. 1497. (Proceedings of a symposium held under the sponsorship of the Subcommittee on Child Prosthetics Problems during January 1966.)
- Inter-Clinic Information Bulletin*. (Monthly publication of the Subcommittee on Child Prosthetics Problems. 12 issues.)
- Report of Workshop on Human Foot and Ankle*, March 1–2, 1968. (In preparation.)
- Report of Workshop Panel on Lower-Extremity Orthotics*, April 3–4, 1968.
- Report of Workshop on Immediate Postsurgical Fitting of Prostheses*, May 18, 1968.
- Report of Workshop on Pressure and Force Measurement*, May 27–28, 1968. (In preparation.)
- Report of Meeting of Subcommittee on Design and Development*, June 3–4, 1968.
- Report of Meeting of Subcommittee on Child Prosthetics Problems*, June 14, 1968.
- Management of the Child with Proximal Femoral Focal Deficiencies*. (Report of a conference of child-amputee clinic chiefs held under the sponsorship of the Subcommittee on Child Prosthetics Problems during June 1968. In preparation.)
- Artificial Limbs*, Vol. 11, No. 1, Spring 1967.
- Artificial Limbs*, Vol. 11, No. 2, Autumn 1967.
- Artificial Limbs*, Vol. 12, No. 1, Spring 1968. (In press.)

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>
Army Medical Biomechanical Research Laboratory— Peter M. Margetis Fred Leonard	Development of Prosthetic and Orthotic Materials and Devices	U.S. Army

<i>Organization and principal investigator</i>	<i>Major area (or areas) of investigation</i>	<i>Sponsoring agency</i>
Attending Staff Association of the Rancho Los Amigos Hospital, Inc.— Vert Mooney	Application of Orthotic Devices in the Treatment of Lower-Extremity Fractures and Degenerative Arthritis	SRS
Robert B. Pearson	Interval Measurements Applied to Skeletal Motor Units	SRS
Worden Waring	Investigation of Myoelectric Control of Functional Braces	SRS
Russell Forney	Development and Evaluation of Procedures for Selection of Students for an Orthotic-Prosthetic Training Program	SRS
Baylor University— Lewis A. Leavitt	Evaluation of Fit and Analysis of Gait of Lower-Extremity Amputees	SRS
California, University of, San Francisco and Berkeley, Biomechanics Laboratory—	Dual-Axis Ankle Control System	SRS
Verne T. Inman	Physiological Factors in the Occurrence and Modification of Human Spastic States	SRS
H. J. Ralston	Dynamics of the Human Body During Locomotion	SRS
Charles W. Radcliffe Howard D. Eberhart James M. Morris	Design of Prosthetic and Orthotic Devices, including Spinal Braces, and Biomechanical Studies of the Lower Extremities	VA
California, University of, Los Angeles, Biotechnology Laboratory— John Lyman	Fundamental and Applied Research Related to the Design and Development of Upper-Extremity Externally Powered Prostheses	VA, SRS
California, University of, Los Angeles, School of Medicine— Charles O. Bechtol	Study of New Materials, Techniques, and Devices, and Preparation of Up-to-date Manual on Upper-Extremity Prosthetics	SRS
	Functional Long Leg Brace	SRS

Bulletin of Prosthetics Research—Fall 1968

<i>Organization and principal investigator</i>	<i>Major area (or areas) of investigation</i>	<i>Sponsoring agency</i>
California, University of, Los Angeles, Child Amputee Prosthetics Project— Charles O. Bechtol Yoshio Setoguchi	An Interdisciplinary Research, Teaching, and Service Program in the Management of the Child Amputee	CB
Case Western Reserve University— James B. Reswick	Biomedical Research on Cybernetic Systems for the Disabled	SRS
Victor Frankel	Pathomechanics of Disorders of the Locomotor System	SRS
Charles Long, II	Basic and Clinical Study of Normal and Abnormal Human Motion	SRS
Olgierd Lindan	Application of Medical Engineering to Patient Care and Rehabilitation	SRS
Duke University Medical Center— J. Leonard Goldner Edward A. Kiessling	Development of Pneumatic Prostheses	CB, SRS
John O. Esslinger	Semiburied Implants for the Attachment of External Prostheses	VA
Gilmatic— Gilbert M. Motis	Development of Upper-Extremity Prosthetic Components	VA
Harvard University— Richard Warren	Survey of Lower-Extremity Amputations for Ischemia	VA
International Society for Rehabilitation of the Disabled— Norman Acton	International Prosthetics Information Service	SRS
Iowa State University— Allan G. Potter	Development of a Myoelectrically Controlled Brace for the Hand	SRS

