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News from the Auditory Valley

AUDITORY VALLEY
FUTURE HEARING

Hearing for all. All people, all situations, all sectors.

Newborn Hearing Screening

"Virtual Artificial Head" Records Sound in Three-Dimensional Space

Music for Hearing with a Cochlear Implant

News from the Cluster of Excellence

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Summer 2015

Hearing 4all

Cluster of Excellence in the
AUDITORY VALLEY
FUTURE HEARING

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Hearing the Future: With this slogan, the Auditory Valley Research and Development network is referring to everything that is known on the topic of hearing. It is our aim with this magazine to whisk you away on a regular basis into the fascinating and diverse world of research.

The central topics under the "Sonic Boom" category in this issue are newborn hearing screening and a specially developed concert for wearers of cochlear implants. In "Directional Filter," we introduce the Subject Database, a unique feature of the Hörzentrum Oldenburg GmbH. Under the category of "Pink Noise," we present a colorful mixture of research news and event reports.
The developments and findings of Hearing4all, the Cluster of Excellence in Auditory Valley, is once again a special focal point in this issue.
In order to promote qualified young talents, the network partners in Auditory Valley are offering a diverse study program on all areas of hearing. In each issue of "Click," we introduce an Auditory Valley course of study under the "Spectrum" category. In the current issue, the "Engineering Physics" course at Oldenburg University is in the spotlight.

Have fun reading!
Your CLICK editorial staff

P.S. Would you prefer to receive "CLICK" by email as a PDF? Just contact us at info@auditory-valley.com.

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Cornelia Rundt, Minister for Social Affairs, Health, and Equality in Lower Saxony

Dear readers,

Have you ever wondered what it would mean for you personally, if you could no longer hear well or if you lost your hearing completely? If you slept late in the morning because you could not hear the alarm clock, if you had to ask repeatedly when getting your work instructions, or if you missed a lot of things on the phone? Whoever cannot hear well, who literally cannot understand, has to face a whole swath of disadvantages in the social sphere as well as at work.

To keep this from happening, it is important for us to have the hearing ability of children checked right from an early age. A hearing impairment not "only" means reduced auditory perception; there are often severe developmental disorders at a linguistic, intellectual, social, and emotional level involved as well. The longer impaired hearing goes unnoticed and untreated in infants or toddlers, the worse its consequences become. If not enough auditory impressions are passed on to the brain during the crucial first developmental phase of the child extending until around the age of four, then the development of these brain structures will remain inferior for the rest of the child's life. Afterwards, this deficit can no longer be compensated for, even with intensive rehabilitation measures. That is why it is vital to begin therapy as early as possible – along with any necessary hearing aids and accompanying speech rehabilitation. It is mainly the first months of life that are significant for this, and it is at this time that we need to act.

The process called audiometry is fast and safe and can detect an auditory defect in a sleeping child without causing pain. I was able to observe that myself during my visit to the House of Hearing. Due to the major importance of hearing tests for childhood development, parents have had a legal right to have them performed on newborns since 9/1/2009. All insurance companies cover the costs. If a hearing impairment is discovered, which is fortunately rare, it is not only necessary to improve the child's hearing ability, but its speech development needs to be fostered from an early age as well.

This combination therapy improves the developmental chances of affected children considerably. That is why early diagnostics are so important – the longer hearing loss remains undetected, the harder it will be for the child to catch up from behind, particularly with regard to speech development.

I am therefore grateful to the staff at the House of Hearing for their important work.

Yours truly, Cornelia Rundt

Minister for Social Affairs, Health, and Equality in Lower Saxony

Minister for Social Affairs Cornelia Rundt of Lower Saxony (2nd from left) learning about the medical background and necessity of newborn hearing screening at the NHS Northwest Screening Center in the House of Hearing. In the front: Tanja Lux with Janno at a newborn hearing screening with Dr. Rüdiger Schönfeld (2nd from right) and Prof. Dr. Dr. Birger Kollmeier (right).

Minister for Social Affairs Rundt paying a visit to the House of Hearing

To learn about all the current developments in newborn hearing screening (NHS), Cornelia Rundt, Minister for Social Affairs of Lower Saxony, visited the NHS Northwest Screening Center in the House of Hearing on January 14th.

After a tour of the House of Hearing and a demonstration of the communication acoustics simulator, the Screening Center team provided insights into everyday practice. The scientific head of the Hörzentrum Oldenburg GmbH auditory researcher Prof. Dr. Dr. Birger Kollmeier (University Oldenburg) and chief physician for phoniatrics and pedaudiology Dr. Rüdiger Schönfeld (Evangelical Hospital Oldenburg) explained the medical backgrounds and necessity of NHS. "The ability to hear is of immense importance for the development of children, particularly in the first few years. That is why it is vital to begin therapy as early as possible – along with any necessary hearing aids and accompanying speech rehabilitation. Newborn hearing screening therefore is very resonable," stressed Rundt during her visit.

In Germany, two out of every thousand newborns are severely hard of hearing when they are born. Early recognition of a hearing defect can lead to effective and early treatment, either with hearing aids or with a cochlear implant (inner ear prosthesis). An assistive device, combined with special pedagogical therapy, makes it possible to greatly improve and ensure the phonetic and mental development of these children. In many cases, this guarantees development that will later make it feasible for the child to attend a regular school. It is particularly the first months of life that are crucial for this. Should an inborn hearing defect not be diagnosed until later, this will have disastrous, adverse effects on the child's development, directly affecting phonetic and mental development, schooling and vocational training, and thus the ability to socialize in our society. In numerous European countries and in parts of the USA, standardized newborn hearing screening has already been introduced. Since

2009, newborns in Germany have had a legal right to an early recognition examination for hearing defects as a service of statutory health insurance.

The NHS Northwest Screening Center based in the House of Hearing ensures that the goals of NHS are met through quality-controlled follow-up measures for infants tested as "conspicuous." A key part of this, besides technical and scientific support from the maternity clinics and other facilities involved in the hearing screening program, is tracking children whose examination results are either lacking or conspicuous. For this reason, the Hearing Screening Center informs parents when checkups have been missed in order to clarify the status of examinations. Tracking is continued until there are definitive results or the parents refuse any further contact by the Screening Center.

If a hearing defect is detected, the parents and children are helped through the steps that follow (hearing aid therapy, early intervention) and have a contact person in the Screening Center. Moreover, they can obtain information at any time over the telephone or on the Internet. Affected parents are also warmly invited to stop by in person in order to ask questions, receive information, and have their fears relieved.

To contact the NHS Northwest Screening Center:
+49 441 2172 100

Newborn Hearing Screening

How is hearing screening carried out?

The hearing ability of a newborn can be checked using two measuring methods.
With the first method, automated auditory brainstem response (AABR), a probe tone is played, and the reaction of the brain to the probe tone is measured. To do this, small electrodes are first adhered to the forehead, neck, and cheek bones, or the measurement is performed via built-in electrodes in the screening device. If the response can be measured, the middle ear, cochlea, acoustic nerve, and the lower part of the auditory pathway are functional.
With the second measuring method, the derivation of otoacoustic emissions (OAE), a probe tone is played in the ear. A healthy ear registers this tone and responds with a second tone. If this tone is present, it means that the middle ear and cochlea are working.

Is the examination uncomfortable?

The examination is easiest to perform when the baby has been fed and is asleep. It lasts only a few minutes and is completely painless and in no way uncomfortable for the baby.

What are the results?

The results given by the hearing test device are in message form, where "PASS" or "Unremarkable" indicates normal hearing and "REFER" or "Check" means that further testing is necessary. If "PASS" or "Unremarkable" appears on the screen of the hearing test device, then everything is in order. If "REFER" or "Check" appears, then testing at the maternity clinic is needed on the same day or the following day.

What needs to be done if "REFER" appears repeatedly?

If the device shows "REFER" or "Check" at the follow-up examination as well, this does not necessarily mean that the child is hard of hearing. Not every child whose hearing test indicates a need for testing actually has a hearing defect. It has to do with the (statistical) analysis method on the one hand, which does not want to overlook any child in need of treatment and therefore puts up with follow-up examinations for children with good hearing, and with "obstacles" to examining newborns (e.g. earwax in the auditory canal or amniotic fluid in the middle ear) on the other.

In the event of a repeated "REFER" or "Check" message, however, we strongly recommend going to a specialist for a confirmation examination within four weeks. The specialist will conduct further tests in order to be sure of the child's hearing ability and may be able to initiate any necessary treatments immediately.

