

SUMMARY OF ACTIVITIES OF THE COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT FOR THE PERIOD JUNE 1, 1970, TO DECEMBER 31, 1970

The Committee continued to exercise its liaison and coordinating functions through the activities of the Committee as a whole, its five continuing subcommittees, and a very productive program of workshop panels and special meetings. A report of specific activities conducted during the reporting period follows.

Subcommittee on Fundamental Studies

During the prior reporting period an *ad hoc* committee had been appointed to study the structure and functions of the Subcommittee on Fundamental Studies and to make recommendations designed to enlarge the scope of the subcommittee's work and to increase the output of useful fundamental data. The *ad hoc* committee recommended the formation of workshop panels to deal initially with six areas of fundamental research. These areas were:

- Human locomotion
- Lower-extremity kinematics
- Tissue physiology
- Control of externally powered devices
- Upper-extremity kinematics
- History of hardware design

As a result of these recommendations, the Subcommittee on Fundamental Studies has been reconstituted under the chairmanship of Dr. Victor Frankel. The organization of the recommended workshop panels has begun with attention initially focused on human locomotion. Three meetings on this subject have been held.

The reconstituted Subcommittee on Fundamental Studies held its first meeting under Chairman Frankel in Cleveland, Ohio, on October 5, 1970. At this meeting recommendations for future work were made with most of the recommendations being assigned high priorities:

Neuromuscular Control—Three areas of study in this realm were identified: feasibility of neuromuscular stimulation; basic neurophysiology of tone, motion, and sensory feedback; and clinical application of neuromuscular stimulation.

A panel, with Dr. Joseph P. Van der Meulen as chairman, was appointed to initiate efforts in the first of these areas.

Studies of the Spine—Two areas of clinical study related to the spine were identified: biomechanics of the spine, and effect of disease on the spine.

Studies of the Lower Extremities

Loading of the lower extremities during various activities, and biomechanics of the foot and ankle were two additional areas of study assigned routine priority.

Internal Prosthetics—The unsolved problems of joint replacement of the hip, fingers, knee, elbow, and shoulder were assigned high priority, with a lower urgency assigned the study of skeletal attachment of prostheses.

Materials—The properties of biological materials and of biological structures were identified as needed areas of study.

Tissue Response to Force—The responses of soft and “hard” tissue to local forces were identified as areas needing study, and Dr. Donald B. Kettelkamp was appointed as chairman to stimulate activity in this area. Additional study areas of lower priority were identified.

Subcommittee on Sensory Aids

A special conference on the Model C-4 VA Bionic Laser Typhlocane was held in Hines, Illinois, on September 3, 1970. It was agreed that a common protocol for the next phase of evaluation of the Laser Typhlocane was most desirable. A working group under the chairmanship of Dr. Patrick W. Nye was subsequently established to assist in this matter.

The fourth meeting of the subcommittee was held in Boston, Massachusetts, on September 14–15, 1970. During the course of the meeting, visits were made to the American Center for Research in Blindness and Rehabilitation, the Sensory Aids Evaluation and Development Center—M.I.T., the Department of Mechanical Engineering—M.I.T., the Sensory Measurement Research Group of the Research Laboratory for Electronics—M.I.T., and the Low Vision Clinic of Boston University Medical Center.

The fifth meeting was held on December 12, 1970, in Washington, D.C. Mobility aids, proposals for future work with the Mauch Visotoner and Cognodictor, the Stanford Optacon, and aids for the partially sighted were among the topics discussed.

Subcommittee on Design and Development

The tenth meeting of the Subcommittee on Design and Development was held on September 8–11, 1970, in Annapolis, Maryland. This meeting took the form of working panels of carefully selected individuals charged with developing plans and priorities for the Prosthetic-Orthotic Design and Development effort over the next 5 years. Each panel focused on one of six specific areas of work: lower-extremity orthotics, lower-extremity prosthetics, upper-extremity orthotics, upper-extremity pros-

thetics, spinal orthotics, and surgery. The productive outcomes of this meeting have been incorporated in a design for the future to be prepared for transmission to the sponsors.

In addition to this major meeting the subcommittee continued to sponsor an active program of workshop panels and special events.

Panel on Upper-Extremity Orthotics

A newly constituted workshop panel on upper-extremity orthotics, with Charles M. Fryer as chairman, held its first meeting July 8–10, 1970, in Hillside, Illinois, and at Hines VA Hospital. This first panel reviewed the current status of upper-extremity orthotics practice as related to selected disabilities: 1. the quadriparetic, quadriplegic, and hemiplegic hand and wrist, 2. the arthritic hand and wrist, and 3. the traumatic hand and wrist (including burns). Major attention was devoted to the first category.

