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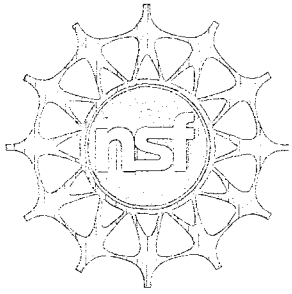

RECENT AWARDS

October–December 1980

NATIONAL SCIENCE FOUNDATION
Directorate for Engineering and Applied Science
Division of Problem-Focused Research
Washington, D.C. 20550

INFORMATION RESOURCES
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16. Abstract (Limit: 200 words)

Each of the following program areas of the Division of Problem-Focused Research is described: alternative biological sources of materials; earthquake hazards mitigation; human nutrition; and science and technology to aid the handicapped. The presentation format includes the title of the specific grant, the name and mailing address of the principal investigator, the institution conducting the research, the award number, and a detailed summary of the project. Persons wishing to obtain information on project findings, including project reports, monographs, journal articles, technical reports, and other relevant materials, should write to the principal investigator at the grantee institution to determine what information is available and at what cost, if any, it may be obtained.

17. Document Analysis a. Descriptors

Research projects	Human nutrition	Water treatment
Earthquakes	Physiclly handicapped	Resources
Hazards	Water supply	Food supply

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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INTRODUCTION

Recent Awards keeps researchers, research users and policy makers informed about projects being supported by NSF's Division of Problem-Focused Research (PFR).

This brochure describes awards made by PFR primarily during the period October 1 through December 31, 1980 (first quarter, Fiscal Year 1981). Awards made before October 1, 1980 are included here if they were not reported in a previous issue of *Recent Awards*. The data have been reconciled with the NSF's Management Information System.

DEFINITIONS AND EXPLANATION OF FORMAT

Study of Earthquake-Induced Bond Deterioration;[1] Neil M. Hawkins;[2] University of Washington, Department of Civil Engineering, Seattle, WA 89195;[3] **Award #76-15366 AO2[4]**; $59,647 for 12 months beginning May 15, 1979[5]

1. **Title of the Award**
2. **Principal Investigator:** the chief scientist or administrator who is responsible for th
   cal expenditures as an NSF av
3. **Institution Conducting the I**
   university, laboratory, industry
   whether operating on a profit o
   as State governments and Fede
4. **Award Number:** the award number and amendment number, if applicable.
5. **Amount, Duration and Starting Date of the Award** (a duration of 0 months means the amount awarded is a supplement to an existing award).

HOW TO OBTAIN RESEARCH REPORTS

One of the most important objectives of PFR is the timely and widespread dissemination of the results of PFR-supported research to potential users. The name and mailing address of the Principal Investigator and Grantee Institution is contained in each project description in this brochure. Persons wishing to obtain information on project findings, including project reports, monographs, journal articles, technical reports, and other materials should write to the Principal Investigator at the Grantee Institution to determine what information is available and at what, if any, cost it may be obtained. The Grantee Institution may charge a nominal amount for the duplication and mailing of such materials to cover costs. The Principal Investigator may furnish information on how interested persons may acquire reports and other materials from the National Technical Information Service (NTIS) of the Department of Commerce in lieu of furnishing the report or other material directly.

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er publications where project in-
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Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

ALTERNATIVE BIOLOGICAL SOURCES OF MATERIALS

The Alternative Biological Sources of Materials program deals with selected aspects of the problem of meeting the Nation's future needs for raw materials. This program is directed toward alleviating national dependence on selected scarce resources by making alternative biological sources of materials available in the United States.

1. Lignocellulosic Waste Conversions: Controlled Gas Environments; Richard E. Mudgett; University of Massachusetts, Amherst Campus, Department of Food Engineering, Amherst, MA 01003; **Award #80-17732**; $78,349 for 24 months beginning November 15, 1980.

   While little is known about metabolic effects of the gas environment in aerobic fermentations, recent reports have shown that oxygen and carbon dioxide levels significantly affect levels of biomass and enzyme production by mycelial organisms. Also, oxygen has a stimulatory effect on lignolytic activity by wood-decaying fungi and fungal-like bacteria.