Source: www.neugeborenen-hoerscreening.de

musIC 2.0

The MHH Offers a Special Concert for Hearing with a Cochlear Implant

More than 200 enthusiastic listeners came to hear "musIC 2.0" in Hanover, a concert organized especially for CI wearers by the DHZ (German Hearing Center of Hanover) along with the Hanover School of Music and musicians from Hamburg, Barcelona, and Naples. The title, "musIC 2.0," was intentionally chosen, since the concert involves both interaction between CI wearers and composers as well as a new kind of music. It is new because it does not exclude CI wearers due to the complexity of its structure, but instead purposely includes them so that EVERYONE can enjoy the concert. In the end, the only thing that is important is the question whether CI wearers have had a similar experience to those who can hear normally. "Since listening to music tends to be difficult for many wearers of cochlear implants – CI was always mainly oriented towards good speech comprehension – the music may need to change to be enjoyable for CI wearers," explains Prof. Waldo Noguiera from the DHZ and the initiator of the project. For this reason, the sound artists from the Hanover School of Music and from Hamburg, Barcelona, and Naples composed new pieces specifically adjusted to the particularities of listening with CI. Prof. Nogueira was able to interest many CI wearers in this, who came to discuss their experiences with the musicians multiple times, explaining to them the limits of CI. "I'm happy that we can experience this special event here in Hanover, for this kind of a concert has only been held four times throughout the world," stated ENT Hospital Director Dr. Thomas Lenarz.

For about two hours, the listeners heard a wide variety of music, sometimes played on instruments like the piano, violin, accordion, and flute, sometimes produced electronically – such as through the artist's body movements, translated into various sounds by a device – or by the Reactable, an electric-acoustic musical device invented only a few years ago whose surface works like a sound-producing computer. For this last piece, the composer Sergio Nadei had blown-up balloons distributed among the audience so that everyone could physically feel the deep frequencies as vibrations in the balloons.

Now after 30 years of clinical experience with CI, it has been proven how well it can be used to understand language. Music, however, is still a challenge for many CI wearers and is thus a task for researchers. "With the musIC 2.0 project, we wanted to create music that is enjoyable for CI wearers – and for normal hearers alike. Moreo-


ver, we are looking for input on how we can improve the technology in order to transport the complex system of music with its elements such as sound, interval, melody, rhythm, harmony, and the tone of the instruments in such a way that CI wearers can enjoy it," explains initiator Prof. Waldo Nogueira from the ENT Clinic of the MHH. ENT Clinic Director Prof. Lenarz and Prof. Nogueira found that people were very open to this idea, for a group of around 25 CI wearers had formed within a very short time, and they met together with the composers at a total of three afternoon workshops. In addition, the project greatly profited from the fact that the group was very diverse – running the gamut from hobby musicians to those who had very little experience with music.

The title was intentionally chosen: "As with Web 2.0, which represents a new stage of evolution of the World Wide Web, we are of the opinion that we need new music that is suitable for listening with CI.

Our project likewise depends on the collaboration of CI users and musicians," says Prof. Nogueira. Both groups have worked together to discover which sounds, instruments, tone sequences, and tone intervals can be easily recognized with the CI. In this way, the CI wearers played a major role in determining the compositions. What is more, the title "musIC" has the letters IC, pointing to the cochlear implant. And the addition of "2.0" indicates the fact that musIC is heavily influenced by technology.

Acknowledgements

For their music and compositions:

Arsalan Abedian, Jieun Jun, Jacob Sello, Clemens Damerau, Luis Nogueira, Pablo Carrascosa, Sergio Nadei, Stefan Weinzierl, Roser Pla, Hanna Wranik, Karl Peterson as well as Pit Noack und Joachim Heintz for their support and counselling

For their patient explanations of the CI and how they hear music:

Mario Millan, Dagmar Urban, Wolf-Dieter Göcke, Jutta Müller-Schwarz, Andree Schmitzius, Susanne Herms, Anette Spichala, Renate Kloppmann, Ludmila Schmidt, Petr Dobias, Arnold Erdsiek, Hans Albert Duckstein, Rosa Affenzeller, Klaus Ramme, Roswitha Rother, Dieter Meier, Elena Ekondraschowa, Annegret Feldhordt , Johannes Behr and familiy, Rolf Erdmann

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We thank MED-EL and the colleagues their for their generous support, in particular:

Cornelia Batsoulis, Timo Bräcker, Johanna Pätzold, Daniel Sieber

Oldenburg Auditory Researchers Receive Multiple Awards at the DGA Conference

At this year's annual conference of the German Audiology Society (DGA) in Bochum, the auditory researchers from Oldenburg once more produced dazzling proof of their reputation by receiving multiple rewards at the same time.

The highest award given out by the DGA went to Prof. Dr. Dr. Ulrich Eysholdt, who recently became senior professor with visiting professor status at the faculty VI of Medicine and Health Sciences at the University Oldenburg and the Evangelical Hospital. He was appointed as an honorary member of the DGA for his special interdisciplinary merits. Eysholdt received the honorary membership for the totality of this scientific work, which includes pioneering work in objective auditory diagnostics, a leading role in vocal diagnostics on an international scale, and many years of promoting audiology as a review board member of the German Research Foundation (DFG).

(v.l.) Prof. Dr. U. Hoppe (Laudator), Prof. Dr. Dr. Ulrich Eysholdt und Prof. Dr. Tobias Moser (President of the German Audiology Society)

Dr. Thomas Brand, directing scientific associate and postdoctoral researcher in the Medical Physics Group at the Medicine and Health Sciences faculty at the University Oldenburg, was awarded the Meyer-zum-Gottesberge prize for outstanding young scientists. The DGA awards this prize for excellent work in the field of auditory research. The prize is endowed with € 3,000. All scientists and physicians in Germany and neighboring countries are eligible. Along with numerous publications, Brand's work is also characterized by his successful supervision of master's and Ph.D. students and by his efforts to establish the master's program in "Hearing Technology and Audiology". With his work on modeling hearing impairment and audiology methods, he has made a significant contribution towards the international reputation of auditory research in Oldenburg. "The fact that we have been able to hold on to such a distinguished and committed researcher in Oldenburg for over 20 years is a pure stroke of luck," declares Prof. Dr. Dr. Birger Kollmeier, director of the Medical Physics Group.

(v.l.) Prof. Dr. Tobias Moser (President of the German Audiology Society), Dr. Thomas Brand and Prof. Dr. Dr. Birger Kollmeier

This year's DGA publication prize was given to Anne Schlüter, who represented the Institute for Hearing Technology and Audiology at Jade University of Applied Sciences. She received the award together with her co-authors Jacob Aderhold, Shiran Kofman, Melanie Krüger, Theresa Nüsse, Dr. Ulrike Lemke, and Prof. Dr. Inga Holube for their article "Research on a Procedure to Verify Methods for Reducing Background Noises in Hearing Aids" in "Zeitschrift für Audiologie." The publication prize is awarded each year to the best article in the magazine and is endowed with € 300. The basis for the prize article is a study conducted in a project internship of the "Hearing Technology and Audiology" study program. Ph.D. student Anne Schlüter played a significant role supervising the internship.

(v.l.) Prof. Dr. Tobias Moser (President of the German Audiology Society), Ph.D. student Anne Schlüter, Prof. Dr. Jürgen Kießling (Editor of Zeitschrift für Audiologie).

Sennheiser introduces the new RS 195 headphones + Fraunhofer technology makes better speech comprehension and compensation for hearing loss possible

Headphones Improve Hearing for Speech and Music on an Individual Basis

With the RS 195 model, the Sennheiser company has developed headphones in collaboration with the Fraunhofer Institute for Digital Media Technology (IDMT) that compensate for age-related hearing loss by means of personalized sound adjustment and can be set to the individual preferences of the user. The wireless headphones make it possible to compensate for the hearing impairment and, at the same time ensure a high level of audio quality. For example, users can optimize speech comprehensibility and sound so that the TV program or the music selection is reproduced clearly and rich in detail. This is made possible thanks to signal processing strategies from hearing aid technology that scientists at the Fraunhofer IDMT have developed further for use in entertainment electronics. In addition to providing the technical basis, the researchers also conducted extensive user studies to orient the headphones to the needs of people with age-related hearing loss.

Better Comprehensibility for Age-Related Hearing Loss

"Every person has a personal sound preference with respect to speech comprehensibility. Individual sound adjustment is therefore useful for everyone. At 50 years of age, normal hearing ability starts to decline for many people. The transition to being hard of hearing is gradual," explains Dr. Jan Rennies of the project group for Hearing, Speech, and Audio Technology at the Fraunhofer IDMT. "Studies with participants over the age of 50 who have age-related hearing loss have shown that speech comprehensibility can be significantly increased using the signal processing we have integrated into the headphones," says Rennies. Besides adjusting the sound pattern, the headphones also automatically optimize the volume, such as for TV programs with extreme volume fluctuations. Manual readjustment is therefore no longer necessary.

