

15th Quarterly Progress Report

April 1, 2006 to June 30, 2006

Neural Prosthesis Program Contract N01-DC-02-1006

The Neurophysiological Effects of Simulated Auditory Prosthesis Stimulation

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This report describes our progress during the 15th quarter of contract NIH-NIDCD-DC-02-1006 (April 1, 2006 - June 30, 2006). During this quarter, our effort was directed predominately toward continued work on several archival manuscripts describing our progress during the course of this contract. Also during this quarter, several neurophysiology experiments were conducted that continued and extended our investigations of interactions between cochlear implant channels. These experiments, as well as other work completed during the quarter, are described briefly in the next section. The final section of this report briefly describes the work we plan for the next quarter.

Summary description of work over the last quarter

- During the previous quarter we continued work on several manuscripts currently in progress. Parts of the experimental results described in these manuscripts have been included in previous progress reports. These manuscripts include: S. Bierer et al., “Inferior Colliculus Response to Electrical Stimulation of the Cochlea by Interleaved Pulse Trains,” R. Snyder et al., “The Neurophysiological Effects of Cochlear Implant Stimulation: Electrode Configurations,” and S. Rebscher et al., “Design and Fabrication of Multichannel Cochlear Implant Electrodes for Animal Research.” Work also continues on two additional manuscripts: B. Bonham et al., “Two-Tone Interactions Observed in the Neurons of the Inferior Colliculus: Forward Masking,” and B. Bonham et al., “Focused Electrical Stimulation of the Cochlea: Effects of Changing the Tripolar Remote Current Fraction,” though our efforts during the previous quarter were focused on the first three manuscripts.
- J. Middlebrooks of the University of Michigan visited UCSF to discuss progress on a sixth manuscript describing physiological effects of forward masking by electrical pulse trains observed in the inferior colliculus.
- During the previous quarter, several neurophysiology experiments were completed that continued our investigation of responses to stimulation of multiple auditory information channels. These experiments were conducted at the University of Michigan in the laboratory of J. Middlebrooks. In these experiments, the cochlea was electrically stimulated by unmodulated biphasic current pulse trains delivered via a cochlear implant. The extent of cochlear activation during and following stimulus presentation was determined by observation of neuronal activity along the tonotopic axis of the inferior colliculus (IC). The experiments completed during the this quarter complete our acquisition of data for a manuscript describing the forward masking observed in the inferior colliculus during stimulation of the cochlea by high-rate biphasic current pulse trains.
- We have continued to develop data analysis software, and to analyze experimental data acquired during experiments completed during previous quarters.

- We prepared and submitted an implanted guinea pig cochlea for high-resolution CT scanning. This cochlea was retained from a previously conducted physiology experiment that provided extensive characterization of auditory responses to electrical stimulation by this cochlear implant. We are currently waiting for the results of that scan.
- We continued histological and morphological analysis of previously implanted cochleas.
- We fabricated three guinea pig electrodes to be used in experiments during the next quarter
- We initiated correspondence with Dr. L. Litvak of Advanced Bionics Corporation regarding software that can be used to simulate speech processing by a clinical implant processor. This simulation software will be used in future experiments to examine responses in the inferior colliculus to implant-processed speech signals.

Travel

J. Middlebrooks visited UCSF to discuss progress on experiments and a manuscript describing forward masking during cochlear stimulation by electrical pulse trains. During his visit, B.Bonham, R.Snyder, and J. Middlebrooks also discussed progress of other ongoing work and manuscripts.

Other Activities

Our laboratory hosted a site-visit by Dr. R. Miller, the NIDCD Project Officer for this contract. During his visit, Dr. Miller met with investigators and staff working on this contract. Additionally, he enjoyed an extensive powerpoint presentation describing much of the contract work completed to date, and demonstrations of laboratory and electrode fabrication facilities.

Work planned for next quarter

We plan to continue work on the manuscripts described above and to submit two or three of these manuscripts for publication prior to the end of the next quarter. We plan to continue experiments designed to investigate responses to cochlear stimulation by amplitude modulated biphasic current pulse trains. We plan to collaborate with D. Sinex of Utah State University in a series of experiments that investigate and compare responses to acoustic speech, presented via a loudspeaker, with responses to electrically processed speech presented via a cochlear implant.