

Quarterly Abstract Update

April-June 2006

- 1 Adunka, O. F., Pillsbury, H. C. and Kiefer, J (2006). "Combining perimodiolar electrode placement and atraumatic insertion properties in cochlear implantation - fact or fantasy?" *Acta Otolaryngol* 126(5): 475-82.....5
- 2 Attias, J., Buller, N., Rubel, Y. and Raveh, E (2006). "Multiple auditory steady-state responses in children and adults with normal hearing, sensorineural hearing loss, or auditory neuropathy." *Ann Otol Rhinol Laryngol* 115(4): 268-76. 5
- 3 Barton, G. R., Stacey, P. C., Fortnum, H. M. and Summerfield, A. Q (2006). "Hearing-impaired children in the United Kingdom, II: Cochlear implantation and the cost of compulsory education." *Ear Hear* 27(2): 187-207.....6
- 4 Boex, C., Baud, L., Cosendai, G., Sigrist, A., Koos, M.-I. and Pelizzone, M (2006). "Acoustic to electric pitch comparisons in cochlear implant subjects with residual hearing." *J Assoc Res Otolaryngol* 7(2): 110-24.....7
- 5 Briaire, J. J. and Frijns, J. H. M (2006). "The consequences of neural degeneration regarding optimal cochlear implant position in scala tympani: a model approach." *Hear Res* 214(1-2): 17-27.8
- 6 Brungart, D. S., Lyer, N. and Simpson, B. D (2006). "Monaural speech segregation using synthetic speech signals." *J Acoust Soc Am* 119(4): 2327-33. 8
- 7 Campisi, P (2006). "Voice analysis in pediatric cochlear implant recipients." *Int J Pediatr Otorhinolaryngol* 70(4): 760 @@ - 230-0468-2793-0.9
- 8 Cartee, L. A., Miller, C. A. and van den Honert, C (2006). "Spiral ganglion cell site of excitation I: comparison of scala tympani and intrameatal electrode responses." *Hear Res* 215(1-2): 10-21.9
- 9 Choi, C. T. M., Wei-Dian Lai and Sih-Sian Lee (2006) "A novel approach to compute the impedance matrix of a cochlear implant system incorporating an electrode-tissue interface based on finite element method." *IEEE Trans. Magn. (USA)* 42(4): 1375-8.....9
- 10 Clark, G. M (2006). "The multiple-channel cochlear implant: the interface between sound and the central nervous system for hearing, speech, and language in deaf people-a personal perspective." *Philos Trans R Soc Lond B Biol Sci* 361(1469): 791-810. 10
- 11 Clark, G. M (2006). "Review. The multiple-channel cochlear implant: the interface between sound and the central nervous system for hearing, speech, and language in deaf people-a personal perspective." *Philos Trans R Soc Lond B Biol Sci* 361(1469): 791-810. 10
- 12 Damen, G. W. J. A., Pennings, R. J. E., Snik, A. F. M. and Mylanus, E. A. M (2006). "Quality of life and cochlear implantation in Usher syndrome type I." *Laryngoscope* 116(5): 723-8..... 11

13	Faulkner, A., Rosen, S. and Norman, C (2006). "The right information may matter more than frequency-place alignment: simulations of frequency-aligned and upward shifting cochlear implant processors for a shallow electrode array insertion." <i>Ear Hear</i> 27(2): 139-52.	11
14	Flipsen, P., Jr. and Colvard, L. G. (2006). "Intelligibility of conversational speech produced by children with cochlear implants." <i>Journal of Communication Disorders</i> 39(2): 93-108.	12
15	Friedland, D. R (2006). "Structure and function in the auditory system: From cochlea to cortex." <i>Anat Rec A Discov Mol Cell Evol Biol</i> 288(4): 326-30.	13
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1 **“Combining perimodiolar electrode placement and atraumatic insertion properties in cochlear implantation - fact or fantasy?”** Adunka, O. F., Pillsbury, H. C. and Kiefer, J (2006). Acta Otolaryngol 126(5): 475-82.

Conclusions. Except for basal cochlear traumatization, all specimens implanted into scala tympani showed atraumatic insertion properties and good perimodiolar electrode positioning. Cochleostomy preparation and placement can have a significant impact on levels of basal cochlear trauma. Objective. In the past, perimodiolar cochlear implant electrodes increased the risk for intracochlear traumatization when compared to free-fitting arrays. Recently, however, clinical evidence for atraumatic perimodiolar implantations with preservation of residual hearing has been described. The aim of this paper was to histologically evaluate a perimodiolar cochlear implant array for its insertion properties in cadaver human temporal bones. Surgical and electrode factors, as well as preparation artifacts influencing intracochlear trauma, were considered in the evaluation. Materials and methods. Sixteen human temporal bones were harvested up to 24 hours post mortem and implanted immediately with the Nucleus 24 Contour Advance cochlear implant electrode array. Implantations were either performed using a regular caudal approach cochleostomy or through the round window membrane. After implantation, all bones underwent special histological processing, which allowed sectioning of undecalcified bone. Insertion properties were evaluated according to a grading system. Results. Fourteen specimens were implanted into scala tympani and only two exhibited basal trauma attributable to electrode insertion characteristics. Two bones were implanted into scala vestibuli after causing trauma in the region of the cochleostomy. Insertion depths ranged from 180 degrees to 400 degrees . All bones showed good perimodiolar electrode positioning. Basal trauma due to surgical issues and histological artifacts was present in 10 of 16 bones. @@ - 230-0482-8234-0

2 **“Multiple auditory steady-state responses in children and adults with normal hearing, sensorineural hearing loss, or auditory neuropathy.”** Attias, J., Buller, N., Rubel, Y. and Raveh, E (2006). Ann Otol Rhinol Laryngol 115(4): 268-76.

OBJECTIVES: We tested the clinical effectiveness of multiple auditory steady-state responses (ASSRs) for the objective assessment of hearing thresholds in patients with and without hearing loss, candidates for cochlear implants, and children with auditory neuropathy. METHODS: The study sample included 29 subjects with sensorineural hearing loss (SNHL), 18 candidates for cochlear implants, 11 subjects with auditory neuropathy, and 18 subjects with normal hearing thresholds. Behavioral hearing thresholds and ASSRs to carrier frequencies of 0.5, 1, 2, and 4 kHz were obtained. Special care was taken to minimize possible aliasing and high-intensity

multiple stimulation effects. Differences and correlations between the ASSRs and the behavioral thresholds were determined. RESULTS: The ASSR estimation of behavioral thresholds in the normal-hearing group was elevated, whereas very close predictions were found for the SNHL group. The correlations between the two measures ranged from 0.86 at 0.5 kHz carrier frequency to 0.94 at 2 kHz. In the cochlear implant candidates and the auditory neuropathy group, the ASSR thresholds generally overestimated the behavioral audiogram. In these groups the number of detected ASSRs was higher than the number of behavioral responses, especially for the high-frequency carrier stimuli. CONCLUSIONS: Multiple ASSRs may reliably predict the behavioral threshold in subjects with SNHL and may serve as a valuable objective measure for assessing the hearing threshold across different frequencies in candidates for cochlear implants and children with auditory neuropathy. @@ - 234-1713-2023-2

3 "Hearing-impaired children in the United Kingdom, II: Cochlear implantation and the cost of compulsory education." Barton, G. R., Stacey, P. C., Fortnum, H. M. and Summerfield, A. Q (2006). Ear Hear 27(2): 187-207.

OBJECTIVE: The objective of this study was to estimate the impact of cochlear implantation on the cost of compulsory education of hearing-impaired children in the United Kingdom. STUDY DESIGN: In a cross-sectional survey, teachers were asked to report the school placement of, and amount of support provided to, a representative sample of hearing-impaired children. Costs of school placement were obtained from published sources. Costs of support were calculated from a survey of 11 special education services. The annual education cost (in euros at 2001/2002 levels) of each child was calculated by summing the placement and support costs. Linear regression analyses calculated the association between annual education cost and possession of an implant while controlling nine other variables: average (unaided, preoperative) hearing level (AHL), age at onset of hearing impairment, age, gender, the number of additional disabilities, parental occupational skill level, ethnicity, parental hearing status, and academic achievement. RESULTS: Data were received for 2241 children, 383 of whom had cochlear implants. Mean annual education cost ranged from 15,745 euros for children with moderate hearing impairments to 30,071 euros for nonimplanted children with profound hearing impairments and was 28,058 euros for implanted children. A lower annual education cost was associated with a more favorable AHL, a later age at the onset of hearing impairment, female gender, a younger age, fewer additional disabilities, and a higher level of academic achievement. When these variables were controlled, costs were lower on average for implanted compared with nonimplanted children for the subset of children whose AHLs exceeded 111 dB. At the mean AHL of the implanted children (115 dB), implantation was associated with a reduction of 3105 euros (95% confidence interval, 1105 euros to 5106 euros) in annual

education costs. **CONCLUSIONS:** Pediatric cochlear implantation is sufficiently effective to influence resource-allocation decisions in the education sector. The health-service cost of implantation is partly offset by savings in the cost of education. These savings occur without detriment to academic achievements. @@ - 230-0469-3344-9

4 "Acoustic to electric pitch comparisons in cochlear implant subjects with residual hearing." Boex, C., Baud, L., Cosendai, G., Sigrist, A., Koos, M.-I. and Pelizzone, M (2006). J Assoc Res Otolaryngol 7(2): 110-24.