   The objective of this project is to investigate the effects of controlled gas environments by means of a novel aeration system (previously employed in the study of fungal enzyme production) on the degradation of lignocellulosic materials by selected mycelial organisms in submerged culture and solid substrate fermentations. Oxygen and carbon dioxide partial pressures are maintained at various levels in such fermentations and their effects evaluated in stationary and agitated cultures for conditions of cultivation known to induce lignolytic activity. Gas transfer rates and respiratory quotients are determined for model systems selected from preliminary screening studies.

EARTHQUAKE HAZARDS MITIGATION

The goals of the Earthquake Hazards Mitigation (EHM) program are to develop an understanding of earthquakes in relation to constructed facilities, and to reduce casualties, damage and social and economic disruption which are the result of earthquakes. The actions necessary to attain these goals are heavily dependent upon technical capabilities which require development through research.

Primary objectives of EHM-supported research are: to determine the nature of strong ground shaking during earthquakes; to develop analytical procedures to predict the spatial and temporal distribution of strong ground motion at different sites; to understand the dynamic behavior of soil and rock subjected to strong shaking; to determine the nature of the interaction of structures and their supporting soil during earthquakes; to determine the engineering aspects of reservoir-induced seismicity; to develop procedures for performing dynamic analyses of proposed or existing construction under earthquake loadings; to develop an understanding of materials and structural components subjected to damaging dynamic loads; to develop procedures for analysis and design of non-structural and architectural systems for earthquake effects; to study the influences of architecture and urban planning activities on the earthquake vulnerability of regions; and to determine the social and economic aspects of mitigation, preparedness, and disaster impacts.

1. A Longitudinal Study of the Effects of the 1976 Guatemala Earthquake; Frederick L. Bates; University of Georgia, Department of Sociology, Athens, GA 30602; **Award #80-12339**; $186,054 for 12 months beginning October 15, 1980.

   This research continues the analysis of data collected in a three-year longitudinal study of the Guatemalan Earthquake of February 1976. The objective is to trace the long-range social and economic effects of the earthquake and of the relief and reconstruction efforts which followed it and to determine the factors which account for differential rates of recovery among various communities and population groups. This research tests the hypothesis that disasters produce a situation which favors social and economic change. The results of the research are published in both a series of descriptive reports aimed at practitioners in the field of disaster mitigation and analytical reports aimed at a scientific audience.

2. A Generalized Approach to Risk and Damage Analysis Associated with Seismically-Induced Pore Water Pressure Build-Up; G. Wayne Clough; Stanford University, Department of Civil Engineering, Stanford, CA 94305; **Award #80-07083**; $62,480 for 12 months beginning November 15, 1980.

   The behavior of cohesionless soils under earthquake loading has been an area of extensive research in the past 15 years. Models have been developed to assess quantitatively or qualitatively the liquefaction potential at a given site. However, very little has been done to study uncertainties involved in experimental and analytical results, and to provide the engineering profession with information regarding actual damage potential due to liquefaction.

   This research includes a fundamental, probability based approach which is directed toward predicting the likelihood of pore pressure build-up and ground deformations, and the resultant damage potential of these consequences. The research combines existing technology for prediction of pore pressure build-up, evaluation of ground movements, and seismic risk analysis. The framework is general so that new developments in models, techniques, or case history information can be incorporated.

3. Cyclic Behavior of Concrete Beams with Low Values of Flexural Reinforcement; David Darwin; University of Kansas Main Campus, Department of Civil Engineering, Lawrence, KS 66045; **Award #79-24696**; $192,971 for 24 months beginning December 1, 1980.

Very little is known about the behavior of reinforced concrete flexural members with low amounts of flexural steel in which the strength is controlled by shear under cyclic loading. In this project, the behavior of lightly reinforced concrete beams under cyclic load is studied. Test results are used to develop design recommendations for structures subject to seismic loading. Cantilever beams are subjected to large displacements of the type expected during a major earthquake. Strength, ductility, and energy dissipation capacity are measured as functions of the flexural reinforcing ratio, degree of shear reinforcement, stirrup spacing, ratio of positive to negative flexural steel, and the shear-span to depth ratio. Test results are compared with existing data for more heavily reinforced sections, and recommendations are made for the design of shear reinforcement. The recommendations will result in improved safety, reduced design time, less cluttered reinforcing details, and easier construction of reinforced concrete structures in earthquake zones.