Individually Adjustable Sound

The transmitting station of the RS 195 also serves as the charging station and has numerous setting options for adjusting the sound to the special preferences of each listener. Besides TV noise suppression and switchable modes for speech and music, a total of seven reproduction options with different sound characteristics are available to the user. They compress, accentuate, or intensify the treble, mid, and bass ranges and compensate for individual hearing loss. "This not only makes the sound louder, but it can also be adjusted to the special needs of the user," says Annegret Meyer, Vice President of Sales for Europe Hearing Care of Sennheiser electronic GmbH & Co. KG. "In this way, users with limited hearing ability no longer need to do without excellent sound quality in the entire frequency range." Control elements on the headphones can be used to control both the volume as well as the reproduction mode for speech or music right during use.

The headphones with built-in hearing support has been available in specialist stores since January 2015 under the name "RS 195 Digital Wireless."

Warm Ears and Festive Words – Mayor and University President at the Opening of the House of Hearing Annex

In order to keep up with the increasing need for space for the auditory research in Oldenburg, Hörzentrum Oldenburg GmbH expanded its House of Hearing in 2014 with an annex of 300 m² in size. This created around 25 new office workstations. At the festive dedication in January 2015, Mayor Jürgen Krogmann and temporary University President Prof. Dr. Katharina Al-Shamery inaugurated the new premises. "The success of auditory research in Oldenburg is second to none around the world. I am pleased to accompany this showcase for Oldenburg on its journey," stressed Mayor Jürgen Krogmann in his welcoming speech. University President Prof. Katharina Al-Shamery underscored this, saying, "The House of Hearing is the hub and center for top-quality auditory research by university and non-university research facilities working together. The synergy effects for all sides are enormous."

Lars Krause, Stephan Albani (Hörzentrum GmbH), Prof. Dr. Katharina Al-Shamery (University of Oldenburg), architect Hans-Jürgen Bethge, Dr. Rüdiger Schönfeld (Evangelical Hospital), architect Klaus Wohde, Mayor Jürgen Krogmann, and Prof. Dr. Dr. Birger Kollmeier (University of Oldenburg) inaugurate the new annex of the House of Hearing in Oldenburg.

In the presence of invited guests from the spheres of politics, commerce, and science, the leadership team of Hörzentrum Oldenburg GmbH (Prof. Dr. Dr. Birger Kollmeier, Scientific Director, Dr. Rüdiger Schönfeld, Medical Director, and Stephan Albani, Managing Director) was excited about the start signal for more space for auditory research.

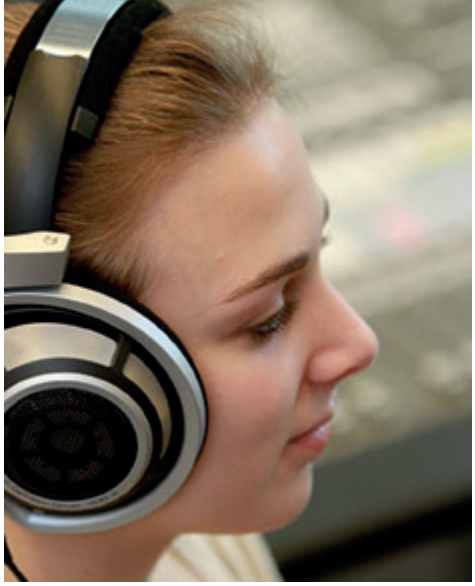
Research Unit "Individualized Hearing Acoustics" Sponsored for Three More Years

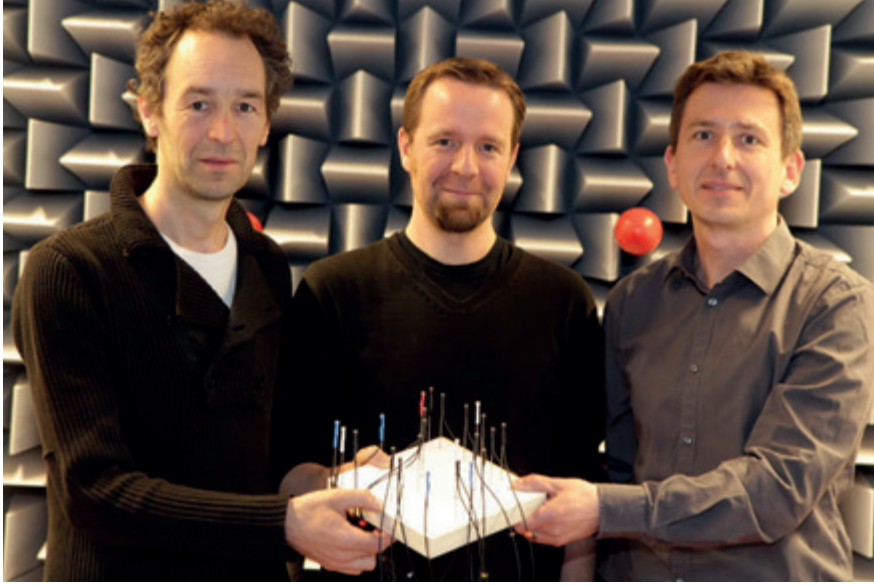
How can proper perception of an acoustic signal be assured for an individual, even in an acoustically challenging situation? To answer this main research question, the research unit 1732 "Individualized hearing acoustics" studies hearing models and algorithms and developes them as a part of demonstrators – i.e. innovative software and device prototypes – that make acoustic perception predictable and controllable for as many individual user profiles as possible in as many situations as possible. The demonstrators serve as the basis for future systems that will help to permanently optimize the acoustic perception of all people in all acoustic situations. In February, the research group, sponsored since 2011 by the DFG, successfully presented its findings to the group of experts. In their report, the latter stated that they found the joint study of people with normal hearing together with the hearing impaired particularly original, and they regarded the work and results of the research group as being world class. Due to unanimously positive recommendations by the experts, the Oldenburg auditory researchers will be sponsored for three more years with 1.95 million euros.

Thanks to technological progress and changed user behavior, the demand for the presentation of hearing in an individualized manner has increased, especially in recent times. However, actual use of the new technologies is still very limited for many (potential) users, since the technologies have not been ideally adapted to either the individual user or to any acoustically challenging ambient situation. To enable individualized hearing presentation, solutions to the following three fundamental problems need to be found:

- Identifying and compensating/suppressing as precisely as possible the sources of acoustic background noise in any given acoustic scenario
- Ensuring the transmission of acoustic information by an electroacoustic system (e.g. hearing aid, audio headset, loudspeakers) to the ear of an individual person
- Extensive compensation of individual hearing impairment and taking into account individual sound preference by corresponding preprocessing of the acoustic signal

Innovative approaches to these problems will be developed by the research unit in the next three years in order to solve the initial research question – and to at least partly fulfill the hopes and expectations of many who are affected.





Fotos: Piet Meyer

v.l. Prof. Dr. Martin Hansen, Dr. Eugen Rasumow und Prof. Dr. Matthias Blau with the Virtual Artificial Head

"Virtual Artificial Head" Records Sound in Three-Dimensional Space

Whether it is orchestra music in the concert hall or driving noise in the interior of a car: The simulation of sound experiences in specific spaces as realistically as possible is the set goal that scientists are pursuing at the Institute for Auditory Research and Audiology at Jade University of Applied Sciences in Oldenburg. The team under Prof. Dr. Matthias Blau and Dr. Martin Hansen had great success with the development of a "virtual artificial head," a system of microphones with which people can be transported acoustically to specific spaces with near perfection. This internationally significant work has now been given an award: The project is receiving 427,000 euros from the "Young Engineers" program of the German Federal Ministry of Education and Research (BMBF) over the next four years in order to help another young scientist finish a doctorate. Title of the project: "Individualized Dynamic Reproduction of Three-Dimensional Sound Fields via Headphones."

The objective of the new project is to develop a recording and reproduction system based on the "virtual artificial head" that can reproduce sound fields via headphones in a way that is true-to-life. The fact that head movements can be calculated and reflected in the sound production is a special highlight. This should make it possible to conquer three-dimensional space and make it dynamic – results that will open up new application scenarios for the industry.

One of the new, prominent partners is Aalto University of Finland, which is regarded as a leader in the area of assessing the quality of concert halls. By collaborating with Jade University of Applied Sciences, it hopes to advance its research further. Another new industrial partner is Mercedes Werk Bremen. It is the idea of the vehicle manufacturer to assess the interior noise of a vehicle as realistically as possible with test persons in the laboratory. "Great teamwork," says Matthias Blau, the project director, "this includes also our scientific partners from University of Oldenburg, of course: Prof. Dr. Simon Doclo, Prof. Dr. Steven van de Par, and Prof. Dr. Volker Mellert."