The aim of this study was to assess the frequency-position function resulting from electric stimulation of electrodes in cochlear implant subjects with significant residual hearing in their nonimplanted ear. Six cochlear implant users compared the pitch of the auditory sensation produced by stimulation of an intracochlear electrode to the pitch of acoustic pure tones presented to their contralateral nonimplanted ear. Subjects were implanted with different Clarion electrode arrays, designed to lie close to the inner wall of the cochlea. High-resolution radiographs were used to determine the electrode positions in the cochlea. Four out of six subjects presented electrode insertions deeper than 450 degrees . We used a two-interval (one acoustic, one electric), two-alternative forced choice protocol (2I-2AFC), asking the subject to indicate which stimulus sounded the highest in pitch. Pure tones were used as acoustic stimuli. Electric stimuli consisted of trains of biphasic pulses presented at relatively high rates higher than 700 pulses per second (pps) . First, all electric stimuli were balanced in loudness across electrodes. Second, acoustic pure tones, chosen to approximate roughly the pitch sensation produced by each electrode, were balanced in loudness to electric stimuli. When electrode insertion lengths were used to describe electrode positions, the pitch sensations produced by electric stimulation were found to be more than two octaves lower than predicted by Greenwood's frequency-position function. When insertion angles were used to describe electrode positions, the pitch sensations were found about one octave lower than the frequency-position function of a normal ear. The difference found between both descriptions is because of the fact that these electrode arrays were designed to lie close to the modiolus. As a consequence, the site of excitation produced at the level of the organ of Corti corresponds to a longer length than the electrode insertion length, which is used in Greenwood's function. Although exact measurements of the round window position as well as the length of the cochlea could explain the remaining one octave difference found when insertion angles were used, physiological phenomena (e.g., stimulation of the spiral ganglion cells) could also create this difference. From these data, analysis filters could be determined in sound coding strategies to match the pitch percepts elicited by electrode stimulation. This step might be of main importance for music perception and for the fitting of bilateral cochlear implants. @@ - 230-0494-9688-1

5 **“The consequences of neural degeneration regarding optimal cochlear implant position in scala tympani: a model approach.”** Briaire, J. J. and Frijns, J. H. M (2006). Hear Res 214(1-2): 17-27.

Cochlear implant research endeavors to optimize the spatial selectivity, threshold and dynamic range with the objective of improving the speech perception performance of the implant user. One of the ways to achieve some of these goals is by electrode design. New cochlear implant electrode designs strive to bring the electrode contacts into close proximity to the nerve fibers in the modiolus: this is done by placing the contacts on the medial side of the array and positioning the implant against the medial wall of scala tympani. The question remains whether this is the optimal position for a cochlea with intact neural fibers and, if so, whether it is also true for a cochlea with degenerated neural fibers. In this study a computational model of the implanted human cochlea is used to investigate the optimal position of the array with respect to threshold, dynamic range and spatial selectivity for a cochlea with intact nerve fibers and for degenerated nerve fibers. In addition, the model is used to evaluate the predictive value of eCAP measurements for obtaining peri-operative information on the neural status. The model predicts improved threshold, dynamic range and spatial selectivity for the peri-modiolar position at the basal end of the cochlea, with minimal influence of neural degeneration. At the apical end of the array (1.5 cochlear turns), the dynamic range and the spatial selectivity are limited due to the occurrence of cross-turn stimulation, with the exception of the condition without neural degeneration and with the electrode array along the lateral wall of scala tympani. The eCAP simulations indicate that a large P(0) peak occurs before the N(1)P(1) complex when the fibers are not degenerated. The absence of this peak might be used as an indicator for neural degeneration. @@ - 230-0487-5420-7

6 **“Monaural speech segregation using synthetic speech signals.”** Brungart, D. S., Lyster, N. and Simpson, B. D (2006). J Acoust Soc Am 119(4): 2327-33.

When listening to natural speech, listeners are fairly adept at using cues such as pitch, vocal tract length, prosody, and level differences to extract a target speech signal from an interfering speech masker. However, little is known about the cues that listeners might use to segregate synthetic speech signals that retain the intelligibility characteristics of speech but lack many of the features that listeners normally use to segregate competing talkers. In this experiment, intelligibility was measured in a diotic listening task that required the segregation of two simultaneously presented synthetic sentences. Three types of synthetic signals were created: (1) sine-wave speech (SWS); (2) modulated noise-band speech (MNB); and (3) modulated sine-band speech (MSB). The listeners performed worse for all three types of synthetic signals than they did with natural speech signals, particularly at low signal-to-noise

ratio (SNR) values. Of the three synthetic signals, the results indicate that SWS signals preserve more of the voice characteristics used for speech segregation than MNB and MSB signals. These findings have implications for cochlear implant users, who rely on signals very similar to MNB speech and thus are likely to have difficulty understanding speech in cocktail-party listening environments. @@ - 234-1721-9236-6

7 **"Voice analysis in pediatric cochlear implant recipients."** Campisi, P (2006). Int J Pediatr Otorhinolaryngol 70(4): 760 @@ - 230-0468-2793-0.

Abstract Unavailable

8 **"Spiral ganglion cell site of excitation I: comparison of scala tympani and intrameatal electrode responses."** Cartee, L. A., Miller, C. A. and van den Honert, C (2006). Hear Res 215(1-2): 10-21.

To determine the site of excitation on the spiral ganglion cell in response to electrical stimulation similar to that from a cochlear implant, single-fiber responses to electrical stimuli delivered by an electrode positioned in the scala tympani were compared to responses from stimuli delivered by an electrode placed in the internal auditory meatus. The response to intrameatal stimulation provided a control set of data with a known excitation site, the central axon of the spiral ganglion cell. For both intrameatal and scala tympani stimuli, the responses to single-pulse, summation, and refractory stimulus protocols were recorded. The data demonstrated that summation pulses, as opposed to single pulses, are likely to give the most insightful measures for determination of the site of excitation. Single-fiber summation data for both scala tympani and intrameatally stimulated fibers were analyzed with a clustering algorithm. Combining cluster analysis and additional numerical modeling data, it was hypothesized that the scala tympani responses corresponded to central excitation, peripheral excitation adjacent to the cell body, and peripheral excitation at a site distant from the cell body. Fibers stimulated by an intrameatal electrode demonstrated the greatest range of jitter measurements indicating that greater fiber independence may be achieved with intrameatal stimulation. @@ - 230-0497-2710-3

9 **"A novel approach to compute the impedance matrix of a cochlear implant system incorporating an electrode-tissue interface based on finite element method."** Choi, C. T. M., Wei-Dian Lai and Sih-Sian Lee IEEE Trans. Magn. (USA) 42(4): 1375-8.

This paper proposes to use a new and realistic finite element model of a single turn human cochlea and cochlear implant electrode array with electrode-tissue interface to model the electric field imaging technique, which creates an impedance matrix. Due to discrepancy in the Warburg capacitor in

the active and nonactive electrode contacts and electric power lost along the cochlea, the diagonal terms of the impedance matrix is larger than the off diagonal terms, which represent the impedance values of the nonactive electrode contacts. The impedance matrix from electric field imaging measurements is compared with the simulation results. @@ - 259-0895-1910-4

10 "The multiple-channel cochlear implant: the interface between sound and the central nervous system for hearing, speech, and language in deaf people-a personal perspective." Clark, G. M (2006). Philos Trans R Soc Lond B Biol Sci 361(1469): 791-810.

The multiple-channel cochlear implant is the first sensori-neural prosthesis to effectively and safely bring electronic technology into a direct physiological relation with the central nervous system and human consciousness, and to give speech perception to severely-profoundly deaf people and spoken language to children. Research showed that the place and temporal coding of sound frequencies could be partly replicated by multiple-channel stimulation of the auditory nerve. This required safety studies on how to prevent the effects to the cochlea of trauma, electrical stimuli, biomaterials and middle ear infection. The mechanical properties of an array and mode of stimulation for the place coding of speech frequencies were determined. A fully implantable receiver-stimulator was developed, as well as the procedures for the clinical assessment of deaf people, and the surgical placement of the device. The perception of electrically coded sounds was determined, and a speech processing strategy discovered that enabled late-deafened adults to comprehend running speech. The brain processing systems for patterns of electrical stimuli reproducing speech were elucidated. The research was developed industrially, and improvements in speech processing made through presenting additional speech frequencies by place coding. Finally, the importance of the multiple-channel cochlear implant for early deafened children was established. @@ - 230-0494-8693-2

11 "Review. The multiple-channel cochlear implant: the interface between sound and the central nervous system for hearing, speech, and language in deaf people-a personal perspective." Clark, G. M (2006). Philos Trans R Soc Lond B Biol Sci 361(1469): 791-810.

The multiple-channel cochlear implant is the first sensori-neural prosthesis to effectively and safely bring electronic technology into a direct physiological relation with the central nervous system and human consciousness, and to give speech perception to severely-profoundly deaf people and spoken language to children. Research showed that the place and temporal coding of sound frequencies could be partly replicated by multiple-channel stimulation of the auditory nerve. This required safety studies on how to prevent the

effects to the cochlea of trauma, electrical stimuli, biomaterials and middle ear infection. The mechanical properties of an array and mode of stimulation for the place coding of speech frequencies were determined. A fully implantable receiver-stimulator was developed, as well as the procedures for the clinical assessment of deaf people, and the surgical placement of the device. The perception of electrically coded sounds was determined, and a speech processing strategy discovered that enabled late-deafened adults to comprehend running speech. The brain processing systems for patterns of electrical stimuli reproducing speech were elucidated. The research was developed industrially, and improvements in speech processing made through presenting additional speech frequencies by place coding. Finally, the importance of the multiple-channel cochlear implant for early deafened children was established. @@ - 230-0474-9622-2

12 "Quality of life and cochlear implantation in Usher syndrome type I."

Damen, G. W. J. A., Pennings, R. J. E., Snik, A. F. M. and Mylanus, E. A. M (2006). Laryngoscope 116(5): 723-8.