4. Committee on Natural Disasters—Post-Event Investigations to Maximize Learning from Destructive Natural Disasters; Edward Epremian; National Academy of Sciences, Committee on Natural Disasters, Washington, DC 20418; **Award #78-10631 A02**; $95,500 for 12 months beginning October 20, 1980.

   The objective of this program is to make possible the collection of perishable information after the occurrence of a natural disaster (such as an earthquake) which causes sudden and widespread destruction and disruption of the economic and social structure of a region. Such a disaster is, in effect, a full-scale test of facilities of varying ages and quality which were designed and built to a variety of codes and standards and which tests the application of engineering and planning principles at different stages of development.

   Because rescue activities may involve large physical movements of debris and damaged facilities and because cleanup operations may start quite quickly after the disaster, it is necessary to have professional teams visit the site as quickly as possible in order to capture information which may help document and explain the failures or satisfactory performance of facilities struck by disaster. The National Academy of Engineering and National Academy of Science are in a unique position to organize and dispatch interdisciplinary teams to collect and publish perishable information which can provide a basis for in-depth studies at a later time by interested researchers. Such an arrangement is particularly of value in maximizing our learning from disasters occurring in foreign countries.

5. Computer Methods for Consistent Formulation of Earthquake Design Modifications; Steven J. Fenves; Carnegie-Mellon University, Department of Civil Engineering, Pittsburgh, PA 15213; **Award #80-13746** $163,791 for 24 months beginning October 15, 1980.

   The objectives of this research are to develop computer aids in two areas to support the development and use of design specifications, including codes and standards, from initial formulation through adoption to actual use and eventual feedback to developers for update and modification.

   The first area deals with extending computer tools previously developed to the execution of specification provisions with actual numeric values, either for conformance checking or for design. The second area deals with exploration of the use of information storage and retrieval techniques to track and record the status of a specification through its "life-cycle".

6. Seismic Design of Cable-Stayed Bridge Structures; John F. Fleming; University of Pittsburgh, Department of Civil Engineering, Pittsburgh, PA 15260; **Award #79-23023**; $85,724 for 24 months beginning November 1 1980.

   This research determines the response of cable-stayed bridge structures to seismic ground motions and establishes safe and economical seismic design criteria. Preliminary studies indicate that even though a cable-stayed bridge has a nonlinear load-displacement relationship, a linear time-history dynamic analysis, starting at the dead load deformed position, yields an acceptable engineering solution. Nonlinear behavior must be considered, however, in determining the structural stiffness under the action of the static dead load.

   This study has two phases: (1) determination of the dynamic characteristics of cable-stayed bridge structures for a wide range of bridge parameters, and the extent of their nonlinear behavior; and (2) the establishment of a seismic design procedure for cable-stayed bridge structures.

7. Seminar on Reducing the Vulnerability of Cultural Objects to Earthquakes and Other Natural Hazards; James L. Haecker; Architectural Research Center Consortium, Department of City and Regional Planning, 1735 New York Avenue, N.W., Washington, DC 20006; **Award #80-07116**; $98,218 for 18 months beginning December 15, 1980.

   Over the past 30 years, there has been an increasing concern with identifying, protecting, and preserving historic architectural and engineering works and historic and cultural artifacts. The preservation of historic structures and cultural artifacts is part of a more general concern for hazard abatement in existing buildings and for the security of building contents during earthquakes.

   This project collects applicable research findings on the topic and conducts a seminar for relevant professionals (engineers, architects, museum directors, and curators of historic property) which serves as the basis for a handbook on reduction of vulnerability of cultural objects to earthquakes and other natural disasters. The handbook covers: Description of the Threat (Destruction of Artifacts and Structures); Assessment of the Hazard; Protection Measures; Repairing Damage; and Necessary Actions at Federal, State, and Institutional Levels. This technical handbook is intended for the use

of designers, museum directors and the curators of historic properties and collections of artifacts.

8. A Study of Seismic Behavior of Precast Concrete Large Panel Buildings Using a Small Shake Table; Harry G. Harris; Drexel University, Department of Civil Engineering, Philadelphia, PA 19104; **Award #79-24723**; $162,000 for 24 months beginning November 15, 1980.