With respect to room acoustics, emotions and individual perception experience also play a role. "Sound can be measured objectively, but it also has something to do with a person's subjective impression and sense," explains Matthias Blau. "Alternative approaches require 200 or possibly even 2000 microphones. Our question was: How can this enormous effort be compensated? What technical quality progress can a person still hear and perceive? As with MP3-encoded music, we can also achieve major data reduction – it is our goal to get by with 24 to no more than 32 microphones."

A person whose hearing is to be measured sits under a hoop that is standing upright with the person's head in the middle. 24 loudspeakers are arranged in the hoop. The sound from these loudspeakers reaches microphones in the ears of the person. The different anatomy of a person's ears, head, and body results in different, directionally dependent sound shapes uniquely perceived by the person as "normal." With the data gathered, the acoustic effect of other sounds in specific spaces (concert hall, car) can be calculated. The data-fed analysis system called the "artificial head" does not look like a head, but instead is a special microphone array with the technology required for processing signals from individual channels. "Previously, only the horizontal level of sound was measured," explains Matthias Blau. "In that respect, we are already doing better than previous, comparable methods."

PINK NOISE

© shutterstock.com / Alan Tunnicliffe

What has the Human Ear in Common with Owls and Lizards?

Most of us have no idea that human ears – and those of many animals – not only can hear, but can transmit sound as well. These inaudible sounds, so-called otoacoustic emissions, are generated by the ear either without an external influence or due to specific acoustic stimuli. A research team under Oldenburg neurobiologist Prof. Dr. Christine Köppl and Canadian physicist Prof. Dr. Christopher Bergevin (York University, Toronto) has discovered that the emissions in humans, birds, and lizards are amazingly similar, despite the very different inner ear structures. Together with zoologist Prof. Dr. Geoffrey A. Manley, guest researcher at the University Oldenburg, the two have now published their findings in the noted US journal PNAS ("Proceedings of the National Academy of Sciences").

Scientists have known about otoacoustic emissions as such since the end of the 1970s, but the origin of them had remained a mystery until now. The new study compares the emissions of human ears in detail with those of barn owls and green anole lizards and suggests a uniform, trans-genus mechanism of origin. "The sensory cells in the inner ear are the common element," says Köppl. "In the course of evolution, a spiral-shaped cochlea developed in mammals and a long, banana-shaped inner ear structure in birds, whereas lizards still have a tiny handful of sensory cells – but the different appearance and coupling apparently plays a subordinate role with otoacoustic emissions."

The scientists measured the otoacoustic emissions of the animals in the laboratory; the data from humans was already available to them. In normal everyday situations, ears rarely emit sound, which is usually all but suppressed by the ambient sounds coming in. In a soundproofed room, however, "spontaneous" emissions can be measured after about ten minutes of absolute silence, or they can be evoked using acoustic stimuli. If these otoacoustic emissions – which occur somewhat more frequently in women for unknown reasons – were amplified, they would sound like a whistle and would even be polyphonic in some cases.

According to Köppl, otoacoustic emissions are "very prominent" in infants and toddlers and therefore form the basis for newborn hearing screening. It is so far a rather simple measuring procedure – if no emissions are measurable, then other tests follow," says Köppl. However, a better understanding of otoacoustic emissions in the future could make more differentiated diagnostics possible, perhaps even an "objective hearing test" that would not require feedback from the patient.

Prof. Dr. Christine Köppl is an expert in cochlear and brainstemm physiology in the Department of Neurosciences of the faculty VI Medicine and Health Sciences and is one of the leading researchers in the "Hearing4all" Cluster of Excellence.

Source: Press & communications, Oldenburg University

Prominent Political Figures Learn about Hearing System Treatment and the Hearing4all Cluster of Excellence at the DHZ

There have already been many prominent political figures this year who have visited the German Auditory Center of the MHH in Hanover and the Hearing4all Cluster of Excellence: First, Christian Dürr, FDP parliamentary party leader in the Lower Saxony State Parliament, and Sylvia Bruns, FDP State Parliament and City Council Delegate, came to visit recently, followed by Hanover Mayor Stefan Schostok (SPD). At the DHZ, the politicians learned about auditory system therapy – primarily about cochlear implants, but also about the good educational and vocational opportunities for those who are treated in a timely manner with the right auditory system.

Newborn hearing screening was a main topic during the visit by Christian Dürr and Sylvia Bruns. They spent more than two hours there and were shown the DHZ facility, the diagnostic methods, and the special service that makes DHZ so unique in all of Germany: This is because people of all ages who suffer from any kind of hearing impairment can be treated here and fitted with the right auditory system.

Clinic Director Prof. Dr. Thomas Lenarz (right) informing Stefan Schostok, Mayor of Hanover, (left) about cochlear implants

The scope of its services is a unique feature of the DHZ that also impressed Hanover's Mayor Stefan Schostok, who came to visit in mid-March. Together with MHH President Prof. Christopher Baum, Clinic Director Prof. Lenarz pointed out the importance and attraction of the ENT clinic as an international research location, for a large number of companies have meanwhile set up shop in the vicinity of the MHH. Only last December, the American company Blackrock opened its European headquarters in the Medical Park in order to intensify its collaboration with the ENT clinic for developing neuroprostheses. The mayor was also impressed by the blueprints for the construction of the auditory clinic. The plan is to rebuild the DHZ building so that all areas of auditory treatment are together in one single location. From diagnosis to imaging, operating area, and inpatient accommodations, including boarding house facilities.

Oldenburg Auditory Researcher Volker Hohmann Helping to Decide Research Funding

Considerable sums for auditory research are involved: When the seven-member scientific committee of the Parisian organization "Acting for Hearing" ("Agir Pour l'Audition") selected recipients of research funds for the first time at the end of February, an Oldenburg scientist was also participating. Prof. Dr. Volker Hohmann, professor of auditory signal processing, one of the leading researchers of the "Hearing4all" Cluster of Excellence, and bearer of the German Future Prize, has been on the committee since it was formed in 2014.

The organization is pursuing the goal of sensitizing French society even more to – the widespread – hearing loss and focusses on improving treatment with auditory systems. The scientific committee appraises two project lines: on one hand, laboratory subsidies for research facilities in France and possibly their partners abroad and, on the other, research grants for French post-doctoral students (worldwide). "Agir Pour l'Audition" is financed by the Bettencourt Schueller Foundation. After an initial meeting in September 2014 to define the research objectives, the committee, chaired by Dr. Karen Avraham (Tel Aviv University) was now meeting alongside an international ENT specialist conference in Maryland (USA).

Hohmann has been working at the Institute for Physics of Oldenburg University since 1993, where he became a professor in 2007. He is one of the founders of the Hörzentrum Oldenburg GmbH. The scientist's research activities focus on models of signal processing in the auditory system, in particular binaural (two-ear) hearing, and its application in the area of signal processing for hearing aids.

Source: Press & communications, Oldenburg University

Oldenburg Hearing Center Expands Its Subject Database

New auditory systems and audio products are being developed to improve the quality of life for the hard of hearing and to optimize sound impression. Here, it is in the manufacturer's interest to demonstrate the improved effect and superior performance of the new device.

As a leading company in the field of auditory research and hearing aid evaluation in Germany, the Hörzentrum Oldenburg GmbH is devising and conducting comprehensive and specifically designed studies on behalf of the industry that subject products to detailed and individualized testing, evaluate them, and – if desired – compare them to other devices as well.

In order to conduct these studies on behalf of customers, the Hörzentrum Oldenburg GmbH has long been relying on a central subject database with more than 2,200 people up to 85 years in age. The hearing abilities range from normal hearing to severe hearing impairment. Previously, the subject database was made up of audiogram data and medical history data from hearing aid treatments. Within the Hearing4all Cluster of Excellence, the Hörzentrum Oldenburg has now added other basic data to this database (such as cognitive factors) to produce a comprehensive subject profile. This gives hearing aid and CI manufacturers – and also customers from other sectors – the possibility of having just the right subjects selected for studies according to a wide variety of specific characteristics.

The auditory researchers from Oldenburg have developed a battery of tests in order to characterize the subjects with respect to audiological, cognitive, and sociopsychological factors. Besides socio-economic variables, the questionnaire gathers data on aspects such as willingness and competency with respect to technology, expectations concerning sound quality, use of hearing aids, and quality of life. In addition, one test measures vocabulary to determine verbal intelligence. The DemTect (dementia screening) gathers data in a simple and objective fashion. The basic battery of tests in the laboratory consists of the audiogram, the loudness scale, the triple-digit test, and the Göttingen sentence test. The result of this extensive data is a detailed audiological profile of the test subjects.