OBJECTIVES: The objectives of this descriptive, retrospective study were to evaluate quality of life, hearing, and vision in patients with Usher syndrome type I with and without cochlear implant. **METHODS:** Quality of life (QoL) of 14 patients with Usher type I (USH1) with a cochlear implant (CI) (seven adults, seven children) was compared with those of 14 patients with USH1 without a CI (12 adults, two children) by means of three questionnaires: NCIQ, SF12, and the Usher Lifestyle Survey. Additional information on hearing level was obtained by the equivalent hearing loss (EHL) principle and on the visual deterioration by the functional vision score (FVS). **RESULTS:** A significant benefit of CI was seen in the hearing-specific questionnaire NCIQ. This difference could not be detected in the generic SF12 survey. The Usher Lifestyle Survey indicated that patients with USH1 with a CI tend to be able to live an independent life more easily than the profoundly deaf unimplanted patients with USH1. EHL and FVS scores varied in both groups. **CONCLUSIONS:** Overall QoL can be enhanced by CI in patients with USH1, although effects are mostly seen in hearing-related QoL items. @@ - 234-1722-7664-9

13 "The right information may matter more than frequency-place alignment: simulations of frequency-aligned and upward shifting cochlear implant processors for a shallow electrode array insertion."

Faulkner, A., Rosen, S. and Norman, C (2006). Ear Hear 27(2): 139-52.

OBJECTIVE: It has been claimed that speech recognition with a cochlear implant is dependent on the correct frequency alignment of analysis bands in the speech processor with characteristic frequencies (CFs) at electrode locations. However, the use of filters aligned in frequency to a relatively basal

electrode array position leads to significant loss of lower frequency speech information. This study uses an acoustic simulation to compare two approaches to the matching of speech processor filters to an electrode array having a relatively shallow depth within the typical range, such that the most apical element is at a CF of 1851 Hz. Two noise-excited vocoder speech processors are compared, one with CF-matched filters, and one with filters matched to CFs at basilar membrane locations 6 mm more apical than electrode locations. DESIGN: An extended crossover training design examined pre- and post-training performance in the identification of vowels and words in sentences for both processors. Subjects received about 3 hours of training with each processor in turn. RESULTS: Training improved performance with both processors, but training effects were greater for the shifted processor. For a male talker, the shifted processor led to higher post-training scores than the frequency-aligned processor with both vowels and sentences. For a female talker, post-training vowel scores did not differ significantly between processors, whereas sentence scores were higher with the frequency-aligned processor. CONCLUSIONS: Even for a shallow electrode insertion, we conclude that a speech processor should represent information from important frequency regions below 1 kHz and that the possible cost of frequency misalignment can be significantly reduced with listening experience. @@ - 230-0469-3341-5

14 **"Intelligibility of conversational speech produced by children with cochlear implants."** Flipsen, P., Jr. and Colvard, L. G. (2006). Journal of Communication Disorders 39(2): 93-108.

The intelligibility of conversational speech produced by six children fitted with cochlear implants before age 3 years was measured longitudinally. Samples were obtained every 3 months during periods of 12-21 months. Intelligibility was measured using both an utterance-by-utterance approach and an approach to the sample as a whole. Statistically significant differences were observed between the two approaches, but the differences were all within the realm of measurement error. Findings indicated that intelligible speech emerges quite rapidly in these children. Conversational intelligibility appears to be superior to that reported in the literature for similar children who use hearing aids but not necessarily as good as in children with normal hearing. Both intelligibility measures were significantly correlated with chronological age, hearing age, and amount of implant use. but were most strongly correlated with chronological age. Learning outcomes: The reader will be able to (1) describe some of the issues involved in measuring speech intelligibility in children with cochlear implants and (2) describe the pattern of outcomes for the intelligibility of speech produced by children receiving cochlear implants before age 3 years. (c) 2005 Elsevier Inc. All rights reserved. @@ - 244-0400-3194-4

15 **“Structure and function in the auditory system: From cochlea to cortex.”** Friedland, D. R (2006). Anat Rec A Discov Mol Cell Evol Biol 288(4): 326-30.

This special issue of the Anatomical Record examines the relationship between structure and function in the auditory system. Early anatomical studies defined this relationship on a macroscopic level and described the roles of structures such as the tympanic membrane, ossicular chain, Eustachian tube, and cochlea. As new tools emerged, the microscopic structure of the organ of Corti was described and later the brain stem regions involved in auditory processing were identified. Further technical advances allowed the description of cells within these central auditory regions in both morphological and physiological terms. More recently, studies of the auditory system have employed molecular biological techniques and novel imaging protocols. All these techniques continue to provide important insights into the structure and function of the auditory system on gross, cellular, and molecular levels. This issue expounds on this theme by demonstrating the importance of anatomy, whether the shape of the otic capsule or the sequence of a gene, in determining the function of the system and even the phenotype of the organism. The articles in this issue represent the cutting edge of today's auditory science and look back at the evolution of hearing and balance, as well as forward toward improving cochlear implant outcomes and gene therapies for treating sensorineural hearing loss. Copyright 2006 Wiley-Liss, Inc. @@ - 234-1723-4709-3

16 **“How we do it: Reinsertion of the stylet into the nucleus contour cochlear implant to facilitate second insertion. A helpful technique salvaging the cochlear implant device.”** Grolman, W., Verdam, F. J. and Tange, R. A (2006). Clin Otolaryngol 31(3): 230-2.

Keypoints * There are several causes for failure of appropriate position of the electrode array of the nucleus cochlear implant, e.g. incomplete insertion, extrusion, luxation, curling of the device, deviation, or false route. * If the position of the electrode array in relation to the modiolus is unsatisfactory, in order to salvage the cochlear implant one can reload the cochlear implant array with its stylet. * In order to reload the electrode array, primarily it needs to be removed from the cochlea and inserted into a small size suction tube (lubricated with just water). Then the stylet needs to be carefully straightened and inserted into the lumen of the array. * This technique is a relatively simple solution for unsatisfactory placement of the electrode array and can prevent discarding the precious cochlear implant. @@ - 230-0494-2344-8

17 **"Safety study of the Cochlear Nucleus 24 device with internal magnet in the 1.5 Tesla magnetic resonance imaging scanner."** Gubbels, S. P. and McMenomey, S. O (2006). Laryngoscope 116(6): 865-71.

OBJECTIVES: To evaluate the effect of the 1.5 Tesla magnetic resonance imager (MRI) on the Cochlear Nucleus 24 Device without removing the internal magnet. To determine whether device fixation using a compression dressing could prevent internal magnet displacement in the MRI scanner and potentially obviate the need for surgical removal of the internal magnet. STUDY DESIGN: Prospective cadaveric study. METHODS: Four cadaver heads were implanted bilaterally with the Nucleus device with the internal magnet in place and placed into the 1.5 Tesla MRI scanner. The devices were then explanted after interaction with the MRI and evaluated for displacement of the internal magnet. Conditions tested include device fixation with a commercially available compression dressing and no fixation (worst-case scenario). Magnet strength was measured before and after each of the test conditions. RESULTS: Moderate to severe displacement of the magnet from the internal device occurred in 14 of 16 (87%) implants when no compression dressing was placed. Displacement occurred in 0 of 16 (0%) implants when the compression dressing was applied. No decrease in the strength of the implant magnet was found with the initial or subsequent MRI/implant interactions. CONCLUSIONS: Use of the 1.5 Tesla MRI on subjects with Cochlear Nucleus 24 implants did not result in any significant demagnetization of the internal magnet and did not cause displacement of the magnet when an external compression dressing was applied. Surgical removal of the internal magnet before scanning with the 1.5 Tesla MRI may not be necessary if a compression dressing is applied. @@ - 234-1723-6518-6

18 **"Treatment of hearing impairment in children."** Hempel, J. M. and Krause, E (2006). MMW Fortschr Med 148(19): 30-3.

The prerequisite for normal speech development is the ability to hear normally. Our objective here is the detection of a hearing deficit with a relevant impact on the acquisition of speech before the child is three months old. Such a hearing impairment due to sensorineural deafness requires the provision of a hearing aid, which needs to be done before the child is six months old. If the provision of a hearing aid fails to provide the desired results, or if they may no longer be expected, a cochlear implant is indicated. In the event of tympanic effusion persistence, an adenotomy with paracentesis, and possibly the insertion of an ear tube, is indicated. This intervention can be done before the child is one year old. Permanent sound-conduction deafness may be due to auditory canal atresia or middle ear anomalies. In such cases, it is important to establish whether surgical reconstruction, for example of the sound conduction system, can restore good

hearing over the long term. Prior to surgery at the age of about five, the child must be provided with a hearing aid. @@ - 230-0490-1626-7

19 **"A longitudinal study of electrical stimulation levels and electrode impedance in children using the Clarion cochlear implant."** Henkin, Y., Kaplan-Neeman, R., Kronenberg, J., Migirov, L., Hildesheimer, M. and Muchnik, C (2006). Acta Otolaryngol 126(6): 581-6.

Conclusions. Electrical stimulation levels and electrode impedance values (EIVs) in children using the Clarion cochlear implant (CI) programmed with CIS strategy stabilized after 3 months of implant use. The data presented here may be useful as a general guideline for the programming of infants and young children and may further be of help for the identification of patients who fall outside the "average" range. Objectives. The purpose of the present study was to evaluate changes in electrical stimulation levels, i.e. threshold (T) levels, comfortable (M) levels, dynamic range (DR), and EIVs during the first 18 months of implant use, in children using the Clarion CI. Materials and methods. The maps of 18 pre-lingual children (mean age at implantation 4.2 years; range 1-8), using the Enhanced Bipolar 1.2 or Bipolar standard electrode with the S-Series speech processor programmed with CIS strategy, were examined at five time points: connection, and 3, 6, 12, and 18 months post-initial stimulation. T levels, M levels, DR and EIVs were analyzed according to four cochlear segments: apical, apical-medial, medial-basal, and basal. Results. During the first 3 months of implant use T levels increased to some extent, whereas M levels and DR increased significantly. From 3 months and through the entire follow-up, T and M levels as well as DR were stable. EIVs of current carrying electrodes decreased significantly from connection to the 3-month visit; thereafter a stabilization of values was evident. Electrical stimulation levels and EIVs did not differ among the cochlear segments during the entire follow-up. @@ - 230-0486-5856-4

20 **"Change of phonation control after cochlear implantation."** Hocevar-Boltezar, I., Radsel, Z., Vatovec, J., Geczy, B., Cernelc, S., Gros, A., Zupancic, J., Battelino, S., Lavrencak, B. and Zargi, M (2006). Otol Neurotol 27(4): 499-503.