   Seismic performance data on the behavior of precast concrete panel buildings are very meager because these buildings were only recently introduced into seismic regions. This project is investigating the seismic behavior of three-dimensional small-scale models before entering into a large-scale testing program. Analytical studies are available but the premises and assumptions require verification.

   The objectives of this project are twofold: (1) to develop data to verify or modify the assumptions required for analysis; and (2) to study the rocking and slip of the panels for various types of connections to determine cost-effective methods of connecting the panels. The research includes a study of floor diaphragms and connections to the panel bearing walls. The investigations are performed on a random vibration shake table.

   The data are being made available in terms of recommendations and improvements in the analysis methods and types of connections between panels.

9. Seismic Response of Curved Box Girder Bridges—U.S./P.R.C. Cooperative Research; Conrad P. Heins; University of Maryland College Park, Institute for Physical Science and Technology, College Park, MD 20742; **Award #80-18729**; $114,084 for 24 months beginning December 1, 1980.

   A great number of box girder bridge structures exist throughout the United States. Although these do not constitute a high percentage of the total number of bridges, they do represent disproportionally higher total costs. The location of such structures is often most critical, as the economic span lengths for box girder structures range from 200'—600' in length. This factor, coupled with the general high sensitivity of such stiffened structures to unusual loading, make the steel box girder bridge a high risk configuration when considering seismic disturbances.

   Box girder bridge structures warrant serious attention to effects such as those induced by earthquake loadings. These structures are particularly susceptible to instability failure where the collapse could be instantaneous and total. Cost and inconvenience could, under these conditions, be well out of proportion to the number of these bridges.

   This study examines the seismic response of both curved steel and concrete box girder bridges and the associated natural frequencies, strength, bearing supports and development of simulated equivalent force techniques. The study of the steel structure is by the U.S. researchers and the study of the concrete structure is by the researchers of the People's Republic of China as part of the cooperative effort.

10. National Workshop on Strong-Motion Earthquake Instrumentation; Wilfred D. Iwan; California Institute of Technology, Department of Applied Mechanics, Pasadena, CA 91104; **Award #80-21025**; $37,280 for 18 months beginning November 15, 1980.

    A Workshop on Strong-Motion Earthquake Instrumentation is to be held in Santa Barbara, California, in Spring 1981 to review existing strong-motion instrumentation programs in the U.S., to develop a unified strategy for the deployment of strong-motion instruments both in the free-field and in buildings, and to formulate a plan for the coordination of existing strong-motion programs, the on-going installation and operation of instruments, and the management of strong-motion data.

    The Workshop provides a forum for such topics as: 1) the adequacy of existing strong-motion programs, 2) optimal geographic locations for strong-motion instruments, 3) free-field deployment of strong-motion instruments, 4) deployment of strong-motion instruments in structures, 5) installation and maintenance of strong-motion instruments, and 6) strong-motion data management. The major product of the Workshop is a final report summarizing and synthesizing the findings and recommendations of the participants which can be used as a reference guideline for the development of a unified strategy for the deployment of strong-motion instruments nationwide.

11. Strengthening of Brick Masonry with Shotcrete; Lawrence Kahn; Georgia Institute of Technology, Department of Civil Engineering, Atlanta, GA 30332; **Award #80-02583**; $56,759 for 18 months beginning September 1, 1980.

    This research project investigates experimentally the strengthening of existing brick masonry walls using reinforced shotcrete for improved earthquake and natural hazard resistance. The research is designed to determine the adequacy of the connection between the brick and shotcrete and to quantify the extent of composite action. Investigations focus on the natural bond between shotcrete and brick, enhanced bond using epoxy, the effect of steel dowels, and the effect of multiple wythes of brick.

    This research initiates experimental research in the area of brick masonry rehabilitation. Rehabilitation of existing facilities, rather than their replacement, will help the nation meet energy conservation goals, maintain our architectural heritage, and provide a more economic solution to urban renewal programs, as well as mitigate earthquake hazards.

12. The Role of States in Earthquake and Natural Hazard Mitigation at the Local Level; W. Henry Lambright; Syracuse Research Corporation, Department of Applied Social Research, Syracuse, NY 13210; **Award #80-18710**; $199,172 for 30 months beginning December 15, 1980.