This comprehensive profile can be used to systematically recruit subjects for studies in the field of hearing aid evaluation and incorporate additional information when interpreting audiological data in the analyses. It turned out that cognitive performance, as measured by the DemTect, is an important predictor for assessing not only speech audiometric data, but also auditory system algorithms. It also became clear that people with a willingness to embrace technology are more open to treatment with auditory systems and are able to operate auditory systems like audio devices more capably and with greater ease. With systematic and detailed profiling, distorting effects of the random sample can already be avoided or controlled for at the time of recruiting.

Evaluation of Listening Effort in Laboratory Measurements and Everyday Situations

Everybody knows what it is like to try to talk with someone in a crowd of people: It soon becomes obvious how strenuous this is. Just listening takes a lot of effort in complex environments.

The more problems we have with our hearing – in other words, the more severe our hearing loss is – the worse this issue, also referred to as listening effort, becomes. Auditory systems aim to help improve listening effort, minimizing it for the individual who is affected. But do they really do that? Good measuring methods are required to test this.

In the last few years, numerous measuring methods for determining listening effort have been developed and used. Of these, it is mainly the subjective measuring methods (e.g. scales, questionnaires) that have proven to be sensitive and that are able to be used quickly and flexibly.

In the Hörzentrum Oldenburg, a new scaling method for laboratory measurements and a new questionnaire for evaluating listening effort in everyday situations have been developed. The adaptive scaling method involves an automatic and easy to use measuring tool for recording listening effort in laboratory situations. The measurement duration is comparable to that of known speech tests (e.g. the Oldenburg sentence test). With the new categorical scaling method, individual level ranges are factored in using adaptive level calculations. During the measurement, the speech level is adaptively changed based on the previous assessment of listening effort, making it possible to determine an individual SNR range for each test subject. The test subject's task is to rate how strenuous it was to follow along with the speaker. With laboratory measurements, the speech material can be selected just as easily as the background noise and adapted to each testing situation. The adaptive scaling of the listening effort is particularly sensitive in the testing range where it is no longer possible to identify differences in speech comprehensibility using speech comprehensibility measurements, i.e. in the range where everything can still be understood, but it is strenuous to understand everything.

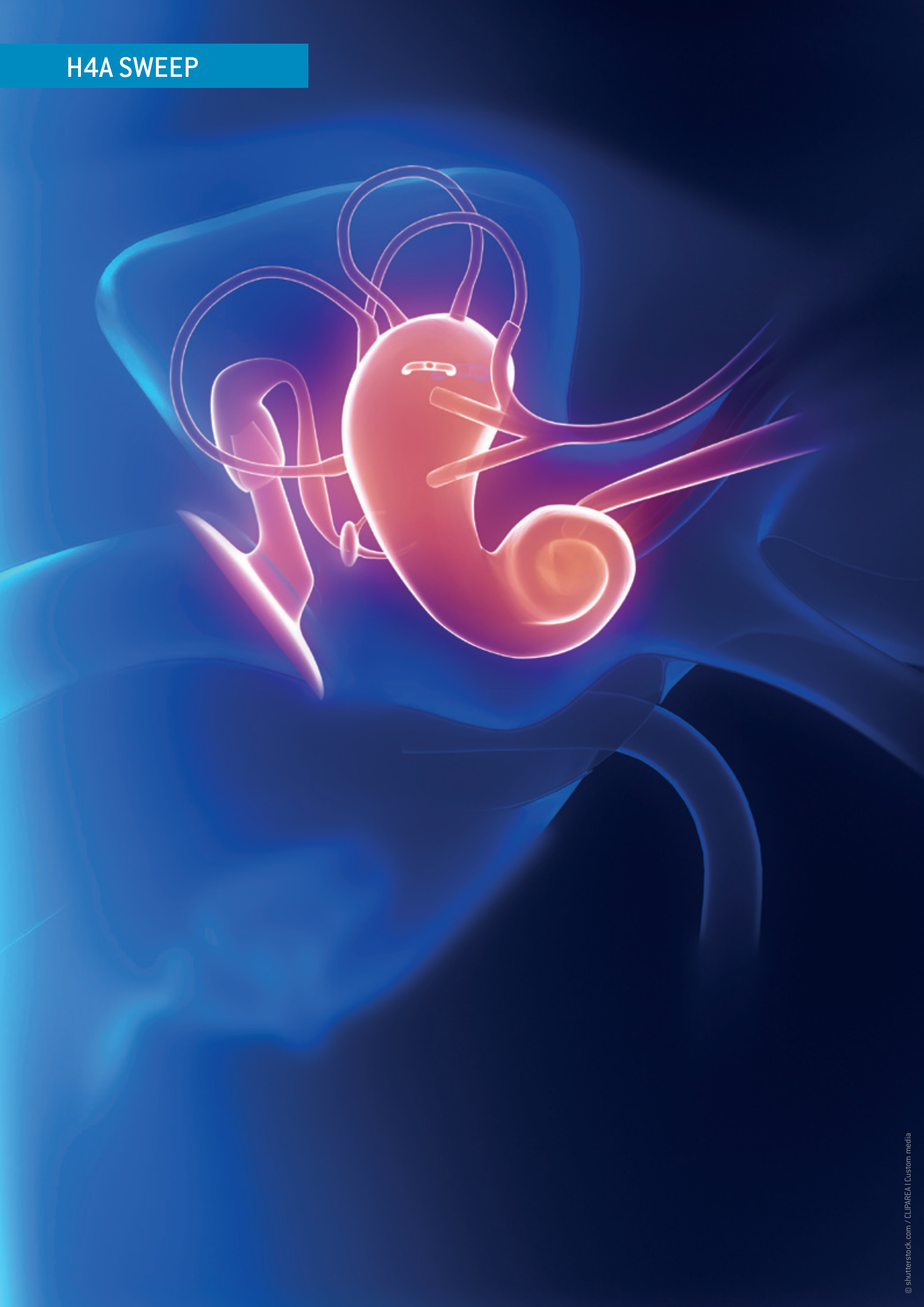
To evaluate everyday situations, a listening effort questionnaire was developed. In doing so, care was taken to ensure that the questions can be answered quickly and easily and that they cover both quiet situations as well as noisy and other challenging situations (e.g. reverberations, poor acoustics). The example statement below illustrates how the questionnaire is set up.

The listening situation being evaluated is described in detail. This makes it easier to give precise answers to the questions. The results of the listening effort questionnaire and the adaptive scaling method can be combined, thereby providing a complete record of the individual difficulties with the listening effort.

1. You are in an important meeting with a small group of people. The room is quiet and you follow the changing conversations.	☐ Situation does not occur Go to next situation If you experience this situation please rate frequency ☐ importance ☐	How much effort do you use to follow the conversations? No effort — Extreme effort 0 1 2 3 4 5 6 7 8 9 10

This example illustrates the strucuture of the questionaire.

H4A SWEEP



Improved Inner Ear Diagnostics: Invasive and Non-Invasive Analysis of the Human Inner Ear Fluid (Perilymph)

Around 80 percent of the 15 million hearing impaired people in Germany have what is called an inner ear hearing impairment, and yet accurate pathophysiological data is only available to a limited extent. This has to do with the fact that the inner ear is hard to reach without damaging the rest of the ear. It is therefore difficult to carry out diagnostic tests on the inner ear, with the result that there is no accurate data concerning the composition of perilymphs and endolymphs and their pathophysiological changes with respect to the different forms of human inner ear hearing impairment.

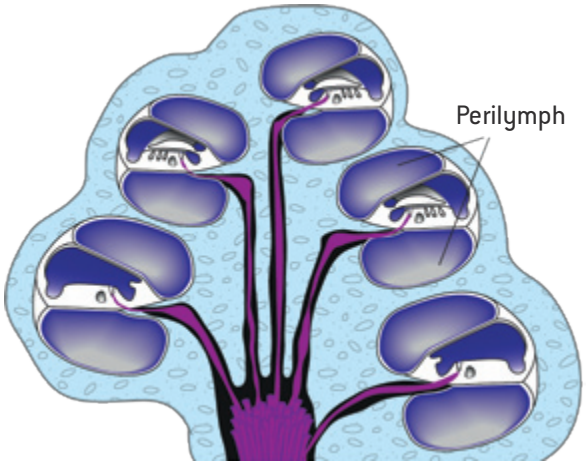
Unlike the outer ear and middle ear, the inner ear is not filled with air, but instead with a clear fluid: referred to as perilymph and endolymph. It is via these fluids that the stimuli acting on the inner ear are transmitted to the respective sensory cells.