OBJECTIVE:: To assess the influence of acquired auditory control on some voice parameters in deaf children and adults after cochlear implantation. STUDY DESIGN:: Prospective clinical study. SETTING:: Tertiary referral center. PATIENTS:: Twenty-nine prelingually deafened children and 11 postlingually deafened adults. INTERVENTIONS:: The samples of a vowel /a/ were analyzed with an Multi-Dimensional Voice Program (Kay Elemetrics Corporation, Lincoln Park, NJ) before and 6 to 12 months after the cochlear implantation. MAIN OUTCOME MEASURES:: The average fundamental frequency (F0), the short-term variation of F0 (JIT) and the amplitude (SH),

the very long-term variation of F0 (vF0) and the amplitude (vAm), and the noise-to-harmonic ratio (NHR) were determined and compared for both age groups. The results of the acoustic analysis performed before the implantation were compared with the results after the implantation for children and adults. RESULTS:: Significantly greater JIT, SH, vF0, and vAm were detected in the children than in the adults before and after the implantation. The prelingually deafened children significantly improved the control of their phonation after 6 to 12 months' use of the cochlear implant (JIT: $p = 0.014$, SH: $p = 0.011$, vF0: $p = 0.014$, vAm: $p = 0.031$). In the postlingually deafened adults, no significant improvement was found in any of the studied voice parameters after the implantation. F0 showed little or no change after the implantation in children and adults. CONCLUSION:: As expected, the voice quality of the prelingually deafened children was significantly worse than that of the postlingually deafened adults. After cochlear implantation, the children significantly improved their short-term and long-term F0 and amplitude variability. In adults, no significant improvement was detected. We suppose that the improvement is a consequence not only of the acquired hearing control but also of the adaptation ability of neuromuscular phonation control and the maturing of these control mechanisms in children. In adults, better phonation quality in general and lesser improvement after the implantation can be the results of well-developed and stable phonation patterns. @@ - 230-0499-1355-4

21 **"Voice and pronunciation of cochlear implant speakers."** Horga, D. and Liker, M (2006). Clin. Linguist. Phon.

Patients with cochlear implants have the ability to exercise auditory control over their own speech production and over the speech of others, which is important for the development of speech control. In the present investigation three groups of 10 subjects were compared. The groups comprised: (1) cochlear implant users, (2) profoundly deaf using traditional hearing aids, and (3) hearing controls. The subjects in three groups were matched in age. While repeating after a model the subjects were recorded and the following linguistic voice variables were analysed: (1) vowel formant space, (2) voice vs. voiceless difference, (3) closure duration and VOT, (4) word accent production, (5) sentence stress production, (6) voice quality, (7) pronunciation quality. Acoustic analysis and perceptual assessment by phoneticians showed that in great majority of variables, subjects with cochlear implants performed better than the profoundly deaf subjects with traditional hearing-aids. © 2006 Taylor & Francis. @@ - 012-2619-5744-8

22 **"Plasticity in the adult central auditory system."** Irvine, D. R. F., Fallon, J. B. and Kamke, M. R (2006). Acoust. Aust. (Australia) 34(1): 13-17.

The central auditory system retains into adulthood a remarkable capacity for plastic changes in the response characteristics of single neurons and the functional organization of groups of neurons. The most dramatic examples of this plasticity are provided by changes in frequency selectivity and organization as a consequence of either partial hearing loss or procedures that alter the significance of particular frequencies for the organism. Changes in temporal resolution are also seen as a consequence of altered experience. These forms of plasticity are likely to contribute to the improvements exhibited by cochlear implant users in the post-implantation period. @@ - 259-0893-5745-5

23 **"Fabrication and optimal design of differential electromagnetic transducer for implantable middle ear hearing device."** Kim, M.-K., Park, I.-Y., Song, B.-S. and Cho, J.-H (2006). Biosens Bioelectron 21(11): 2170-5.

A differential electromagnetic transducer (DET), with similar frequency characteristics to those of a normal middle ear, is designed and implemented for use in an implantable middle ear hearing device (IMEHD). To optimize the characteristics of the DET that depend on the electromagnetically forced vibration, a theoretical analysis is conducted to design the vibrating part. The electromagnetic force of the DET is simulated according to the design parameters of the coil size using a finite element analysis (FEA). As a result, the maximal vibration force is achieved when the optimal length and thickness of the cylindrical coil is 70% of the length of the magnets and 56% of their radius. The vibration characteristics of the DET are then simulated when applying the maximal force. The optimally designed DET is implemented using MEMS technology and vibration experiments carried out with the fabricated DET in an unloaded state. The vibrating displacement of the DET is about 200 nm within a range between 0.1 and 1.5 kHz when a current of 1 mA(rms) is applied to the coil. To investigate the usefulness of the DET, in vitro and in vivo experiments are conducted using the ossicular chain of a cadaver and guinea pig, and the results verify that the implemented DET performs well as a transducer for an IMEHD. @@ - 230-0480-1295-2

24 **"Social and emotional characteristics of adults seeking a cochlear implant and their spouses."** Knutson, J. F., Johnson, A. and Murray, K. T (2006). Br J Health Psychol 11(Pt 2): 279-92.

OBJECTIVES: Because past research has shown that benefits of cochlear implantation may include a significant decrease in psychological and emotional difficulties, this study examined whether persons seeking cochlear implants in recent years differed psychologically from those referred in the

early 1980s. A second objective was to explore mechanisms by which profound deafness could contribute to psychological and emotional difficulties for implant candidates and their spouses. **METHODS:** 178 cochlear implant candidates referred from 1981 to 1998 at the University of Iowa Hospitals completed a standard battery of psychological tests and questionnaires. The sample was divided into six 3-year cohorts and compared on standardized measures of psychological and emotional adjustment, and in participation in social and non-social activities. Spouses of implant candidates completed a similar assessment. **RESULTS:** The sample was characterized by elevations in depression, social introversion, suspiciousness, and social anxiety and loneliness. There were no significant differences among cohorts across time except for an increase in expectations for implant success. Spouses also evidenced elevated levels of psychological distress. Hearing status was associated with significant differences in social activity participation. A paradoxical interaction was found between marital status and deafness. **CONCLUSIONS:** There was no evidence that the psychological status of implant candidates is changing across time, suggesting continued psychological benefit for persons receiving cochlear implants. Both candidates and their spouses participated in fewer social activities than normal controls. Findings underscore the complex relation between marital status, deafness, and engagement and participation in positive activities. @@ - 230-0488-2324-2

25 **"Effect of electrode configuration on psychophysical forward masking in cochlear implant listeners."** Kwon, B. J. and van den Honert, C (2006). J Acoust Soc Am 119(5 Pt 1): 2994-3002.

Bipolar stimulation has been thought to be more beneficial than monopolar stimulation for speech coding in cochlear implants, on the basis of its more restricted current flow. The present study examined whether bipolar stimulation would indeed lead to reduced channel interaction in a behavioral forward masking experiment tested in four Nucleus 24 users. The masker was fixed on one channel and three masker levels that were balanced for loudness between the configurations were chosen. As expected, masking was maximal when the masker and probe channels were spatially close and decreased as they were separated. However, overall masking patterns did not consistently demonstrate sharper tuning with bipolar stimulation than monopolar. This implies that the spatial extent of a bipolar current field is not consistently narrower than that of an equally loud monopolar stimulus; therefore, it should not be assumed that bipolar stimulation leads to reduced channel interaction. Notably, bipolar masking patterns appeared to display more variations across channels, possibly influenced more by anatomical and neural irregularities near electrode contacts than monopolar masking patterns. The present psychophysical results provide a theoretical basis regarding the widespread use (and success) of monopolar configurations by implant users. @@ - 230-0485-1980-8

26 **"The development of proto-performative utterances in deaf toddlers."** Lichtert, G. F. and Loncke, F. T (2006). J Speech Lang Hear Res 49(3): 486-99.

PURPOSE: The purpose of this study was to examine and compare the development of proto-imperative and proto-declarative utterances in normally developing, non-neonatally screened, profoundly deaf toddlers. **METHOD:** Both types of proto-declarative are considered to be the most basic prelinguistic and early linguistic communicative functions. Eighteen normally developing, non-neonatally screened, profoundly deaf toddlers participated in a longitudinal study. All children were enrolled in the same oral-aural home guidance program. At the time of the study, none of the children had received a cochlear implant. At the ages of 18, 24, and 30 months, proto-imperative utterances were elicited using an adapted version of M. Casby and J. A. Cumpata's (1986) Protocol for the Assessment of Prelinguistic Intentional Communication. For eliciting proto-declarative intentions, a video clip was used. **RESULTS:** Results revealed a significant increase in both frequency and level of utterances for both types of proto-performatives. Although there was a clear development from nonlinguistic toward linguistic communication, utterances remained predominantly deictic-gestural for the imperative intentions and referential-gestural for declaratives. **CONCLUSIONS:** The data support the notion from the literature that both types of performatives are susceptible to elicitation. Results also suggest that after neonatal screening, both total communication and oral-aural approaches might accelerate conventionalization of the earliest communicative utterances of profoundly deaf toddlers. @@ - 230-0498-6303-1

27 **"Cochlear implantation with ipsilateral petroclival chondrosarcoma."** Lin, E. M., Ray, M. E. and Telian, S. A (2006). Otol Neurotol 27(3): 337-41.