The current status of design and development work in upper-extremity orthotics was also reviewed, and projected future needs in this area were discussed.

Subcommittee on Evaluation

During the reporting period, the Subcommittee on Evaluation was reconstituted with Frank W. Clippinger, M.D., as chairman. The first meeting of the group under Dr. Clippinger's chairmanship was held on September 11, 1970, in Annapolis, Maryland. Evaluation programs currently in progress were reviewed, in addition to possible new items for evaluation.

The twelfth meeting of the subcommittee, in Durham, N.C., on November 9, 1970, took the form of a review of the results of the externally powered elbow evaluation project, and the formulation of recommendations based on the results of this study. The status of the evaluation studies on lower-extremity orthoses was also reviewed.

Synthetic Balata for Fabricating Below-Knee Sockets

The project involving the evaluation of synthetic balata to form sockets directly on the below-knee stump was completed early in 1970, and the report (E-3) was prepared and distributed.

Veterans Administration Prosthetics Center Patellar-Tendon-Bearing Brace

The evaluation of the Veterans Administration Prosthetics Center PTB weight-bearing brace, which had been delayed for various reasons, was reactivated and completed during the year. The final report (E-2) was in print at the close of the calendar year.

Externally Powered Elbows

An evaluation of three adult-sized electric elbows was initiated with a course of training for participating clinic personnel in October 1969.

By November 1970, the data-collection phase of this study was essentially completed and, following review of the results with both developers and evaluators, a final report (E-4) was completed and was in press at the end of 1970.

Lower-Extremity Orthotic Devices

The clinical evaluation of four lower-extremity orthoses was launched in the late summer and fall of 1970. Fittings of these braces are now under way at the seven clinics participating in the study. More than 70 patients are to be fitted.

Comparative Evaluation of Below-Knee Orthoses

Plans have been made to conduct a biomechanical analysis and comparative study of nine below-knee orthoses whose function primarily is to correct the drop-foot condition associated with hemiplegia and other diseases causing partial paralysis of the foot. Preliminary discussions have been held with personnel at Moss Rehabilitation Center, where the study will be conducted. The protocol will be finalized in January 1971.

Subcommittee on Child Prosthetics Problems

Two meetings of the Subcommittee on Child Prosthetics Problems were held during the reporting period, one on June 11, 1970, and the other on October 16, 1970.

In association with the June 1970 meeting the Annual Meeting of Child Amputee Clinic Chiefs was held over a 2½-day period. The clinic chiefs' sessions included a symposium on "The Child with an Acquired Amputation." The series of papers presented during the symposium is to be published. Also discussed with the clinic chiefs during the meeting was the proposed extension of activities into the evaluation of bracing items for children. Based on the response of the clinic chiefs present, a decision was made to activate this project.

The October 1970 meeting was primarily concerned with a review of progress in on-going and planned studies of powered prosthetic components through the participating clinics.

Cooperative Clinical Research Program

Twenty-nine clinics, specializing in the treatment of the child with limb deficiencies, are now participating in the program which is conducted by the Subcommittee on Child Prosthetics Problems. Direct contact has been made with some 40 additional centers offering specialized programs in this field. It is anticipated that many of these clinics will join the cooperative program over the next several years.

Inter-Clinic Information Bulletin

Six issues of the ICIB were published during the report period.

Bulletin of Prosthetics Research—Spring 1971

Symposium on Surgical and Prosthetic Management of Lower-Extremity Congenital Limb Deficiencies

The four papers on the treatment of lower-extremity anomalies other than proximal femoral focal deficiency, which were presented at the 1969 clinic chiefs' meeting, have all been received and edited. Publication is anticipated early in 1971.

Symposium on the Child with an Acquired Amputation

The papers relating to the management of the child with an acquired amputation which were presented at the 1970 meeting of Child Amputee Clinic Chiefs are still being received. It is anticipated that all papers will be in the hands of the editor early in 1971, following which preparation for publication will be expedited.

Special Meetings and Activities

Postgraduate Course in Lower-Extremity Prosthetics and Orthotics

A postgraduate seminar on "Lower-Extremity Prosthetics and Orthotics: Recent Developments" was held on December 4-6, 1970, at the Americana Hotel in Miami Beach, Florida. The University of Miami School of Medicine conducted the seminar with the cooperation of the Committee on Prosthetics Research and Development and the Veterans Administration.

