A Position-Sensing and Control System for a Cochlear Prosthesis

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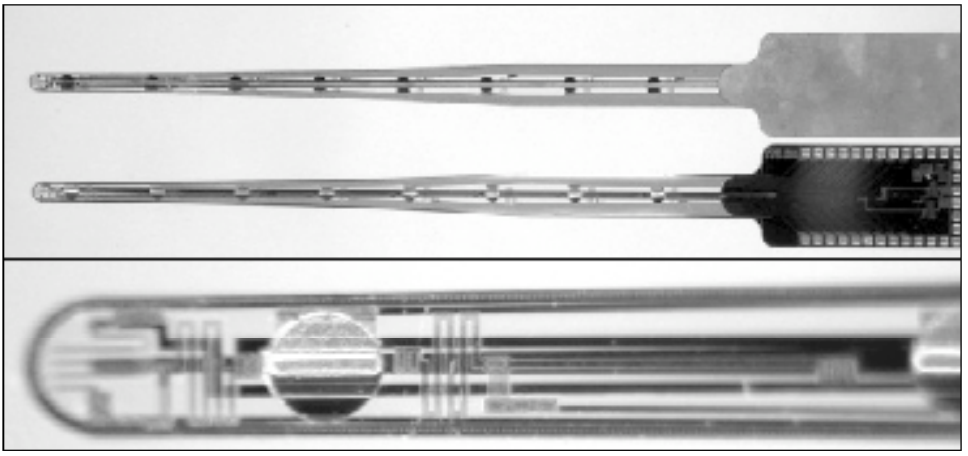

Front and back views of a silicon-dielectric-parylene cochlear probe with integrated position and wall-contact sensors. A detail of the 8mm-long probe tip is shown below.

In cochlear prostheses, the distance between the electrode array and the neural receptors along the cochlear wall is critical not only in determining stimulus levels and frequency resolution, but also in protecting the remaining neurons from damage during the implant. This project seeks to develop sensors for position and wall contact inside the cochlea to allow closed-loop control of stimulus levels and minimize insertion damage. An interface providing multi-point microstimulation and position sensing has been developed, integrating a thin-film electrode array with signal-processing electronics. The array incorporates piezoresistive polysilicon sensors for position and tip contact. The signal-processing chip (2.4mm x 2.4mm) operates from 3V and performs command validation, stimulus generation, sensor selection, 5b offset compensation, and signal conditioning. The calibrated polysilicon sensors have typical gauge factors of 15. They resolve tip position on an 8-segment array to within 50μm. Although the present sensors, intended for animal studies, have shank lengths of only 8mm, they are directly expandable to 32mm-long devices for human use. The present devices employ a parylene coating at wafer level with a bulk silicon release etch. 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.