OBJECTIVE: To highlight a case of cochlear implantation in the setting of ipsilateral petrous apex chondrosarcoma. **BACKGROUND:** A patient with bilateral progressive hearing loss was incidentally found to have a destructive right petrous apex lesion on computed tomography before cochlear implantation. The patient had no associated symptoms and a magnetic resonance imaging scan was obtained, narrowing the differential diagnosis. A middle cranial fossa approach was performed for synchronous biopsy of the lesion and cochlear implantation. **RESULTS:** Frozen sections revealed a low-grade chondroid lesion, and a Med-El Combi 40+ cochlear implant with a split electrode array was inserted via the middle fossa. Final pathologic examination revealed a Grade I chondrosarcoma. The patient suffered no complications postoperatively and was followed-up over 5 years with serial computed tomographic scans and clinical examinations. No additional treatment was administered. Eighteen months postoperatively, the patient

experienced episodic vertigo. There were no new findings on computed tomography, and the vertigo improved with a low-salt diet. Otherwise, the patient had excellent hearing results, and the lesion has not progressed under observation. **CONCLUSION:** The implications of observing low-grade chondrosarcomas in well-selected patients and the unique aspect of cochlear implantation on the affected side are discussed. @@ - 230-0476-9099-8

28 "Endoscopically guided placement of prefabricated cochlear implant electrodes in a common cavity malformation." Manolidis, S., Tonini, R. and Spitzer, J (2006). Int J Pediatr Otorhinolaryngol 70(4): 591-6.

OBJECTIVE: To devise a safe and effective method of optimal customized electrode placement in the common cavity of children with cochleovestibular malformations. **METHODS:** Specialized electrodes were manufactured on the basis of three-dimensional data obtained from the high resolution computed tomography (HRCT) scans of the temporal bones of these two children. Electrode positioning was achieved with direct endoscopic view of the cavity utilizing a three-hole common cavity technique. **RESULTS:** Optimal electrode positioning in apposition to the medial neuroepithelium in the common cavity was verified visually intraoperatively. Postoperatively, minimal stable electrical current levels were found to be required. **CONCLUSIONS:** Custom-designed electrodes have the potential to offer improved results in children with common cavity malformations. Intraoperative direct positioning may further improve these results. @@ - 230-0468-2797-1

29 "Speech perception for adults who use hearing aids in conjunction with cochlear implants in opposite ears." Mok, M., Grayden, D., Dowell, R. C. and Lawrence, D (2006). J Speech Lang Hear Res 49(2): 338-51.

This study aimed to (a) investigate the effect of using a hearing aid in conjunction with a cochlear implant in opposite ears on speech perception in quiet and in noise, (b) identify the speech information obtained from a hearing aid that is additive to the information obtained from a cochlear implant, and (c) explore the relationship between aided thresholds in the nonimplanted ear and speech perception benefit from wearing a hearing aid in conjunction with a cochlear implant in opposite ears. Fourteen adults who used the Nucleus 24 cochlear implant system in 1 ear participated in the study. All participants had either used a hearing aid in the nonimplanted ear for at least 75% of waking hours after cochlear implantation, and/or, hearing loss less than 90 dB HL in the low frequencies in the nonimplanted ear. Speech perception was evaluated in 3 conditions: cochlear implant alone (CI), hearing aid alone (HA), and cochlear implant in conjunction with hearing aid in opposite ears (CIHA). Three speech perception tests were used: consonant-vowel nucleus-consonant (CNC) words in quiet, City University of New York style (CUNY) sentences in coincident signal and noise, and spondees in coincidental and

spatially separated signal and noise. Information transmission analyses were performed on the CNC responses. Of the 14 participants tested, 6 showed significant bimodal benefit on open-set speech perception measures and 5 showed benefit on close-set spondees. However, 2 participants showed poorer speech perception with CIHA than CI in at least 1 of the speech perception tests. Results of information transmission analyses showed that bimodal benefit (performance with CIHA minus that with CI) in quiet arises from improved perception of the low frequency components in speech. Results showed that participants with poorer aided thresholds in the mid-to-high frequencies demonstrated greater bimodal benefit. It is possible that the mid-to-high frequency information provided by the hearing aids may be conflicting with the cochlear implants. @@ - 230-0479-8360-9

30 "Restored speech comprehension linked to activity in left inferior prefrontal and right temporal cortices in postlingual deafness."

Mortensen, M. V., Mirz, F. and Gjedde, A (2006). Neuroimage 31(2): 842-52.

The left inferior prefrontal cortex (LIPC) is involved in speech comprehension by people who hear normally. In contrast, functional brain mapping has not revealed incremental activity in this region when users of cochlear implants comprehend speech without silent repetition. Functional brain maps identify significant changes of activity by comparing an active brain state with a presumed baseline condition. It is possible that cochlear implant users recruited alternative neuronal resources to the task in previous studies, but, in principle, it is also possible that an aberrant baseline condition masked the functional increase. To distinguish between the two possibilities, we tested the hypothesis that activity in the LIPC characterizes high speech comprehension in postlingually deaf CI users. We measured cerebral blood flow changes with positron emission tomography (PET) in CI users who listened passively to a range of speech and non-speech stimuli. The pattern of activation varied with the stimulus in users with high speech comprehension, unlike users with low speech comprehension. The high-comprehension group increased the activity in prefrontal and temporal regions of the cerebral cortex and in the right cerebellum. In these subjects, single words and speech raised activity in the LIPC, as well as in left and right temporal regions, both anterior and posterior, known to be activated in speech recognition and complex phoneme analysis in normal hearing. In subjects with low speech comprehension, sites of increased activity were observed only in the temporal lobes. We conclude that increased activity in areas of the LIPC and right temporal lobe is involved in speech comprehension after cochlear implantation. @@ - 230-0499-3524-3

31 **“Performances and complications of cochlear implant in 134 adult patients implanted since 1990.”** Mosnier, I., Ambert-Dahan, E., Smadja, M., Ferrary, E., Bouccara, D., Bozorg-Grayeli, A. and Sterkers, O (2006). Ann Otolaryngol Chir Cervicofac 123(2): 71-8.

OBJECTIVE: The aim of this study was to analyse performance of cochlear implants in a retrospective series of adults with postlingually in order to search for predictive factors and identify complications. METHODS: Between 1990 and 2003, 134 adult patients were implanted: 129 patients on one side and 5 patients on both sides. Hearing benefit at 6, 12, 24 and 36 months and performance at 12 months were analyzed as function of the etiology, age at implantation, lipreading and speech coding strategy. RESULTS: Compared to performances before implantation, cochlear implants provided significant and rapid improvement at 6 months ($p < 0.0001$). The results were not correlated with age at implantation, etiology or lipreading ability before implantation. Performances were worse in patients with meningitis ($p < 0.01$), but the percentage of improvement was similar between the different etiologies. Major complications were rare: one case of regressive postoperative facial nerve weakness. CONCLUSION: Cochlear implants provide significant and rapid improvement, with low morbidity. Results are not correlated with age at implantation, etiology or lipreading ability. @@ - 230-0493-1078-5

32 **“Effects of early auditory experience on the spoken language of deaf children at 3 years of age.”** Nicholas, J. G. and Geers, A. E (2006). Ear Hear 27(3): 286-98.

OBJECTIVE: By age 3, typically developing children have achieved extensive vocabulary and syntax skills that facilitate both cognitive and social development. Substantial delays in spoken language acquisition have been documented for children with severe to profound deafness, even those with auditory oral training and early hearing aid use. This study documents the spoken language skills achieved by orally educated 3-yr-olds whose profound hearing loss was identified and hearing aids fitted between 1 and 30 mo of age and who received a cochlear implant between 12 and 38 mo of age. The purpose of the analysis was to examine the effects of age, duration, and type of early auditory experience on spoken language competence at age 3.5 yr. DESIGN: The spoken language skills of 76 children who had used a cochlear implant for at least 7 mo were evaluated via standardized 30-minute language sample analysis, a parent-completed vocabulary checklist, and a teacher language-rating scale. The children were recruited from and enrolled in oral education programs or therapy practices across the United States. Inclusion criteria included presumed deaf since birth, English the primary language of the home, no other known conditions that interfere with speech/language development, enrolled in programs using oral education methods, and no known problems with the cochlear implant lasting more than 30 days. RESULTS: Strong correlations were obtained among all language measures.

Therefore, principal components analysis was used to derive a single Language Factor score for each child. A number of possible predictors of language outcome were examined, including age at identification and intervention with a hearing aid, duration of use of a hearing aid, pre-implant pure-tone average (PTA) threshold with a hearing aid, PTA threshold with a cochlear implant, and duration of use of a cochlear implant/age at implantation (the last two variables were practically identical because all children were tested between 40 and 44 mo of age). Examination of the independent influence of these predictors through multiple regression analysis revealed that pre-implant-aided PTA threshold and duration of cochlear implant use (i.e., age at implant) accounted for 58% of the variance in Language Factor scores. A significant negative coefficient associated with pre-implant-aided threshold indicated that children with poorer hearing before implantation exhibited poorer language skills at age 3.5 yr. Likewise, a strong positive coefficient associated with duration of implant use indicated that children who had used their implant for a longer period of time (i.e., who were implanted at an earlier age) exhibited better language at age 3.5 yr. Age at identification and amplification was unrelated to language outcome, as was aided threshold with the cochlear implant. A significant quadratic trend in the relation between duration of implant use and language score revealed a steady increase in language skill (at age 3.5 yr) for each additional month of use of a cochlear implant after the first 12 mo of implant use. The advantage to language of longer implant use became more pronounced over time.

CONCLUSIONS: Longer use of a cochlear implant in infancy and very early childhood dramatically affects the amount of spoken language exhibited by 3-yr-old, profoundly deaf children. In this sample, the amount of pre-implant intervention with a hearing aid was not related to language outcome at 3.5 yr of age. Rather, it was cochlear implantation at a younger age that served to promote spoken language competence. The previously identified language-facilitating factors of early identification of hearing impairment and early educational intervention may not be sufficient for optimizing spoken language of profoundly deaf children unless it leads to early cochlear implantation. @@
- 230-0489-9114-8

33 "Spectral and temporal cues in cochlear implant speech perception." Nie, K., Barco, A. and Zeng, F.-G (2006). Ear Hear 27(2): 208-17.