A subproject of the Hearing4all Cluster of Excellence is developing a method with which samples of the perilymph in the ear can be taken directly. These fluid samples are then examined for certain hearing impairment markers in the laboratory. MHH researchers are using mass spectrometry to study the detailed composition of the perilymph. Their partners at the Leibniz University in Hanover are developing an optical method at the same time to examine samples more closely using Raman spectroscopy.

The perilymph samples are taken during CI implantation procedures at the MHH directly before the CI electrode is inserted. Mass spectroscopy technology can be used to examine the samples with regard to their substance content. Using this method, several hundred proteins have been detected in each perilymph sample – about 1000 different proteins in total. At the same time, the colleagues at LUH are developing an examination method to determine the protein content and composition of the perilymph by exposing it to light. This procedure is used to determine the so-called Raman spectra of the perilymph samples. These spectra are compared with those of known amino acids and proteins, with a catalog of the substances contained in the sample compiled as a result.

The results so far give reason to assume that the invasive methods presented have led to a clearly improved diagnostic method. The proteins analyzed via mass spectrometry still need to be precisely characterized by means of literature and database research in order to develop a detailed perilymph protein structure. The database compiled in this way is to be used to identify the proteins that are characteristic of different inner ear disorders. In the future, these are expected to be useful diagnostic markers for hearing impairment.

The non-invasive optical examination of the inner ear based on findings from the invasive analysis may greatly benefit the patients in the future: It may enable us to better identify individual causes of inner ear hearing impairment, thereby facilitating more targeted treatment. This increase the chances for success of individual treatment considerably.



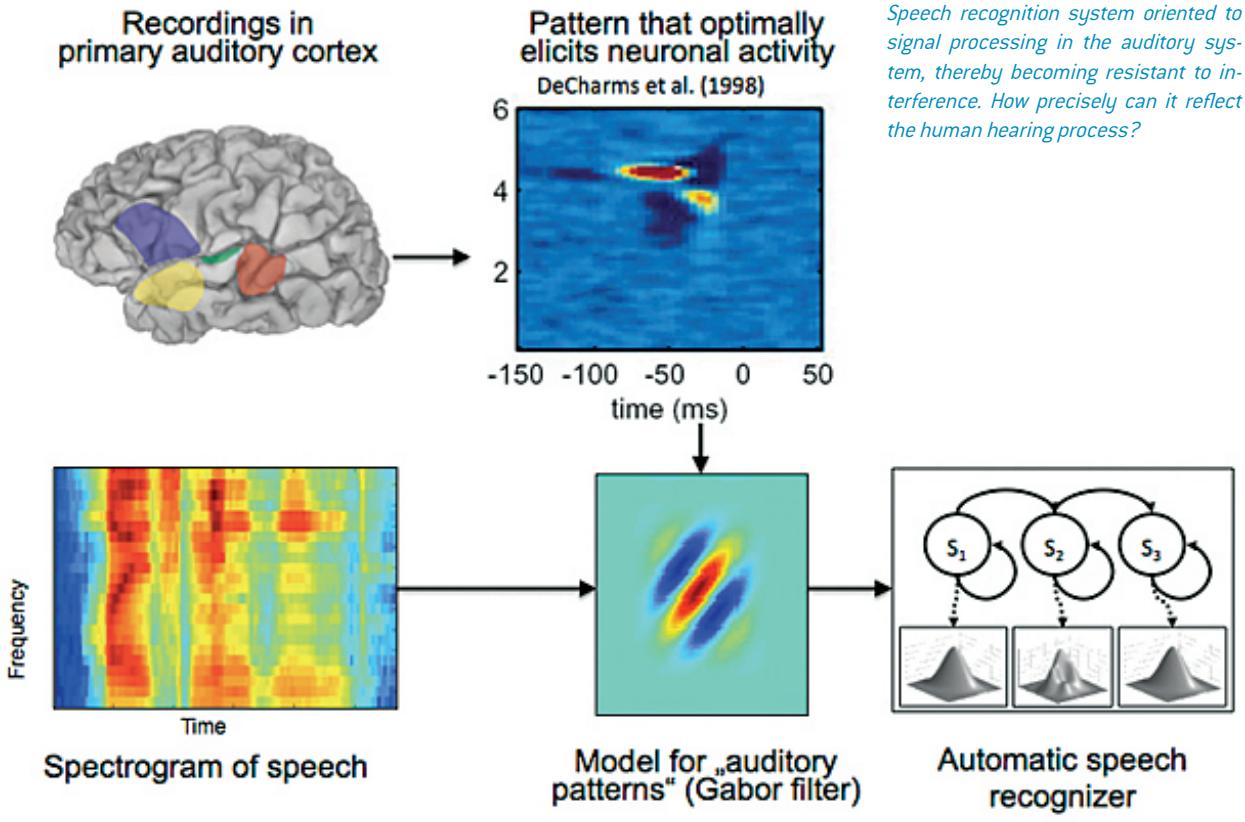
It All Hinges on Speech

People can recognize speech under extremely difficult conditions. No matter whether there are background noises, echoes, or other interference, listeners with normal hearing can focus on the other person and follow what he or she is saying. What does a machine need to learn in order to be able to recognize speech just as well and do it reliably? Dr. Bernd T. Meyer and his colleagues in the junior research group "Automatic Speech and Audio Processing" at University of Oldenburg are asking this and similar questions.

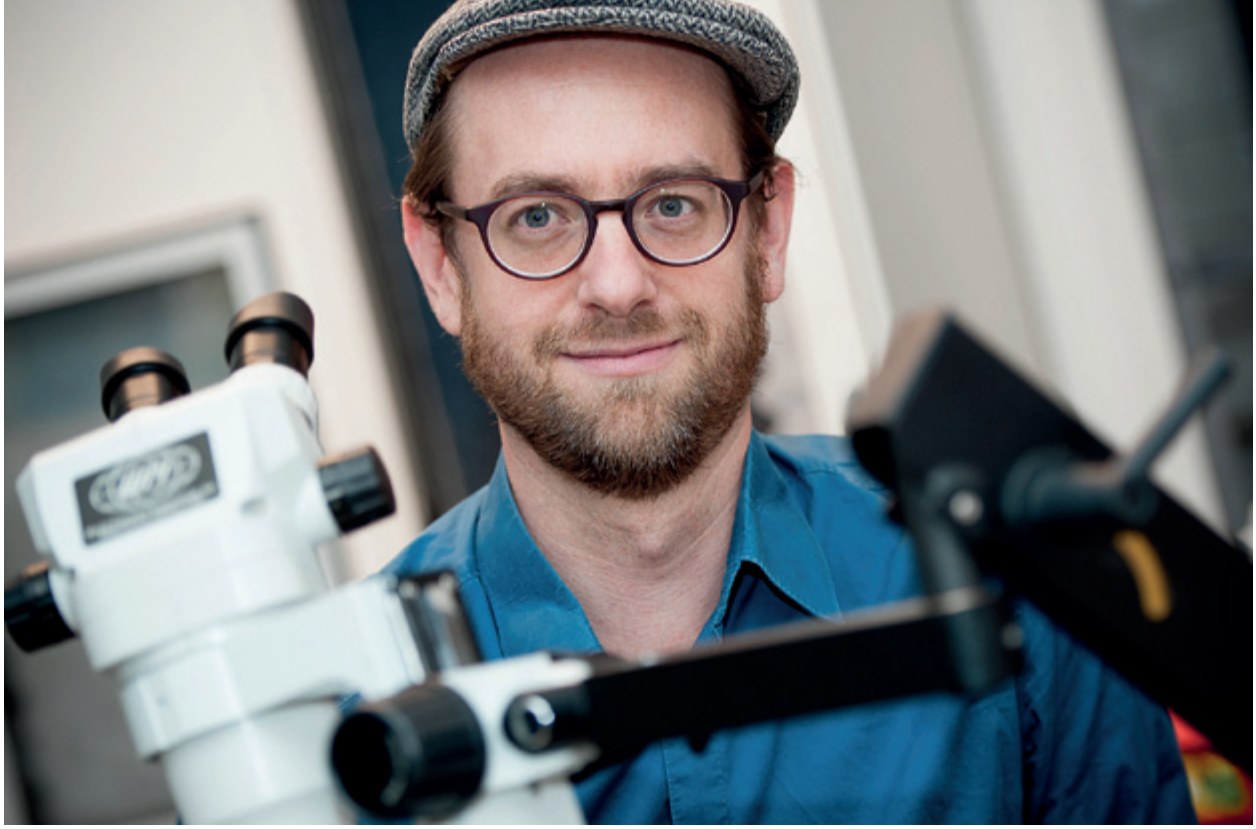
A significant part of the work consists of exactly understanding findings on human hearing. The objective is to teach the computer the properties of the human ear that are perfected for understanding speech in order to improve its recognition. To do so, so-called "spectrotemporal auditory filters" are used to translate a speech signal into a representation that reflects how it is processed by the ear. By using these representations, it is possible to improve the recognition rates of speech recognition systems in difficult situations. In a direct comparison with the performance of human listeners, it is possible to deduce which elements of human hearing are already well understood, among other things. Moreover, this procedure provides an opportunity to identify and understand previously unknown human processing mechanisms.