    This study focuses on the role of States in the adoption and use at the local level of various policy innovations—such as building codes, land-use manage-

ment, preparedness, and public education—intended to reduce the impacts of earthquakes and other natural hazards. Comparative case studies are conducted in California, Nevada, South Carolina, and Texas. In each State, a case in which an innovation process went smoothly is being compared with one that experienced problems. The analysis involves a decision-making approach, and intergovernmental relations are examined during the various stages of problem awareness, innovation adoption, and implementation.

The study addresses the following types of questions: Why does the State adopt certain kinds of innovations rather than others? How does it implement those innovations at the local level? Under what conditions does the State facilitate or hinder innovation? How does the State affect Federal policies intended to encourage local innovation? Data for the study are collected from interviews with key persons involved in the decision-making process, including legislators, administrators, and technical experts, and from written documents.

13. Automation Digitization and Dissemination of Strong Motion Accelerograph Data; Vincent W. Lee; University of Southern California, Department of Civil Engineering, Los Angeles, CA 90007; **Award #80-11544**; $93,050 for 12 months beginning December 1, 1980.

    An automatic digitization system consisting of a rotating drum scanner and a complete computer interactive system has been built at the University of Southern California under NSF support. This capability provides an accurate, convenient and fast way to digitize accelerograph film records. Such a system significantly extends the life of mechanical-optical accelerograph systems and permits continued exploitation of the simplicity and reliability of this accelerograph type.

    This project continues the development of an automatic system by 1) adding one Textronix terminal to the existing system so that the scanning of new records and filtering and editing of data can be done simultaneously, and 2) setting up the necessary interface for the existing computer system to provide access through telephones to all processed data and the data processing software. Under the improved system, the outside user is able to have the requested data printed, recorded and plotted.

14. Strategies for Restoring Older Buildings in Seismic Regions; Folke Nyberg; University of Washington, College of Architecture, Seattle, WA 98195; **Award #80-21118**; $78,350 for 12 months beginning December 15, 1980.

    The College of Architecture, in cooperation with the Department of Civil Engineering of the University of Washington, is conducting a study to develop strategies for restoring older buildings in seismic regions.

    Existing hazardous buildings built prior to the promulgation of seismic design provisions constitute a major threat to life in seismically active areas. The abatement of this hazard poses a very complex set of technical, social, economical, and political problems. This research project includes: (1) study of seismic resistance offered by the structural systems typically used in older buildings in the Pacific Northwest; (2) investigation of the consequences (structural, economic, architectural, and social) of strengthening them to different levels, both equal to and less than those specified in current codes; (3) examination of the balance between the benefits and costs involved in strengthening to various levels; and (4) preparation of a manual for use by all those concerned with the restoration process, suggesting appropriate ways of evaluating the social and economic significance of restoring older buildings.

15. Fire Research on Seismically Damaged Concrete Beams Repaired with Epoxy Adhesives; Joseph M. Plecnik; California State University Long Beach, Department of Civil Engineering, Long Beach, CA 90840; **Award #79-27222**; $135,846 for 24 months beginning November 1, 1980.

    Epoxy repair techniques are used extensively for repair of concrete and masonry structures. Past research indicates that damaged structures repaired properly with epoxy adhesives are restored to original design strength levels. However, strength properties of epoxy adhesives deteriorate rapidly at elevated temperatures. This experimental program investigates the strength properties of epoxy-repaired components during and after fire exposure. The research is directed toward epoxy repaired concrete beams and the formation of a data bank for earthquake-damaged and subsequently repaired structures.

    The primary objectives of this research are: (1) to investigate the behavior of epoxy repaired concrete beams during fire exposure; (2) to determine the nature and extent of residual strength of epoxy repaired structural components after fire exposure under simulated seismic loads; and (3) to prepare a computerized catalog of repaired structures to study their behavior after possible future fires or earthquakes.

16. Risk-Based Assessment of the Safety of Dams; Erik H. Vanmarcke; Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, MA 02139; **Award #78-15898 A01**; $251,553 for 18 months beginning October 1, 1980.

    Major constructed facilities, such as dams, pose potential hazards to life and property and to the environment. The objective of this project is to develop a methodology for quantitative assessments of the risk of dam failure and risk-benefit estimates for alternative measures for dam hazard mitigation, and to establish scientific bases for risk-based dam safety design provisions and criteria.