OBJECTIVE: Taking advantage of the flexibility in the number of stimulating electrodes and the stimulation rate in a modern cochlear implant, the present study evaluated relative contributions of spectral and temporal cues to cochlear implant speech perception. **DESIGN:** Four experiments were conducted by using a Research Interface Box in five MED-EL COMBI 40+ cochlear implant users. Experiment 1 varied the number of electrodes from four to twelve or the maximal number of available active electrodes while keeping a constant stimulation rate at 1000 Hz per electrode. Experiment 2

varied the stimulation rate from 1000 to 4000 Hz per electrode on four pairs of fixed electrodes. Experiment 3 covaried the number of stimulating electrodes and the stimulation rate to study the trade-off between spectral and temporal cues. Experiment 4 studied the effects of envelope extraction on speech perception and listening preference, including half-wave rectification, full-wave rectification, and the Hilbert transform. Vowels, consonants, and HINT sentences in quiet, as well as with a competing female voice served as test materials. RESULTS: Experiment 1 found significant improvement in all speech tests with a higher number of stimulating electrodes. Experiment 2 found a significant advantage of the high stimulation rate only on consonant recognition and sentence recognition in noise. Experiment 3 found an almost linear trade-off between the number of stimulation electrodes and the stimulation rate for consonant and sentence recognition in quiet, but not for vowel and sentence recognition in noise. Experiment 4 found significantly better performance with the Hilbert transform and the full-wave rectification than the half-wave rectification. In addition, envelope extraction with the Hilbert transform produced the highest rating on subjective judgment of sound quality. CONCLUSIONS: Consistent with previous studies, the present result from the five MED-EL subjects showed that (1) the temporal envelope cues from a limited number of channels are sufficient to support high levels of phoneme and sentence recognition in quiet but not for speech recognition in a competing voice, (2) consonant recognition relies more on temporal cues while vowel recognition relies more on spectral cues, (3) spectral and temporal cues can be traded to some degree to produce similar performance in cochlear implant speech recognition, and (4) the Hilbert envelope improves both speech intelligibility and quality in cochlear implants. @@ - 230-0469-3345-6

34 "Cochlear implant outcomes and quality of life in the elderly: Manchester experience over 13 years." Orabi, A. A., Mawman, D., Al-Zoubi, F., Saeed, S. R. and Ramsden, R. T (2006). Clin Otolaryngol 31(2): 116-22.

OBJECTIVES: To objectively evaluate the clinical and functional outcomes of cochlear implantation in an elderly population. DESIGN: Retrospective comparative study. SETTING: Neurotology unit at Manchester Royal Infirmary, a supraregional tertiary referral centre in collaboration with Adult Cochlear Implant Programme at The University of Manchester. PARTICIPANTS: All cochlear implant procedures (38) undertaken on post-lingually deafened elderly patients (age range at the time of implantation 65-80 years, n = 34) in the period from 1989 to 2002. Main outcome measures: Medical and surgical outcomes. Audiological performance outcomes for isolated words, words in sentences in quiet and noise. Functional outcome measures used are self-reported measures of the social, psychological and emotional aspects of quality of life, and the differences between expectations for functional outcomes and the realization of functional outcomes. They

included expectation profiles, Glasgow Benefit inventory (GBI) and Glasgow Health Status Inventory Questionnaire (GHSI). RESULTS: There was statistically significant improvement post-implantation of both open and closed set test scores ($P < 0.01$). Eighty-two percentage of patients were completely satisfied with their cochlear implants. Patients judged that implantation restored half the loss of quality of life that they had experienced as a result of severe-profound deafness with a highly significant ($P < 0.001$) improvement in overall quality of life after implantation. The commonest post-operative observation was transient mild pyrexia. CONCLUSIONS: The age of a cochlear implant candidate should not be a factor in the candidacy decision-making process. The quality of life of our elderly recipients was significantly improved after cochlear implant. @@ - 230-0474-7486-4

35 "Late postnatal onset of hearing loss due to GJB2 mutations."

Pagarkar, W., Bitner-Glindzicz, M., Knight, J. and Sirimanna, T (2006).Int J Pediatr Otorhinolaryngol 70(6): 1119-24.

GJB2 mutations account for approximately 50% of recessive non-syndromic deafness, with 35delG being the most prevalent. Homozygous 35delG mutations cause pre-lingual, non-progressive hearing loss that is detected on newborn hearing screening programmes. We present a sibling pair with homozygous 35delG mutations, who passed hearing tests in early infancy and developed progressive sensorineural hearing loss, one requiring a cochlear implant. These cases illustrate that deafness due to such mutations may have a late onset and consequently be missed on neonatal screening programmes and they may present an argument to consider neonatal screening for GJB2 mutations in order to aid early intervention. @@ - 230-0493-9320-3

36 "A survey of parental views regarding their child's hearing loss: a pilot study." Park, A. H., Warner, J., Sturgill, N. and Alder, S. C (2006).Otolaryngol Head Neck Surg 134(5): 794-800.

OBJECTIVE: Assess parental perceptions of their child's sensorineural hearing loss care. METHODS: Families of pediatric patients diagnosed with a sensorineural hearing loss from 2000 to 2004 were sent a survey asking about their experiences with their child's hearing loss. RESULTS: One hundred eight of 389 families surveyed were studied. Thirteen percent did not know the results of the newborn screening. Twenty-two percent of the primary care physicians were not involved in the child's hearing evaluation. Forty percent of the patients underwent 4 or more audiologic tests before a diagnosis. The most common reason for delayed diagnosis was difficulty in obtaining an appointment with an audiologist. Sixty-two percent of families had difficulties obtaining hearing aids, and 58% noted difficulties obtaining cochlear implants. CONCLUSIONS: Families reported multiple obstacles to

obtain timely diagnosis and treatment. Otolaryngologists may need to be more involved in the evaluation and treatment of these patients. EBM rating: C-4. @@ - 234-1715-5843-5

37 "Revision cochlear implantation for facial nerve stimulation in otosclerosis." Polak, M., Ulubil, S. A., Hodges, A. V. and Balkany, T. J (2006). Arch Otolaryngol Head Neck Surg 132(4): 398-404.

OBJECTIVE: To find if patients experiencing postsurgical facial nerve stimulation caused by underlying disease process (ie, otosclerosis) can improve their hearing performance with their cochlear implant by reimplantation and by an optimal programming strategy. **DESIGN:** Retrospective analysis. **SETTING:** Academic tertiary referral center. **PATIENTS:** Two cochlear otosclerosis patients with resistant facial nerve stimulation (FNS). Both patients were initially implanted with Nucleus 22 devices (Cochlear Corporation, Englewood, Colo) and they developed FNS after a period of use. Owing to the decreasing number of active electrodes, concurrent decreases in speech understanding occurred. **INTERVENTIONS:** Various programming approaches were used to address the FNS. Both subjects ultimately received Nucleus 24 devices. One was reimplanted in the same ear, and the other was implanted in the opposite ear. Both have been followed up for 8 months following the reimplantation. **MAIN OUTCOME MEASURES:** Cochlear implant programming levels, cochlear implant performance, and facial nerve stimulation. **RESULTS:** The FNS was managed for more than 3 years through optimized programming. However, the FNS progressed until performance dropped below acceptable levels. Reimplantation was believed to be the only option for improvement. After reimplantation and programming, both subjects showed immediate improvement in speech discrimination. One user increased his consonant-nucleus-consonant word score from 12% preoperatively to 42%, and the other's performance increased from 0% to 86%. **CONCLUSIONS:** Our results suggest that having more programming options with newer devices is critical in otosclerotic or ossified users who experience FNS. Also, reimplantation may be a useful tool to improve performance. @@ - 234-1708-9453-4

38 "High resolution micro-CT scanning as an innovative tool for evaluation of the surgical positioning of cochlear implant electrodes." Postnov, A., Zarowski, A., De Clerck, N., Vanpoucke, F., Offeciers, F. E., Van Dyck, D. and Peeters, S (2006). Acta Otolaryngol 126(5): 467-74.

X-ray microtomography (micro-CT) is a new technique allowing for visualization of the internal structure of opaque specimens with a quasi-histological quality. Among multiple potential applications, the use of this technique in otology is very promising. Micro-CT appears to be ideally suited for in vitro visualization of the inner ear tissues as well as for evaluation of the

electrode damage and/or surgical insertion trauma during implantation of the cochlear implant electrodes. This technique can greatly aid in design and development of new cochlear implant electrodes and is applicable for temporal bone studies. The main advantage of micro-CT is the practically artefact-free preparation of the samples and the possibility of evaluation of the interesting parameters along the whole insertion depth of the electrode. This paper presents the results of the first application of micro-CT for visualization of the inner ear structures in human temporal bones and for evaluation of the surgical positioning of the cochlear implant electrodes relative to the intracochlear soft tissues. @@ - 230-0491-7561-8

39 "Effect of interphase gap and pulse duration on electrically evoked potentials is correlated with auditory nerve survival." Prado-Guitierrez, P., Fewster, L. M., Heasman, J. M., McKay, C. M. and Shepherd, R. K (2006). Hear Res 215(1-2): 47-55.