Conference on the Establishment of Bioengineering Centers

Under the chairmanship of Dr. Colin A. McLaurin, CPRD conducted a small conference of individuals operating or interested in operating bioengineering research centers. The purpose of the meeting, which was held in Washington, D.C., on June 19-20, 1970, was to discuss the need for bioengineering centers devoted to research involving the neuromusculoskeletal system and to establish criteria for their development.

An expanded meeting which included several groups with possible interests in planning model centers was held September 12-13, 1970, at Annapolis, Maryland. Two days of discussion led to the formulation of recommendations concerning criteria to be expected in a rehabilitation engineering center.

Artificial Limbs

During the reporting period, two issues of ARTIFICIAL LIMBS were published. The Spring 1970 issue was distributed in June 1970, and the Autumn 1970 issue in December 1970.

Prosthetics-Orthotics Exhibit

The exhibit, which had been prepared cooperatively with the American Orthotic and Prosthetic Association, the Prosthetic and Sensory Aids Service of the Veterans Administration, and Social and Rehabilitation Service of HEW, and which depicts research, development, educa-

tion, and clinical application of prosthetics and orthotics in North America, had been shown extensively during 1969. This year the exhibit was displayed at the American Physical Therapy Association's Annual Convention in Washington, D.C., June 1970.

American Academy of Orthopaedic Surgeons

The staff continued a strong relationship with the American Academy of Orthopaedic Surgeons through its Committee on Prosthetics and Orthotics. Assistance is being provided in the preparation of a new text on orthotics and the development of a graphical presentation and analysis of musculoskeletal disabilities.

Engineering Foundation Research Conference

The Executive Director, CPRD, and the Chief, Research and Development Division, PSAS, served as cochairmen and faculty members of an Engineering Foundation Research Conference entitled "Introduction to Prosthetic and Sensory Aids," held at Proctor Academy, Andover, New Hampshire, August 17–21, 1970.

International Activities

At the request of the Division of International Activities of the Social and Rehabilitation Service, the Assistant Executive Director made a return visit to Yugoslavia during the summer of 1970. He assisted in the completion of the evaluation study on the so-called Belgrade Hand.

The Executive Director and the Assistant Executive Director assisted in the editing of the proceedings of The Third International Symposium on External Control of Human Extremities, held in Dubrovnik, Yugoslavia, August 25–31, 1969.

Twenty-fifth Anniversary

A week-long program of events marking the twenty-fifth anniversaries of both the Committee on Prosthetics Research and Development, and the Prosthetic and Sensory Aids Service of the Veterans Administration, was held at the Mayflower Hotel in Washington, D.C., October 12–16, 1970. A feature of the outstanding program was a banquet attended by more than 200 people, honoring the five previous chairmen of the Committee on Prosthetics Research and Development, and the two former Directors of the VA Prosthetic and Sensory Aids Service.

Site Visits

During the reporting period the Executive Director made onsite visits to Rancho Los Amigos Hospital and the University of California at Los Angeles.

The Assistant Executive Director made visits to numerous child amputee centers. Some of these centers are already participants in the cooperative research program coordinated by the Subcommittee on Child Pros-

thetics Problems. Others are prospective participants. Centers visited were: Shriners Hospital for Crippled Children, San Francisco; Children's Hospital and Craig Rehabilitation Center, Denver; Florida Crippled Children's Commission, Orlando; Georgia Juvenile Amputee Clinic at Emory University, Atlanta; Gillette State Hospital, St. Paul; Duke University Medical Center, Durham; Crippled Children's Hospital, Memphis; Shriners Hospital for Crippled Children, Salt Lake City; Children's Orthopaedic Hospital, Seattle; Ontario Crippled Children's Centre, Toronto; and the Child Amputee Clinic, University Hospital, Edmonton, Canada.

Proposals Reviewed on Behalf of SRS and VA

For the Social and Rehabilitation Service, the Committee on Prosthetics Research and Development reviewed 15 new and eight continuation proposals in the fields of prosthetics and orthotics, and 22 proposals for new and continuing projects in sensory aids. One application for continuing support of proposed research in prosthetics and other aspects of rehabilitation was reviewed on behalf of the International Division, SRS. Eight proposals for new and continuing projects in prosthetics and orthotics were reviewed for the Veterans Administration plus three proposals for new and continuing projects in sensory aids.

Miscellaneous

During the report period the staff responded to more than 800 requests for publications or technical information.

Close liaison was maintained with the American Orthotic and Prosthetic Association by personal contact and by staff participation in various Association activities.

Toward the close of the reporting period the Assistant Executive Director was appointed Secretary *pro tem.* of both the University Council on Orthotic-Prosthetic Education (UCOPE) and the Conference on Orthotic-Prosthetic Education (COPE) and acted in this capacity at meetings of the two groups held in Miami, Florida, December 5-6, 1970. These appointments provide the basis for an intensification of the close liaison already existing between the research and education programs.