    A general framework is developed for risk and decision analysis of dams to develop a risk analysis methodology for specific dam failure causes and mechanisms such as earthquakes, landslides, foundation defects and uneven settlements, and load combinations.

HUMAN NUTRITION

An increasing percentage of the American Diet comes from refined and processed foods. Concern is growing about the nutritional value of such foods and about the effects of long-term consumption of processed foods on human health and performance. The major objective of the Human Nutrition program is to evaluate nutritional changes brought about by processing, including refining, cooking, packaging, storage and the use of additives, supplements and substitutes.

1. Chemico-Physical Analysis of Dietary Fiber in Foods; Bertha A. Lewis; Cornell University, Department of Nutritional Sciences, Ithaca, NY 14850; **Award #79-19135 A01**; $103,836 for 12 months beginning March 1, 1981.

   Reliable methodology for the analysis of dietary fiber is important for interpretive studies of the effects of dietary fiber on gastrointestinal function, for dietary therapy, and in food labeling regulation. A primary objective of this research is to evaluate the adequacy and reliability of presently available methods for dietary fiber analysis and to improve the existing methodology for routine analysis. The effect of processing (cooking, freezing, canning, drying) of food on the composition and bioavailability of non-structural carbohydrates is studied. A determination is made of physical properties (particle size, waterholding and ion exchange capacity and absorption of nutrients such as cations, anions and bile acids) of the dietary fiber and its components.

SCIENCE AND TECHNOLOGY TO AID THE HANDICAPPED

The Science and Technology to Aid the Handicapped program supports fundamental scientific research which may lead to products, treatment methods, or societal and environmental changes of significant benefit to the handicapped. (As defined for purposes of this program, handicapped persons are those who have a physical or mental impairment which substantially limits their vocational, educational or social activity.) Awards are made on the basis of scientific and technical merit and the probability that the research will be successful in helping to meet high-priority needs of the handicapped.

1. Tactile Perception of Speech; James C. Craig; Indiana University-Bloomington, Department of Psychology, Bloomington, IN 47401; **Award #80-17178**; $71,451 for 12 months beginning December 1, 1980.

   The major objective of this project is to examine the feasibility of using the tactile sense as an alternate modality for the perception of speech and the understanding of spoken language. Two major questions fundamental to this problem are addressed: first, how should the distinctive elements of acoustic speech signals be transformed to provide recognizable tactile patterns; and second, what is the most effective training procedure for both perceptual learning of tactile speech displays and evaluating various tactile representations of speech?

   Natural and synthetic speech tokens are presented to the skin of the finger(s) using a computer-controlled spectral display and Optacon transducers. Training procedures for the acquisition of tactually-presented speech are developed and evaluated. A novel training paradigm is examined that takes advantage of the close association between speech production and speech perception by allowing learners of tactile speech to produce, hear, and feel their own speech patterns. Results of these experiments have broad implications for the development and improvement of speech aids for the deaf and aids for both perception and production of speech.

2. Production and Visual Articulatory Shaping of Speech in Deaf Children; Samuel G. Fletcher; University of Alabama in Birmingham, Department of Biocommunication, Birmingham, AL 35294; **Award #80-16736**; $122,442 for 12 months beginning November 15, 1980.

   The goal of this research is to bring new scientific and engineering developments to bear on understanding and improving the speech production of deaf children. Four lines of investigation are underway: First, using a new computer-based instrumentation system, a complete physiologic, acoustic, and phonetic description of speech production by 6- to 14-year old deaf and hearing children is developed. These data are used to identify contrasting patterns and strategies of speech production and to investigate relationships between articulatory visibility and proficiency. Second, visual displays and monitoring devices are used to study lip, jaw, and tongue control in articulator positioning and in manipulating forms within the mouth. These data are interpreted from a sensory deprivation viewpoint. Third, static and dynamic visual articulatory displays are used to study recognition of English sounds through vision. Fourth, the efficiency and effectiveness of visual articulatory displays for monitoring the speech of others and changing their own articulatory patterns is explored.

   The goal of this work is to develop an accurate, internalized conceptual schema using vision to specify articulatory targets and guide movements to and from such targets in three dimensional space.

3. The Development of a Nonvocal Communication System for Pre-Reading Children; Cheryl Goodenough-Trep; Tufts-New England Medical Center, Department of Rehabilitation Medicine, Boston, MA 02111; **Award #80-17163**; $165,360 for 24 months beginning December 15, 1980.