This work aims to develop and improve so-called "assistive systems." For instance, an assistive system may be a speech control system for controlling devices. And even future hearing aids may benefit from assistive systems in order, for instance, to better assess spoken language and, based on that, select the most suitable program in each situation.

In the other direction, researching automatic speech recognition systems also makes it possible to design new models of human speech comprehension. For instance, a speech recognition system could be used to estimate how much a person can still understand in a given situation. This will help with developing future hearing aid algorithms, the suitability of which can then be tested by the automatic speech recognition system. This could speed up development tremendously, since it would make some of the long, drawn-out studies with subjects superfluous.



Speech recognition system oriented to signal processing in the auditory system, thereby becoming resistant to interference. How precisely can it reflect the human hearing process?



Prof. Dr. K. Jannis Hildebrandt, junior professor for Auditory Neurobiology at the University of Oldenburg

The Special Thing about Grasshoppers

At night, when it is quiet, the siren of an ambulance has an absolutely shocking acoustic effect. On a busy street during the day, the same siren is just one source of noise among many – still very loud, but without the merciless penetrating force it has at night. "Adaptation" is what researchers call the mechanism with which the sensory system in both humans and animals adapt to their environment. Oldenburg auditory researcher Prof. Dr. Jannis Hildegrandt has devoted himself to studying this phenomenon – and, in the process, he has discovered something new about the auditory system of grasshoppers. In a study in the renowned biological trade journal PLOS Biology, Hildebrandt shows the following: the hearing of the Grasshoppers' is always readjusting itself in order to be able to clearly hear the singing of other members of the same species in different noise situations. In doing so, these little animals solve a problem that has so far stumped researchers.

The fact that the ear quickly adapts to the environment also results in reduced perception of the absolute volume. For example, if loud noises enter one ear over a prolonged period of time, it will become less sensitive than the other ear – and the animals cannot tell exactly where another noise comes from. The special thing about grasshoppers: The nerve cells responsible for sound location only respond to the beginning of a noise. Then they quickly shut down again – before the cells in the ear have adapted their sensitivity. "These cells won't respond until there is a new noise that is relevant for the grasshoppers – that is, the song of another grasshopper – and then only to its beginning," says Hildebrandt. Computer simulations confirm the findings: Locating singing would work much more poorly if the central cells did not shut down.
Hildebrandt made use of the inborn behavior of these animals when studying how the cells shut down. Male grasshoppers turn quickly and consistently in the direction in which they have located the singing female. The researcher regaled the males with sounds. They always became confused when the singing of their female counterparts began softly and only gradually got louder – they hopped forwards in the wrong direction, even though the sound came from one side. If the song was loud right from the beginning, then the animals had no problems. "That showed us how important the beginning of the song is for the grasshoppers. If the sounds get slowly louder, then the auditory system constantly adapts – and then has no chance to focus on the beginning. The sound locating cells do not shut down."

While it is true that the findings do not translate one-to-one to humans, admits Hildebrandt, the experiments of this auditory research nevertheless contribute towards a better understanding of the human auditory system. "We assume that some of the mechanisms we have found are also present in humans, such as the fact that sound locating cells shut down rapidly."

Source: Press & communications, Oldenburg University

Compatibility of Job, Private Life, and Family

The "Joint Research Academy in Biomedical Engineering and Science of Hearing and Sensory Systems" (JRA) is expressly committed to ensuring that vocation, private life, and family are compatible for scientists in the Cluster of Excellence.

It is a declared goal of the Cluster of Excellence to support scientists with one or more children. By offering childcare and measures for improving the compatibility of work requirements with those of family, such as through providing technical help in the laboratory, we want to create a basis for harmonizing vocation and family and making it possible for scientists to return to their vocation more quickly. Childcare is offered at all large internal events of the Cluster. In addition, there is also the possibility of being reimbursed for childcare costs incurred by participating in conferences or scientific workshops. The offers that are already available at the different locations (Oldenburg University, Leibniz University in Hanover, Hanover Medical School) are supplemented by JRA measures adapted for each location.

Offers at University of Oldenburg

In addition to the main childcare offers by the University of Oldenburg, such as support for preschool and nursery school placement or vacation care, the University of Oldenburg has also been offering individualized and flexible childcare solutions since 1/1/2015 in the context of "Hearing4all" in collaboration with the AWO Parents and Seniors Service for scientists with children. In the forefront here are families with very small children (less than one year old), who are in need of individualized and flexible solutions. The AWO Parents and Seniors Service helps find openings in daycare facilities, with day nannies and live-in nannies, and babysitter services.

Technical help in the office or laboratory is mainly for scientists during pregnancy, maternity leave, and parental leave – until the child has reached 3 years of age. The goal is to ensure better compatibility between laboratory work and childcare and to make lab work possible under the legal framework conditions of maternity leave.

Offers of the Hanover locations

In addition to regular care, there is an extensive range of different childcare options available at the Hanover Medical School and the Leibniz University. For example, employees at each of the two universities have the option

of emergency care that is guaranteed for the next day by "pme Familienservice GmbH" if requested over the phone by 6:00 p.m.

Flexible childcare for important, scheduled appointments and dates at the Hanover Medical School (tests, conferences, or other important events) can be arranged at any time for any Cluster member who contacts the Equal Opportunities Office of Hanover Medical School in a timely manner. Comparable services are also offered at the Leibniz University by the Family Service Office in the Equal Opportunities Office. Both of these large universities in Hanover regularly organize and ensure joint vacation care for children between the ages of 6 and 10.

The offer of technical assistance in the office and laboratory for scientists with one or more children is also being set up at the Hanover Medical School in the context of "Hearing4all" in order to take the next step towards compatibility of family and work demands.

Consultation and Contact

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Interview

Lena Schell-Majoor, Scientist in the Hearing4all Cluster of Excellence, on the Compatibility of Vocation, Private Life, and Family

Lena Schell-Majoor is currently working on her Ph.D. thesis on the topic of "Objective Quality Assessment of Device Noises" and is the mother of an 18-month old daughter

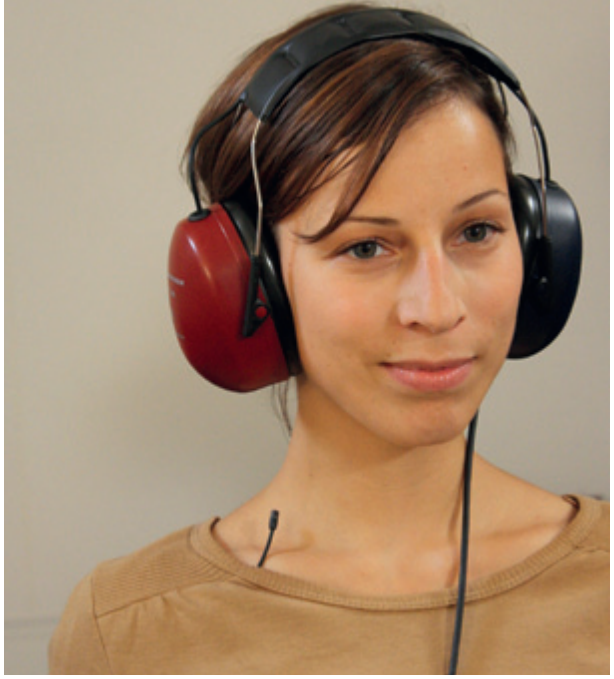
What do you see as the greatest difficulties when it comes to combining professional and family life? For me, the greatest challenge is to reconcile all of the needs and demands. Before I had a child, I mainly had to decide for myself how to redistribute my time, for example more time in the office instead of with sports, and I was the main person who had to deal with the consequences of my decision. Today, it's very clear to me that my child naturally demands part of my time and is also dependent on receiving part of my time. So to do justice to your own needs and wants, you first have to be very clear on what needs and wants you realistically can and want to fulfill, and then you have to try to come up with a plan so that it all works out. Added to the mix is that some things are very difficult to plan and also that unforeseeable things often happen with children.