We investigated the effect of pulse duration (PD) and interphase-gap (IPG) on the electrically-evoked auditory brain stem response (EABR) and eighth nerve compound action potential (ECAP) of deafened guinea pigs in order to test the hypothesis that the extent of change in these neural responses is affected by the histological status of the auditory nerve. Fifteen guinea pigs were deafened by co-administration of kanamycin and furosemide. Animals were acutely implanted with an 8-band electrode array at 1, 4 or 12 weeks following deafening. EABR and ECAP input/output functions were recorded in response to charge balanced biphasic current pulses. We determined the change in current required to equalize; (i) the EABR amplitude when the duration of the current pulse was doubled (104-208 micros/phase); and (ii) the EABR and ECAP amplitudes when the IPG was increased from 8 to 58 micros using a 104 micros/phase current pulse. Following the completion of each experiment the cochleae were examined quantitatively for spiral ganglion neuron survival. As expected, the current level required to evoke an EABR with equal amplitude was lower when the animal was stimulated with current pulses of 208 compared with 104 micros/phase. Moreover, the current level required to evoke EABR/ECAPs with equal amplitude was lower when current pulses had an IPG of 58 versus 8 micros. Importantly, there was a reduction in the magnitude of this effect with greater neural loss; the reduced efficacy of changing both PD and IPG on these electrically-evoked potentials was statistically correlated with neural survival. These results may provide a tool for investigating the contribution of auditory nerve survival to clinical performance among cochlear implant subjects. @@ - 230-0497-2715-2

40 **"Effects of introducing unprocessed low-frequency information on the reception of envelope-vocoder processed speech."** Qin, M. K. and Oxenham, A. J (2006). J Acoust Soc Am 119(4): 2417-26.

This study investigated the benefits of adding unprocessed low-frequency information to acoustic simulations of cochlear-implant processing in normal-hearing listeners. Implant processing was simulated using an eight-channel noise-excited envelope vocoder, and low-frequency information was added by replacing the lower frequency channels of the processor with a low-pass-filtered version of the original stimulus. Experiment 1 measured sentence-level speech reception as a function of target-to-masker ratio, with either steady-state speech-shaped noise or single-talker maskers. Experiment 2 measured listeners' ability to identify two vowels presented simultaneously, as a function of the F0 difference between the two vowels. In both experiments low-frequency information was added below either 300 or 600 Hz. The introduction of the additional low-frequency information led to substantial and significant improvements in performance in both experiments, with a greater improvement observed for the higher (600 Hz) than for the lower (300 Hz) cutoff frequency. However, performance never equaled performance in the unprocessed conditions. The results confirm other recent demonstrations that added low-frequency information can provide significant benefits in intelligibility, which may at least in part be attributed to improvements in F0 representation. The findings provide further support for efforts to make use of residual acoustic hearing in cochlear-implant users. @@ - 234-1721-9244-0

41 **"Cochlear implant explantation as a sequela of severe chronic otitis media: case report and review of the literature."** Roehm, P. C. and Gantz, B. J (2006). Otol Neurotol 27(3): 332-6.

INTRODUCTION: In the 1980s, intracranial and inner ear infections were feared complications in patients with recurrent or chronic otitis media (COM) who had undergone cochlear implantation. Current studies show a low incidence of such complications. We present a case of a patient who developed severe COM requiring cochlear explantation. CASE: Our patient had a previous cleft palate repair and as a three-year-old was implanted with a Nucleus-24 implant. She developed chronic otorrhea in the implanted ear, which was managed by her pediatrician until her cochlear implant stopped functioning. Radiographic imaging revealed erosion of the cochlea and extrusion of the distal electrode medially in the petrous apex. SETTING: Tertiary care university hospital. INTERVENTION/RESULTS: The patient underwent cochlear explantation, subtotal petrosectomy, obliteration of ear, and intravenous antibiotic therapy. One month later she was implanted in the contralateral ear. CONCLUSION: COM poses potentially severe complications in patients receiving cochlear implants. Patients receiving cochlear implants who are at high risk for COM require follow-up for an extended period of time. @@ - 230-0476-9098-0

42 **"Sensitivity to isolated and concurrent intensity and fundamental frequency increments by cochlear implant users under natural listening conditions."** Rogers, C. F., Healy, E. W. and Montgomery, A. A (2006). J Acoust Soc Am 119(4): 2276-87.

Sensitivity to acoustic cues in cochlear implant (CI) listening under natural conditions is a potentially complex interaction between a number of simultaneous factors, and may be difficult to predict. In the present study, sensitivity was measured under conditions that approximate those of natural listening. Synthesized words having increases in intensity or fundamental frequency (F0) in a middle stressed syllable were presented in soundfield to normal-hearing listeners and to CI listeners using their everyday speech processors and programming. In contrast to the extremely fine sensitivity to electrical current observed when direct stimulation of single electrodes is employed, difference limens (DLs) for intensity were larger for the CI listeners by a factor of 2.4. In accord with previous work, F0 DLs were larger by almost one order of magnitude. In a second experiment, it was found that the presence of concurrent intensity and F0 increments reduced the mean DL to half that of either cue alone for both groups of subjects, indicating that both groups combine concurrent cues with equal success. Although sensitivity to either cue in isolation was not related to word recognition in CI users, the listeners having lower combined-cue thresholds produced better word recognition scores. @@ - 234-1721-9231-7

43 **"Brain power - borrowing from biology makes for low power computing bionic ear."** Sarpeshkar, R (2006). IEEE Spectr. (USA) 43(5): 24-9.

This paper describes the recent advances in the field of neuromorphic engineering, more generally, biologically inspired electronics. This paper focuses on the work being done to develop bionic ears. A key area of interest is understanding the scheme that allows low-power analog processing in the ear followed by digitization. Researchers at MIT have developed a bionic ear processor that does the job of the digital signal processor, is small enough to be implanted, and could run on a 2 gram battery needing a wireless recharge only every two weeks. This effort has also led to the design of a new algorithm that can improve the performance of ordinary cochlear implants and other speech processors. The team is currently working on designing an ultrawideband spectrum analyzer that can simultaneously tune into radio signals all the way from the FM radio bands to Wi-Fi bands. @@ - 259-0891-8455-2

44 **“Event related potentials - are they useful in paediatric cochlear implant patients?”** Singh, S., Liasis, A., Rajput, K. and Luxon, L (2006). Clin Otolaryngol 31(3): 248-9.

Background. The use of cochlear implants in profoundly deaf children is increasing with a trend towards earlier implantation. However, tools used at present to assess outcome are primarily based on behavioural tests, which are difficult to use effectively in young children. Event related potentials (ERP) such as Mismatch Negativity (MMN) have been proposed to have potential in assessing central processing in cochlear implant patients.(1) Objective. The main objective of this study was to assess the correlation of ERP measures with behavioural assessment data to identify if they can be used to predict performance in cochlear implant patients. Methods. We carried out a prospective, blinded, non-randomised study investigating auditory ERPs to speech stimuli in 35 cochlear implanted children. We compared P1, N2 and MMN parameters with behavioural outcome, assessed at the time of recording ERPs and 2 years later. Results. Auditory ERPs were identifiable in 30 out of 35 patients. MMN was recorded in 85% of star performers but in only 20% of poor performers. At behavioural reassessment 2 years later, 50% of poor performers who had demonstrated a MMN progressed to achieve 'star' performance in comparison to 25% of those who had not. Conclusion. These results indicate that MMN can be used to assess the functional status of auditory cortex in young children with cochlear implants and may provide an objective measure to predict future performance. However a large longitudinal study is needed to establish its sensitivity and specificity before using it as a clinical tool. Reference 1 Singh S., Liasis A., Towell A., et al. (2004) Event related potentials in cochlear implant patients. *Ear and Hearing*25(6), 598--610. @@ - 230-0494-2367-9

45 **“Hearing-impaired children in the United Kingdom, I: Auditory performance, communication skills, educational achievements, quality of life, and cochlear implantation.”** Stacey, P. C., Fortnum, H. M., Barton, G. R. and Summerfield, A. Q (2006). Ear Hear 27(2): 161-86.

OBJECTIVES: The objectives of this study were to identify variables that are associated with differences in outcome among hearing-impaired children and to control those variables while assessing the impact of cochlear implantation. STUDY DESIGN: In a cross-sectional study, the parents and teachers of a representative sample of hearing-impaired children were invited to complete questionnaires about children's auditory performance, spoken communication skills, educational achievements, and quality of life. Multiple regression was used to measure the strength of association between these outcomes and variables related to the child (average hearing level, age at onset of hearing impairment, age, gender, number of additional disabilities), the family (parental occupational skill level, ethnicity, and parental hearing status), and cochlear implantation. RESULTS: Questionnaires were returned by the

parents of 2858 children, 468 of whom had received a cochlear implant, and by the teachers of 2241 children, 383 of whom had received an implant. Across all domains, reported outcomes were better for children with fewer disabilities in addition to impaired hearing. Across most domains, reported outcomes were better for children who were older, female, with a more favorable average hearing level, with a higher parental occupational skill level, and with an onset of hearing-impairment after 3 years. When these variables were controlled, cochlear implantation was consistently associated with advantages in auditory performance and spoken communication skills, but less consistently associated with advantages in educational achievements and quality of life. Significant associations were found most commonly for children who were younger than 5 years when implanted, and had used implants for more than 4 years. These children, whose mean (preoperative, unaided) average hearing level was 118 dB, were reported to perform at the same level as nonimplanted children with average hearing levels in the range from 80 dB to 104 dB, depending on the outcome measure. **CONCLUSIONS:** When rigorous statistical control is exercised in comparing implanted and nonimplanted children, pediatric cochlear implantation is associated with reported improvements both in spoken communication skills and in some aspects of educational achievements and quality of life, provided that children receive implants before 5 years of age. @@ - 230-0469-3343-1

46 **"Connexin-associated deafness and speech perception outcome of cochlear implantation."** Taitelbaum-Swead, R., Brownstein, Z., Muchnik, C., Kishon-Rabin, L., Kronenberg, J., Megirov, L., Frydman, M., Hildesheimer, M. and Avraham, K. B (2006). Arch Otolaryngol Head Neck Surg 132(5): 495-500.

