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Research:

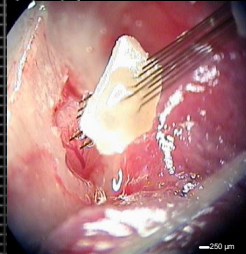
- More than 28 million Americans have some form of hearing loss.
- Deafness etiology generally mandates treatment option.
- Treatment options include:
 - Hearing Aids
 - Cochlear Implants
 - 100,000 patients
 - Auditory Brainstem Implants
 - ~100s of patients
 - Cortical Implants?



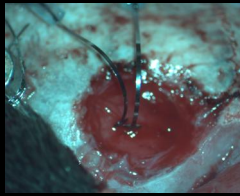
Courtesy of The House Ear Institute, www.hei.org

Methods: Surgical Preparation

Electrode arrays are chronically implanted into the primary auditory cortex.

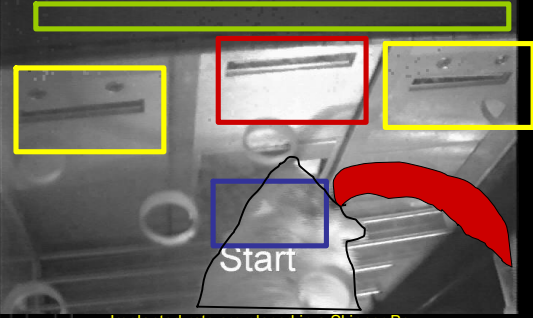


Arrays of tungsten microwires.
16 wires, 50 micron diameter.



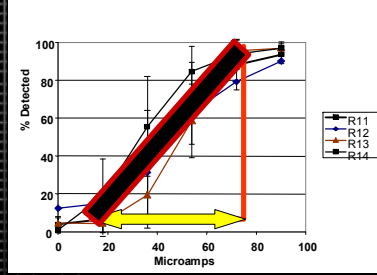
Silicon-substrate microelectrodes.
Two 16-channel devices placed side-by-side

Methods: Behavioral Assessment



Implanted rats are placed in a Skinner Box.
Center lever presses start trial.
Right lever = stimulus present; Left = Null stim.
Stimulus level is varied per trial (displayed at top).
Animals receive food for correct responses.

Microstimulation Detection Results

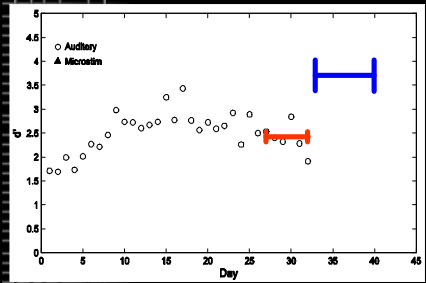


Microamps	R11 (% Detected)	R12 (% Detected)	R13 (% Detected)	R14 (% Detected)
0	0	0	0	0
20	10	10	10	10
40	40	40	40	40
60	70	70	70	70
80	90	90	90	90
100	100	100	100	100

- Average responses of 8 testing sessions for 4 different rats
- The "dynamic range" of the microstimulation intensity in this example is ~60 μ A.

Rousche, Otto and Kipke, Hearing Research 2003

Microstimulation Discrimination Results



Day	Auditory (% Discrimination)	Microstim (% Discrimination)
0	1.5	-
5	2.0	-
10	2.5	-
15	2.8	-
20	2.8	-
25	2.8	2.5
30	2.8	2.5
35	2.8	2.5
40	2.8	2.5
45	2.8	2.5

- Rats were tested for either auditory frequency discrimination or discrimination of microstimulation location.
- Performance on an auditory discrimination task is fairly stable over ~20 days.
- The first microstimulation discrimination session was more accurate than any of the previous auditory sessions.

Otto, Rousche and Kipke, Hearing Research 2005

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KJO1 Kevin Otto, 4/26/2006