What services offered by JRA are of particular interest to you in this context? Of greatest interest to me is the opportunity to receive support from a scientific assistant. I am already taking advantage of this offer.

What relief does using this offer give you in your professional and private life? Specifically, the support helps me conduct my hearing research. Particularly things scheduled in the afternoon and early evening would only be doable for me to a very limited extent. Even if something comes up on short notice, there is a backup to go to before something on the schedule has to be canceled. That speeds up my studies. In addition, I can also hand over routine work, which in turn gives me time that I can use for things that only I can do.

Would you want to have more opportunities of this kind?
For me, this offer is a great help just the way it is. However, I can't give up a large part of my work, nor do I have any desire to do so. I also have the possibility of arranging my work time very flexibly, which also simplifies a lot. That's why I feel I'm in a pretty good position with my job, my colleagues, and my professional surroundings. Basically, in my opinion, offers like this are absolutely desirable and make total sense.

Engineering Physics



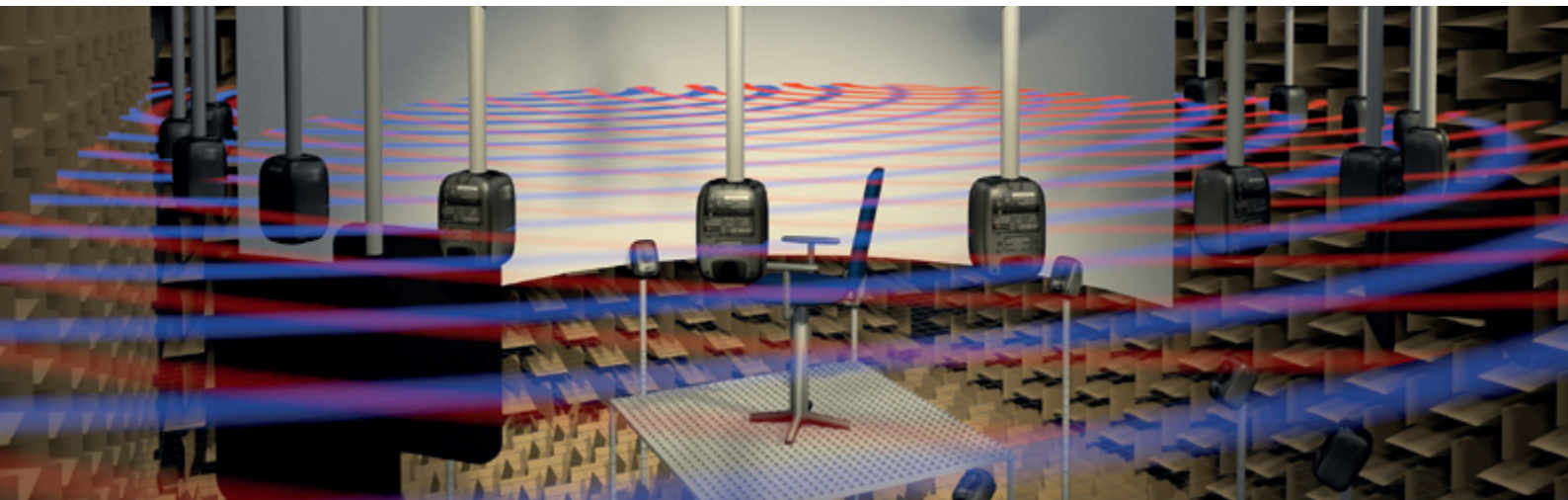
Carl von Ossietzky University in Oldenburg and the Emden/Leer University of Applied Sciences are offering Engineering Physics as an international Bachelor's course of study in order to close the gap between traditional physics and engineering training. Since 1998, students have been educated here who are able to use basic education in mathematics and natural sciences combined with practically oriented engineering sciences to understand and further develop modern technologies. Students can specialize in the core areas of "Lasers & Optics," "Renewable Energies," or "Biomedical Physics and Acoustics."

During the first 5 semesters, the technical foundation in physics and in engineering sciences is laid. Physics and mathematics modules closely follow traditional physics education. It is here that the basic knowledge is taught that will allow graduates of the program to take part in the rapidly developing field of science and technology. In engineering sciences, they acquire the ability to quickly put their knowledge to use in finding problem solutions for science and industry.

The Biomedical Physics area focuses on applying physical principles to medical diagnostics (X-ray, ultrasound) and therapy (e.g. laser medicine, minimally invasive surgery, radiation therapy). An important subarea in Oldenburg is audiology. This interdisciplinary education program opens up a wide range of vocational fields to graduates, from basic research and the development of medical technology systems and procedures in industrial companies all the way to applications in hospitals.

Acoustics is an interdisciplinary subject: Sound and vibrations are a very important part of many technical fields (machine acoustics), the environment (noise), room acoustics (concert halls, auditoriums), medicine and material testing (ultrasound diagnostics), vehicle acoustics, communication (language), etc. Specific vibroacoustic measures (e.g. sound insulation, sound design) require very detailed physical and technical knowledge, which is conveyed in the context of the Sound & Vibration area. Acousticians find employment in research and development at universities, in development departments of electrical and telecommunications technology manufacturers, in vehicle and machinery construction, and in engineering offices for technical specialist planning.

The Master of Science in Engineering Physics is open to students who have their first university-level degree (diploma, technical college diploma, Bachelor's degree) in physics or related fields. The course of studies consists of the fields of physics, engineering sciences, and a specialization. In the field of physics, in-depth modules are taught on select areas of physics. The specialization includes both basic education as well as state-of-the-art applications for the respective emphasis (see above). In the field of engineering sciences, students have the opportunity to become familiar with the details of various modern technologies. The course of studies is rounded off by a project at a research facility or company or by a management module.



Events and Advanced Training Sessions in Auditory Valley

June 3

Company Showcase & Barbecue
HörTech gGmbH and the Hörzentrum Oldenburg GmbH auditory center present the current state of their technologies and services in presentations and demo sessions.

June 4-5

Hearing Aid Developers Forum (HADF)
Engineers of well-known companies discuss current challenges and trends of the industry with scientists and develop possible solutions that are meant to be advanced in precompetitive consortia.

June 10

"Oldenburg Speech Tests" Advanced Training Session
In this workshop, an answer will be given to the question of which test procedure is best suited to which problem and how it should be carried out. In addition, a comparison to other established test procedures will also be made.
For further information: www.hoertech.de

June 12-13

The Auditory Model Workshop
This workshop is intended as a forum to discuss challenges to future auditory models that are meant to increase our understanding of normal human hearing and hearing impairment.
Contact: sarah.verhulst@uni-oldenburg.de
www. hearing4all.eu

June 23-26

Joint Summer School for Ph.D. programs "Hören" and "Auditory Sciences" of the "Hearing4all" Cluster of Excellence
Contact: kaiser.odett@mh-hannover.de,
jacqueline.lessig-owlanj@uni-oldenburg.de

July 1

Medical Product Value Chain
An event series of the ENT clinic of the MHH in collaboration with BioRegioN, Fraunhofergesellschaft ITEM, BiomeTI e.V., and Hearing4all
Registration: www.bioregion.de/mpvc

July 2-4

Compact Knowledge for Audiometrists
This practical course is oriented to doctor's assistants and medical-technical assistants in ENT practices who are either new to the field or want to perfect their technique.
For further information: www.hoertech.de

September 16-18

Intensive Course in Audiological Technology for Beginners (ENGLISH!)
The goal of this intensive course is to provide an overview of the methods and procedures of this specialist field and convey an understanding of the most important problems and framework conditions.
The knowledge acquired will, for instance, give new employees of hearing aid, CI, and measuring instrument manufacturers a comprehensive and competent introduction to the material.
For further information: www.hoertech.de

September 24-27

32nd Annual Scientific Conference of the DGPP in Oldenburg
Main topics:

- Pediatric audiometry (objective vs. subjective)
- Genetics and immunology in phoniatry and ped-audiology
- Dysphagia
- Musician's medicine

For further information: www.dgpp.de

November 13

Basic Knowledge around the Topic of Hearing – for Nursing Professions and Interested Family Members
This day seminar is oriented to people who are involved in the nursing and care of elderly people. It is intended to give participants the ability to recognize hearing impairment, help the affected person deal with the condition, and support them with operating hearing aids and assistive technologies.
For further information: www.hoertech.de

Auditory Valley offices

The offices act as the contacts and coordinators for all Auditory Valley work. The offices have a broad range of tasks as active coordinators and points of contact for Auditory Valley. The team of staff from HörTech gGmbH and the Hanover Medical School research topics and trends, bring innovative minds together, determine Auditory Valley's strategic orientation, make sure the activities have a focus and work to give the region's expertise a clear profile.

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