A High-Density Cochlear Electrode Array With Programmable Current Shaping

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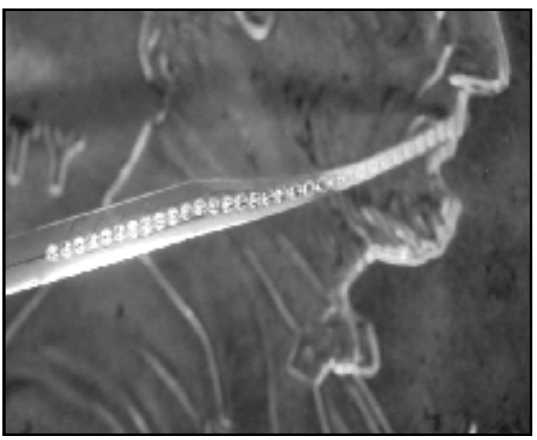
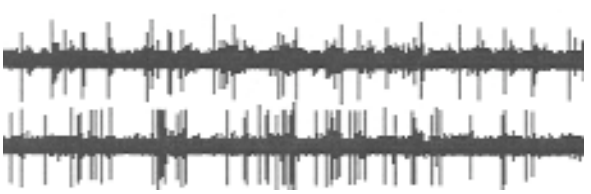
In the development of thin-film, high-density, cochlear electrode arrays, 32-site structures have been developed, including integrated position and wall-contact sensors. Extending these prototype arrays, intended for use in animal studies, to a full high-density array for human use involves a number of remaining challenges. Multi-layer metal having controlled stress and able to conform to the modiolar wall of the scala tympani is needed along with substantially improved robustness when compared to the present silicon-dielectric structures. Improved strategies for site selection, stimulus current generation, and current shaping using multi-polar drive are also needed and must result in circuitry that fits on the back-end of the array. This project is addressing these and other areas. A set of parylene-metal-parylene, parylene-metal-silicon-oxide, and parylene-metal-dielectric cables and electrode arrays has been designed and fabricated. These structures are being tested *in-vivo* and *in-vitro* to verify their integrity. Cable flex tests and insertion of arrays through three-dimensional scala tympani models have demonstrated improved mechanical durability. Future work will address the challenges of controlled-stress multi-level metal. Additionally, new approaches to the interface circuitry will be investigated. This project is supported by the Engineering Research Centers Program of the National Science Foundation under award number EEC-9986866 and by a gift from Ms. Polly Anderson.



A 32-site parylene-metal-parylene cochlear electrode array shown on a U.S. penny.



Two channels of single-unit activity recorded one week post-op using a probe with parylene cables.