MEMBERSHIP

COMMITTEE ON PROSTHETICS RESEARCH AND DEVELOPMENT

DIVISION OF ENGINEERING—NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING

Colin A. McLaurin, Sc. D., *Chairman*: Project Director, Prosthetic Research and Training Unit, Ontario Crippled Children's Centre

Frank W. Clippinger, M.D., *Vice-Chairman*: Professor of Orthopaedic Surgery, Duke University Medical Center

- James C. Bliss, Ph. D., Manager, Bioinformation Systems Group, Engineering Sciences Laboratory, Stanford Research Institute
- Dudley Childress, Ph. D., Prosthetic Research Evaluation, Northwestern University Medical School
- Mary Dorsch, C.P.O., President, Dorsch-United Limb and Brace Company
- Herbert Elftman, Ph. D., Professor of Anatomy, College of Physicians and Surgeons, Columbia University
- Sidney Fishman, Ph. D., Coordinator, Prosthetics and Orthotics, New York University Post-Graduate Medical School
- Victor H. Frankel, M.D., Professor of Orthopaedic Surgery and Biomedical Engineering, Case Western Reserve School of Medicine
- Richard Herman, M.D., Director, Krusen Center for Research and Engineering, Moss Rehabilitation Hospital
- Richard E. Hoover, M.D., 14 West Mt. Vernon Place, Baltimore
- James M. Morris, M.D., Assistant Professor of Orthopaedic Surgery, Biomechanics Laboratory, University of California at San Francisco
- Roy Snelson, C.P.O., Project Director, Amputation and Problem Fracture Service, Rancho Los Amigos Hospital, Inc.
- Staff: A. Bennett Wilson, Jr., Executive Director
 Hector W. Kay, Assistant Executive Director
 Maurice A. LeBlanc, C.P., Staff Engineer

Publications

- Annual Summary Report of Activities for Year Ending June 30, 1970*
 (Report to the Veterans Administration, the Social and Rehabilitation Service, and the Children's Bureau, from the Committee on Prosthetics Research and Development covering the Fiscal Year 1969-1970.)
- Selected Lower-Limb Anomalies—Surgical and Prosthetic Management*, National Academy of Sciences, Proceedings of a symposium held May 9, 1969, under the sponsorship of the Subcommittee on Child Prosthetics Problems. (In preparation.)
- Report of Eighth Workshop Panel on Upper-Extremity Prosthetics*
 March 31-April 2, 1970. (In press.)
- Report of Twenty-First Meeting of Committee on Prosthetics Research and Development*, April 21-22, 1970.
- Report of Tenth Meeting of Subcommittee on Evaluation*, May 12-13, 1970
- The Child with an Acquired Amputation*, National Academy of Sciences, Proceedings of a symposium held June 9, 1970, under the sponsorship of the Subcommittee on Child Prosthetics Problems. (In preparation.)

Report of Meeting of Subcommittee on Child Prosthetics Problems, June 11, 1970.

Report of Conference on Bioengineering Centers, June 19–20, 1970.

Report of the Workshop on Knee-Disarticulation Prosthetics, June 22–23, 1970.

Report of First Workshop Panel on Upper-Extremity Orthotics, July 8–10, 1970. (In preparation.)

Report of Tenth Meeting of Subcommittee on Design and Development, September 8–11, 1970.

Report of Eleventh Meeting of Subcommittee on Evaluation, September 11, 1970

Report of Fourth Meeting of Subcommittee on Sensory Aids, September 14–15, 1970.

Report of Meeting of Subcommittee on Fundamental Studies, October 5, 1970.

Report of Meeting of Subcommittee on Child Prosthetics Problems, October 16, 1970.

Report of Twelfth Meeting of Subcommittee on Evaluation, November 9, 1970.

Report of Fifth Meeting of Subcommittee on Sensory Aids, December 12, 1970.

The Veterans Administration Prosthetics Center Patellar-Tendon-Bearing Brace—Clinical Applications, Report E-2, 1970.

Externally Powered Prosthetic Elbows—A Clinical Evaluation, Report E-4, 1970.

Inter-Clinic Information Bulletin. (Published monthly for the Subcommittee on Child Prosthetics Problems, 6 issues.)

Artificial Limbs, Vol. 14, No. 1, Spring 1970.

Artificial Limbs, Vol. 14, No. 2, Autumn 1970.

Artificial Limbs, Vol. 15, No. 1, Spring 1971.