OBJECTIVE: To compare performance after cochlear implantation in children with mutations in connexin (Cx) 26 (GJB2) or Cx30 (GJB6) and children with deafness of unknown etiology. **DESIGN:** Genetic analysis and speech perception evaluation was performed in the children with and without Cx mutations who had undergone cochlear implantation. Speech perception performance was retrospectively analyzed 6, 12, 24, 36, and 48 months after implantation. Test material was selected according to the child's age and cognitive and language abilities. **SETTING:** The study took place at speech and hearing and genetic centers of a hospital in the central part of Israel and the genetics departments of 3 additional centrally located hospitals. **PATIENTS:** A total of 30 children who had undergone cochlear implantation were selected for the study, with control patients matched according to age at implantation, duration of implant use, and mode of communication. There was no evidence for additional disabilities or handicaps in either group. **MAIN OUTCOME MEASURES:** Speech perception measurements included a questionnaire, as well as closed and open-set tests. **RESULTS:** Overall, the 2 groups showed significant improvement in speech perception results after implantation. Four years after implantation, both groups achieved mean open-

set speech perception scores of approximately 60%, 75%, and 90% for monosyllabic, 2 syllables, and words in sentences tests, respectively. CONCLUSIONS: There were no apparent differences in speech perception performance after implantation between the children with Cx mutations and children with deafness of unknown etiology. These data have important implications as a prognostic indicator when counseling candidates for cochlear implantation. @@ - 234-1720-7827-6

47 **"Intracochlear misdirected implantation of a cochlear implant."** Tange, R. A., Grolman, W. and Maat, A (2006). Acta Otolaryngol 126(6): 650-2.

This paper discusses a rare complication of an intracochlear misdirection of the electrode of a cochlear implant in a 55-year-old male. The patient received a cochlear implant using the mastoid-saving surgical approach. Intraoperative measurements showed impedance and NRT reactions suggesting a reasonable function of the inner ear and the implant. Postoperatively our patient suffered from passing vertigo. Postoperative CT scans revealed a misdirection implantation of the cochlear implant into the vestibular part of the inner ear. A deformed implant was removed and a reimplantation was successfully performed after enlarging and reshaping the cochleostomy. Our patient now enjoys all the benefits of an optimal functioning cochlear implant. Intracochlear misdirection of the electrode can occur even when intraoperative measurements seem to be normal. When a patient suffers from unexplained vertigo after cochlear implantation with a poor function of the implant a misdirection of the active electrode must be considered. New high resolution peroperative three-dimensional imaging techniques can probably help to avoid such insertion failures. @@ - 230-0486-5866-3

48 **"An investigation of weak syllable processing in deaf children with cochlear implants."** Titterington, J., Henry, A., Kroamer, M., Toner, J. G. and Stevenson, M (2006). Clin Linguist Phon 20(4): 249-69.

In this study the influence of prosodic foot structure on the processing of weak syllables in children with cochlear implants (CI) was investigated. A battery of tests investigating processing of weak syllables in single and multi-word utterances was carried out on four groups of children: 15 children with CI developing spoken language as expected (Main CI); five children with CI reported to have additional speech and language problems; 15 age matched; and 15 language matched (LM) children with normal hearing (NH). Children in the main CI and, to a lesser extent, the LM groups processed footed weak syllables preferably over unfooted weak syllables (particularly as memory load increased). Thus, these children with CI appear to possess a similar Prosodic Hierarchy (PH) to their LM peers with NH, and possibly due to the impact of

delayed and constrained exposure to audition on the development of linguistic processing and short-term memory, are influenced by its foot structure in the processing of weak syllables. @@ - 234-1719-8884-8

49 **“Activity-dependent regulation of synaptic strength and neuronal excitability in central auditory pathways.”** Walmsley, B., Berntson, A., Leao, R. N. and Fyffe, R. E. W (2006). J Physiol 572(Pt 2): 313-21.

Neural activity plays an important role in regulating synaptic strength and neuronal membrane properties. Attempts to establish guiding rules for activity-dependent neuronal changes have led to such concepts as homeostasis of cellular activity and Hebbian reinforcement of synaptic strength. However, it is clear that there are diverse effects resulting from activity changes, and that these changes depend on the experimental preparation, and the developmental stage of the neural circuits under study. In addition, most experimental evidence on activity-dependent regulation comes from reduced preparations such as neuronal cultures. This review highlights recent results from studies of the intact mammalian auditory system, where changes in activity have been shown to produce alterations in synaptic and membrane properties at the level of individual neurons, and changes in network properties, including the formation of tonotopic maps. @@ - 234-1721-5514-0

50 **“Axon guidance cues in auditory development.”** Webber, A. and Raz, Y (2006). Anat Rec A Discov Mol Cell Evol Biol 288(4): 390-6.

The innervation of the cochlear sensory epithelium is intricately organized, allowing the tonotopy established by the auditory hair cells to be maintained along the ascending auditory pathways. These auditory projections are patterned by several gene families that regulate neurite attraction and repulsion, known as axon guidance cues. In this review, the roles of various axon guidance molecules, including fibroblast growth factor, ephs, semaphorins, netrins and slits, are examined in light of their known contribution to auditory development. Additionally, morphogens are discussed in the context of their recently described influence on axonal pathfinding in other sensory systems. The elucidation of these various mechanisms may guide the development of therapies aimed at maximizing the connectivity of auditory neurons in the context of congenital or acquired sensorineural hearing loss, especially as pertains to cochlear implants. Further afield, improved understanding of the molecular processes which regulate innervation of the organ of Corti during normal development may prove useful in connecting regenerated hair cells to the central nervous system. Copyright 2006 Wiley-Liss, Inc. @@ - 234-1723-4708-5

51 **"Bacterial meningitis among cochlear implant recipients--Canada, 2002."** Wilson-Clark, S. D., Squires, S., Deeks, S. and Centers for Disease Control and Prevention MMWR Morb Mortal Wkly Rep 55 Suppl 1: 20-4.

INTRODUCTION: In July 2002, a cluster of bacterial meningitis (BM) cases was identified among European cochlear implant recipients (CIRs), prompting Health Canada to conduct a retrospective cohort study to determine the rate of BM infection among Canadian CIRs and to identify risk factors for acquiring BM. METHODS: A survey was mailed to 1,432 Canadian CIRs who had received implants during January 1995-July 2002 to assess occurrence of postimplant BM infection. Data collection included demographics, episodes of meningitis, and vaccination status. RESULTS: A total of 1,024 (72%) surveys were completed. Median age of CIRs at implantation was 16 years (range: 7 months-81 years). Five (0.5%) cases of BM infection were reported (two pneumococcal, one meningococcal, and two of unknown etiology); one CIR died. Four cases occurred among children aged <18 years. Time between implantation and BM infection varied (range: 7 months-7.7 years; median: 11 months). The rate of BM infection per 1,000 person-years was 0.7 among CIRs aged > or =18 years and 2.9 among those aged <18 years. The proportion of CIRs vaccinated against pneumococcal and meningococcal disease was low (46% and 41%, respectively). Preimplant meningitis was identified as a risk factor for postimplant BM ($p = 0.002$). No other risk factors evaluated were associated with an increased risk for BM infection. CONCLUSION: CIRs have a high rate of postimplant BM infection. Preimplant BM infection was identified as a risk factor. Cases of BM infection might have been prevented through vaccination. @@ - 234-1699-0600-0

52 **"Speech perception in individuals with auditory neuropathy."** Zeng, F.-G. and Liu, S (2006). J Speech Lang Hear Res 49(2): 367-80.

PURPOSE: Speech perception in participants with auditory neuropathy (AN) was systematically studied to answer the following 2 questions: Does noise present a particular problem for people with AN? Can clear speech and cochlear implants alleviate this problem? METHOD: The researchers evaluated the advantage in intelligibility of clear speech over conversational speech in 13 participants with AN. Of these participants, 7 had received a cochlear implant. Eight sentence-recognition experiments were conducted to examine the clear speech advantage in 2 listening conditions (quiet and noise) using 4 stimulation modes (monaural acoustic, diotic acoustic, monaural electric, and binaurally combined acoustic and electric stimulation). RESULTS: Participants with AN performed more poorly in speech recognition in noise than did the normal-hearing, cochlear-impaired, and cochlear implant controls. A significant clear speech advantage was observed, ranging from 9 to 23 percentage points in intelligibility for all listening conditions and stimulation modes. Electric stimulation via a cochlear implant produced significantly higher intelligibility than acoustic stimulation in both quiet and in

noise. Binaural hearing with either diotic acoustic stimulation or combined acoustic and electric stimulation produced significantly higher intelligibility than monaural stimulation in quiet but not in noise. **CONCLUSIONS:** Participants with AN most likely derive the clear speech advantage from enhanced temporal properties in clear speech and improved neural synchrony with electric stimulation. Although the present result supports cochlear implantation as one treatment choice for people with AN, it suggests that the use of innovative hearing aids may be another viable option to improve speech perception in noise. @@ - 230-0479-8362-5

53 "Prediction and management about perilymph gusher in cochlear implantation." Zhang, D., Hu, B., Xiao, Y. and Zheng, H (2006). Lin Chuang Er Bi Yan Hou Ke Za Zhi 20(7): 295-6, 299.

OBJECTIVE: To discuss the clinical experience of prediction and management about perilymph gusher in cochlear implantation. **METHOD:** Among 327 cases of cochlear implant, eleven recipients were selected by the high resolution computed tomography (HRCT) findings of cochlear malformations and bony fistula on fundus of the internal auditory canal that caused an abnormal connection between subarachnoid and perilymphatic spaces. **RESULT:** Perilymph gusher was found in all of these 11 recipients during cochlear implantation and was controlled with muscle tissue seal. **CONCLUSION:** The reason of perilymph gushers in cochlear implantation is that abnormal connection between subarachnoid and internal auditory canal. HRCT can be used to assess the possibility of perilymph gusher in surgery. The safe and rapid surgical method of gusher controlling can avoid complication. @@ - 230-0497-4262-3