<i>Organization and principal investigator</i>	<i>Major area (or areas) of investigation</i>	<i>Sponsoring agency</i>
Massachusetts Institute of Technology— Robert W. Mann	Development of a Myographically Controlled Artificial Arm	SRS and Liberty Mutual Ins. Co.
Mauch Laboratories, Inc.— Hans A. Mauch	Research and Development in Lower-Extremity Prosthetic Devices	VA
Michigan, University of— James W. Rae, Jr.	Biomedical Engineering in Physical Rehabilitation	SRS
Michigan Crippled Children Commission— George T. Aitken Charles H. Frantz	Clinical Testing of Prosthetic Devices and Techniques for Child Amputees; and the Development of Improved Clinical Management Procedures	CB
Moss Rehabilitation Center— Leonard Policoff	Biomedical Engineering Research and Development	SRS
Navy Prosthetics Research Laboratory (U.S. Naval Hospital, Oakland, Calif.)— D. W. Rohren	Immediate Postsurgical Fitting of Prostheses; and Lower-Extremity Prosthetic and Orthotic Development	U.S. Navy
New York University, School of Engineering and Science, Research Division, Prosthetic Devices Study— Renato Contini	Determination of the Pressure Distribution between Lower-Extremity Sockets and Stumps Body Segment Parameters	VA SRS
New York University, Post-Graduate Medical School, Prosthetic and Orthotic Studies— Sidney Fishman	Development of Devices and Techniques to Facilitate Diagnosis of Problems and Improve Fitting of Lower-Extremity Prostheses and Orthoses	SRS
	Evaluation of Prosthetic Devices and Techniques for Child Amputees	CB

Bulletin of Prosthetics Research—Fall 1968

<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— Allen S. Russek	Investigation of Immediate Prosthetic Fitting and Early Ambulation Following Amputation in the Lower Extremity	SRS
Ralph Lusskin	Control of Adventitious Bone Formation with Plastic Implants	SRS
Northwestern University Prosthetic Research Center— Robert G. Thompson	Design and Development of Devices and Techniques for the Improvement of Prosthetic Practices, Especially for Geriatric and Problem Cases	VA
Pennsylvania State University— Chauncey A. Morehouse	Evaluation of Stability of the Knee	SRS
Prosthetics Research Study— Ernest M. Burgess	Immediate Postsurgical Prosthesis Fitting and Ambulation	VA
Temple University— Leonard Policoff	Electromyographic Control of Protheses	SRS
Texas Institute for Rehabilitation and Research (Baylor University College of Medicine)— Thorkild J. Engen	The Development of Powered Upper-Extremity Orthotic Systems	SRS
Veterans Administration Hospital, San Francisco— Wesley S. Moore Albert D. Hall	Study of Below-Knee Amputation for Vascular Insufficiency	VA
Veterans Administration Prosthetics Center— Anthony Staros	Development and Testing of Prosthetic and Orthotic Devices and Techniques	VA

(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 and Orthotic Devices for Children
Rehabilitation Institute of Montreal— Maurice Mongeau	Development of Externally Powered Upper-Extremity Prosthetic Devices, with Special Reference to Children
Prosthetics /Orthotics Research and Development Unit, Manitoba Rehabilitation Hospital— James Foort	Development of a Variety of Prosthetic Devices with Special Reference to Lower-Extremity Requirements.
The University of New Brunswick Bio-Engineering Institute— R. N. Scott	Orthotics and Prosthetics 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
Haskins Laboratories, Inc.	Fundamental Studies of Speech and Speechlike Sounds as Outputs for Various Types of Reading Machines for the Blind	VA
Massachusetts Institute of Technology, Center for Sensory Aids Evaluation and Development	Evaluation of a Wide Variety of Devices from the Very Simple to the Very Complex	SRS
Mauch Laboratories, Inc.	Further Development of the Mauch Personal-type Reading Machine for the Blind	VA

Appendix B

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