

## Coding of speech in the intact and implanted inner ear

W. Hemmert<sup>a</sup>, M. Nicoletti<sup>a</sup>, C. Wirtz<sup>b</sup>, M. Rudnicki<sup>a</sup>

<sup>a</sup>Technische Universität München

<sup>b</sup>MED-EL Deutschland GmbH

werner.hemmert@tum.de

Cochlear implants bypass the damaged inner ear and stimulate the auditory nerve directly with electric current pulses. Coding strategies try to replicate coding of the intact inner ear, however, due to many limitations involved in electrical stimulation, the code provided by the stimulated auditory nerve fiber population differs from the coding in the intact inner ear. We extend our modeling activities to the next levels and model processing in the auditory brain stem and the sound localization pathway to evaluate how precise auditory nerve spike trains are processed.

We found that at least about 5000 auditory nerve fibers are required for faithful coding of speech formants in electric hearing, where the quality of coding depends heavily on the actual distribution of surviving nerve fibers. Our evaluation of the precision of interaural time difference coding suggests that globular bushy neurons significantly sharpen the spatial percept. Our assessment of fine structure coding strategies used in latest cochlear implants revealed not only that they reach a temporal precision to discriminate 7 positions in space but also that these positions are resolved in the activity of the auditory nerve, albeit with much less salience compared to the intact inner ear.

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