The goal of this research is the development of an unrestricted, rapid communication system for severely motorically involved children who have been diagnosed as unlikely to develop functional speech. The system uses visual representations of frequently used words, word-parts and sounds on an elastomeric keyboard, coupled with synthesized speech output, to make available to the pre-reading nonvocal child the means for productive language at a level equivalent to the child's perceptual language. The design of this system makes use of algorithms which select items based on the relative frequencies of occurrence of phoneme-sequences in spoken English.

Nonvocal children are typically able to communicate only in extremely restricted fashion by means of sets of pictures until they have mastered the complexities of English orthography. Picture indication offers little scope for the development of language skills and is conducive to a passive communication strategy which becomes difficult for the nonvocal child to forsake later on. The proposed system will offer a means of providing nonvocal, pre-reading children full, productive access to their linguistic knowledge during the most critical period for the acquisition of language and the development of communicative competence.

4. Urinary Sphincter Control by Collision Block Techniques; J. Thomas Mortimer, Case Western Reserve University, Department of Biomedical Engineering, Cleveland, OH 44106; **Award #80-17190**; $158,332 for 24 months beginning December 1, 1980.

   This research develops a method to block spastic motor activity to the external urinary sphincter. Sphincter spasticity results in incomplete bladder evacuation and is a major complication of spinal cord injury. Efforts to induce bladder evacuation by electrical stimulation of the detrusor muscle can also be complicated by a reflex contraction of the sphincter.

   This study investigates the technique of collision block, a method which uses tiny electrical currents to block a peripheral nerve. The properties of a monopolar electrode system are studied in relation to the generation of unindirectionally-propagated action potentials, the key to achieving success in the collision-block technique. Results of this study are compared with data from various studies using a tripolar electrode. Electrodes are constructed for implantation in animals, and tests are run to determine the effect of tissue ingrowth on the blocking properties of the electrode.

5. Low Bandwidth Video Communication for the Deaf; George Sperling; New York University, Department of Psychology, New York, NY 10003; **Award #80-17189**; $198,433 for 12 months beginning December 1, 1980.

   The only telephone-substitute available to the deaf is the teletypewriter, which is slow and cumbersome. The goal of this research is to develop a television-like system to transmit a dynamic picture between sender and receiver. Such a system would enable the participants to communicate by means of manual systems such as American Sign Language (ASL), finger spelling, and speech reading at rates comparable to spoken English. While television or previously-developed video telephones would serve admirably, they are impractical because they require a bandwidth on the order of 1,000,000 Hz. To maximize its availability, the video communication system must be able to use ordinary telephone lines, which have a bandwidth of 3,000 Hz.

   Preliminary experiments show that 20,000 Hz is adequate for visual communication of ASL; this project continues this research. It involves basic research to determine certain essential parameters of such a system, developmental research to discover an image coding scheme to achieve the bandwidth reduction to 3,000 Hz, and applied research to produce specifications for a prototype. The widespread availability of such a video communication system would have a profoundly favorable social and economic impact on the deaf.

6. Establishment of Common Interconnector Formats for Electronic Communication and Control Aids for Severely Handicapped Individuals; Gregg C. Vanderheiden; University of Wisconsin-Madison, Waisman Center, Madison, WI 53706; **Award #80-06480**; $114,596 for 12 months beginning December 15, 1980.

   Within the last few years, in response to advancing technology and an increasing attention to rehabilitation of severely handicapped individuals, there has been a rapid increase in electronic communication and control aids for individuals having severe or multiple physical disabilities. A large variety of different aids, interfaces, and accessories have been developed to meet the diverse needs, capabilities, and disabilities of the different handicapped individuals. Almost every manufacturer of these aids chose a slightly different connector pin-out, voltage convention, or format. The result has been a situation where clinicians, handicapped individuals, and rehabilitation personnel have the almost impossible task of finding compatible components to meet the special needs of the handicapped user.

   This program develops, through national and international cooperation, a common format for connectors for communication and control aids for the severely physically handicapped. Formats for interfaces, intercontroller connections, and accessories are defined. The results will allow aids and devices of various manufacturers and developers to be interchanged and interconnected easily by non-technical personnel.