NATIONAL SCIENCE FOUNDATION
1800 G STREET, WASHINGTON, D.C. 20550
SCIENCE and TECHNOLOGY to AID THE HANDICAPPED
Donald R. McNeal, Ph. D., Program Manager

A General-Purpose System for the Synthesis by Rule of Natural-Sounding Speech
New standard grant PFR 80-06144
Haskins Laboratories, Inc.
New Haven, Conn. 06510

Ignatius G. Mattingly,
Principal Investigator

Targeted disability: nonvocal, blind. Duration: 24 months.

This project will develop a set of rules for the synthesis of General American English and a computer system for synthesis of natural-sounding speech from these rules. The project is of practical interest because of the need for improved synthetic speech in devices to aid the handicapped and in a number of other applications, and of scientific interest because of the light it may shed on the production and perception of phonetic units.

The quality, intelligibility, and comprehensibility of speech that can now be synthesized by rule still fall well short of those of natural speech. It has been shown that even moderate degradation of speech, as judged by its intelligibility, has a very significant adverse effect on its comprehensibility.

This project concentrates on phonetic as distinct from phonological aspects of the problem, takes the syllable as the unit of processing, and emphasizes timing rules. While the primary objective is to produce synthetic speech of high quality, an important secondary objective is to make a system that phoneticians can easily use.

Speech Perception in Noise by the Hearing-Impaired
New standard grant PFR 80-01936
Northeastern University
Boston, Massachusetts 02115

Bertram Scharf,
Principal Investigator

Targeted disability: hearing-impaired. Duration: 24 months.

A series of experiments will examine the psychoacoustical bases for poor speech perception in noise by persons with sensorineural impairment. Two major hypotheses are to be tested. First, because persons with cochlear impairment are less able than normal-hearing persons to separate out incoming signals on the basis of spectral differences (a deficit referred to as reduced frequency selectivity), they are less able to localize one sound in the presence of other sounds.

Second, this reduced localization ability makes it difficult for the hearing-impaired person to take advantage of the spatial separation of a target speech source and other interfering sources. Such separation is common in real environments and facilitates speech perception by normal-hearing persons.

Tests of these hypotheses, and of the general notion that reduced frequency selectivity is a prime cause of impoverished speech perception in general in sensorineural impairment, will be conducted by means of detailed psychoacoustical measures of frequency selectivity (and the critical band) and of localization and speech perception under masking. Tone bursts, bands of noise, computer-synthesized speech, and natural speech will be presented via earphones or via loudspeakers in a free field.

These data should provide a basis for developing binaural hearing aids with appropriate signal processing.

Capuchin Monkeys as Aides for the Severely Disabled
New standard grant PFR 80-01936
Tufts-New England Medical Center Hospital
Boston, Massachusetts

Mary Joan Willard,
Principal Investigator

Targeted disability: neurologically impaired. Duration: 12 months.

The initial results of a small pilot project to train capuchin monkeys as aides for the severely disabled has shown that monkey helpers are able to perform many tasks for the handicapped, supplementing the assistance provided by personal care attendants and mechanical devices. The goal of this project is to train two capuchin monkeys to perform as aides for two disabled individuals in their respective home environments.

Achieving this goal requires that the animals master a variety of helping skills, that destructive behaviors within the home environment are eliminated, and that the monkeys are 100 percent reliable in depositing waste matter in a designated container within the home cage.

Operant conditioning procedures will be used to achieve these objectives. Determining which procedures best achieve these objectives are the focus of this research. A training manual will be written detailing the training program which is found to be most effective.

Research on Transitory Tactile Displays
New standard grant PFR 80-06382
American Foundation for the Blind
New York, N.Y. 10011

Douglas Maure,
Principal Investigator

Targeted disability: blind. Duration: 18 months.

This project investigates the feasibility of developing a new and inexpensive way to locate, address, raise and lower multiple tactile pins in a transitory array of any configuration. Projected costs are 5 to 100 times lower compared with alternative approaches, depending on size of array.

This research is expected to lead to the development of a new generation of transient tactile arrays to expand reading and information-processing opportunities for blind persons. Potential uses include presentation of braille text stored on a tape cassette, and computer terminal output displays.

Experimental studies will deter-

mine human factor and mechanical design specifications for a range of sizes and configurations. Presentation of graphic data, currently impossible with any transitory display, will be emphasized. Reliability and manufacturing feasibility will be tested, using prototypes to be constructed.

Identification of the Relevant Parameters and their Magnitudes for Electrical Stimulation of Bone Remodeling
New continuing grant PFR 80-06137
University of Pennsylvania
Philadelphia, Pennsylvania 19174

Edward Korostoff,
Principal Investigator

Targeted disability: orthopedically impaired. Duration: 30 months.

There are important current and projected clinical uses of exogeneous electrical bone stimulation. The problem in advancing this field is that very little is known about the theory, and about all that is known (of a practical nature) is that between 10 and 20 microamperes of current will cause bone growth or fracture healing.

This project is aimed at advancing our theoretical understanding of this phenomenon and providing guidelines for clinical application. Experiments are being conducted to understand better the process by which bone develops stress-generated potentials. This is important because the assumption is made that it is this endogeneous electricity that mediates normal bone remodeling.

This assumption is being tested by combining a recently developed microelectrode technique for measuring microscopic stress-generated potentials with an immunohistochemical technique for identifying active bone cells. These experiments will identify the correlation between endogeneous potentials and new cells.

Another set of experiments uses standard reference electrodes to obtain the electrochemical potentials at both anode and cathode, in order to identify the electrochemical and biochemical reactions taking place. These experiments will provide insight into the mechanism of electrical stimulation and will identify the critical parameters and their magnitudes for clinical application.

Application of Personal Computing to Assist the Handicapped
New standard grant PFR 80-17898
Applied Physics Laboratory
Laurel, Maryland 20810

Paul L. Hazen,
Principal Investigator

Targeted disability: general. Duration: 8 months. This is a follow-on to a feasibility study previously funded by the National Science Foundation—PFR 79-21124.

The Johns Hopkins University Applied Physics Laboratory is managing and administering a series of regional and national competitions to find innovative applications of personal computers to assist the handicapped.

To provide opportunities for a broad spectrum of participants, prizes will be awarded for each of the following categories: students, amateurs, professionals and corporations. A handicapped person has been broadly defined as a person suffering from any chronic impairment, either physical or mental in nature.

Rules for participation and judging have been drawn up with the assistance of an Advisory Committee composed of outstanding individuals selected from corporations, universities, governmental agencies, and groups of handicapped persons.

Common Interconnector Formats for Electronic Communication and Control Aids for Severely Handicapped Individuals
New standard grant PFR 80-06480
University of Wisconsin
Madison, Wisconsin 53706

Gregg C. Vanderheiden,
Principal Investigator

Targeted disability: general. Duration: 12 months. (This is a follow-on to a 6-month study previously funded by the National Science Foundation—PFR 80-06477.)

Within the last few years, in response to advancing technology and an increasing attention to rehabilitation of severely handicapped individuals, there has been a very rapid increase in electronic communication and control aids for individuals having severe and multiple physical disabilities.

A large variety of different aids, interfaces, and accessories have been developed to meet the very diverse needs, capabilities, and disabilities of the different handicapped individuals. As might be expected, almost every researcher or 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 an almost impossible task of finding compatible components for the special needs of the handicapped user.

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