The newsletter of
The Acoustical Society of America

ECHOES

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The Jamie Whitten National Center for Physical Acoustics

Henry Bass and George Atkins

In a windowless lab filled with monitors, Director Henry Bass and Claus Hetzer discuss data coming in from one of the 15 Global Infrasound Stations maintained and monitored by National Center for Physical Acoustics (NCPA) as the US lead for the US Infrasound Team….

NPCA wind tunnel

Down the hall, Dr. Jim Sabatier and the porous media group are conducting experiments with dozens of volunteers to explore acoustic/seismic capabilities of human footstep detection.

In another corridor Dr. Joel Mobley works with both Army and NCPA personnel to develop an ultrasonic medical device for battlefield situations…

In NPCA's newest facility, Dr. Jack Seiner and his aeroacoustic researchers are firing up the state of art wind tunnel to study vibrational effects on weapons bay functions at speeds up to Mach 5…

Since its creation in 1986, the National Center for Physical Acoustics at the University of Mississippi has grown from an idea conceived by a handful of scientists in the Physics Department to an 84,000 square foot facility that includes the aforementioned wind tunnel, a smaller Mach 2 jet test facility, an anechoic chamber, coded and secure laboratories, a million dollar machine and electric shop for prototype production, and secure meeting spaces that include an 80-seat auditorium. But while its growth in infrastructure and equipment is impressive, its main strength lies in its expertise in specific areas of acoustics, and its ability to utilize that expertise, attract funding for better infrastructure and recruit talent to pave the way for the future.

Atmospheric acoustics

The acoustics group at the University of Mississippi has been a major contributor to the understanding of atmospheric sound propagation since the early 1970s. During that era, Shields and Bass worked with others to form a rigorous physical and mathematical basis for the prediction of the absorption of sound in the atmosphere. That effort was followed with lengthy studies of the interaction of airborne sound with the surface of the Earth. A collaboration with several other research groups led to the biannual Long Range Sound Propagation Symposium where research in the field is discussed intensively over a period of two or three days. The last symposium was in New Orleans, the next in Lyon. The desire to understand surface impedance and its effect on incident sound led to studies of acoustic to seismic coupling which is described later in this article.

An immediate application of the improved understanding of outdoor sound propagation was to modify the sonic boom propagation codes developed at the University of Texas to incorporate more accurate absorption and surface reflection. This work has continued with improved ability to handle complex weakly non-linear waveforms.

Richard Raspet and Ken Gilbert attended the first Long Range Sound Propagation Symposium. They discussed the potential for applying underwater propagation codes to atmospheric propagation. Out of that collaboration, Raspet pursued the Fast Field Program and Gilbert pursued the Parabolic

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We hear that . . .

• **William Yost**, formerly at Loyola University in Chicago, is Chair of Speech and Hearing Sciences at Arizona State University. Bill is a Fellow of ASA and served as president 2005-2006.

• **Leo Beranek** received La Caracola de la Sociedad Española de Acústica, the highest award given by the Spanish Acoustical Society at the recent ICA in Madrid.

Leo Beranek with award

A letter to the editor:

Your mention of "Stop the Decibel Damage" in the Scanning the Journals section of *ECHOES* Vol. 17, No. 3 propagates a myth that we as acousticians should be stopping when it says "earplugs or muffs can cut noise by 30 dB or more." Reductions of 30 dB are confined to laboratory performance, not the real world. See, for example, the web page http://www.e-a-r.com/pdf/hearingcons/earlog20.pdf by Berger. Unfortunately this figure is commonly quoted and leads people to assume their hearing is adequately protected when it may well not be.

Regards and thanks for a most enjoyable newsletter.

Tim Kelsall
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National Center for Physical Acoustics

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Equation. Both are still in wide use.

The understanding of absorption and surface reflections combined with powerful numerical solutions to the wave equation led the NCPA team to address the effect of turbulence on both continuous wave and impulsive sound. McBride followed a point scattering approach while Gilbert pursued a phase screen description. Both have proven useful in better understanding fluctuations of sound as well as sound measured in classical shadow zones.

Advances in understanding and predicting outdoor sound are by no means complete. Current efforts continue to exploit combined meterological and propagation models, study the sources of and suppression of wind noise, and include topography in propagation predictions.

Porous media

Studies of sound propagation outdoors led NCPA personnel into detailed studies of sound in the atmosphere/Earth interface. Working with colleagues at the National Research Council and the Open University, NCPA personnel exploited the Biot model of the Earth to develop analytical expressions for acoustic energy transfer across the surface. This model allowed the group to explain the locally reacting nature of the surface and place limits on the local reaction approximation. Understanding of the porous nature of the Earth also lead to techniques to measure properties of soil which is of interest in agriculture. A very important discovery was that non-porous objects buried in soils represent an interface that can be detected acoustically. Using acoustic excitation and measuring surface motion with a laser Doppler vibrometer, Sabatier was able to image buried land mines. This approach to detecting and imaging buried land mines continues to be a prominent contender for next generation mine detection systems.

The Porous Media group has also conducted research leading to novel ultrasonic methods for human detection that combine both a passive and an active ultrasonic sensor: the passive sensor detects the ultrasonic component of human footsteps while the active sensor measures characteristic human body motion through ultrasonic Doppler vibrometry.

The biomechanical nature of a footstep results in two characteristic frequency bands in the vibration and sound responses of footstep signatures. The first band, typically used for seismic footstep detectors, is created by the footstep force component normal to the supporting surface and is concentrated in a low-frequency range below 500 Hz. The second footstep frequency band is generated by the tangential friction force of the footstep and is located in a high-frequency range, above 1 kHz up to ultrasonic frequencies ranges. In buildings, footstep vibration magnitudes in the high-frequency range are comparable to those in the low frequency and are independent

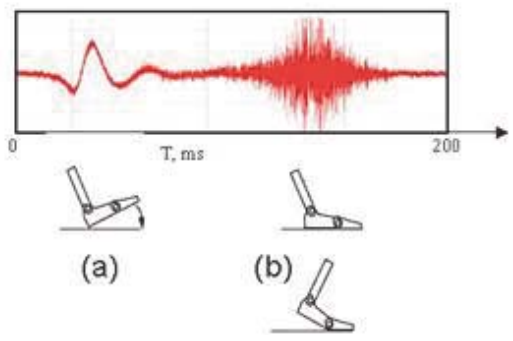

Figure 1. Two phases of foot motion provide the major contribution to the human footstep vibration signature: (a) the heel of the leading foot contacted the floor, (b) the contact of the toe of the leading foot and the pushing motion (sliding) of the trailing foot.

ECHOES

Newsletter of the Acoustical Society of America

Provided as a benefit of membership to ASA members

The Acoustical Society of America was organized in 1929 to increase and diffuse the knowledge of acoustics and to promote its practical applications.

Echoes Editor . . . . . .Thomas Rossing
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of walking styles at distances close to the detector.

This research involves the use of both passive and active ultrasonic methods to exploit unique, human, high-frequency footstep sound pressure and human motion Doppler signatures of body appendages for detection and recognition. Ultrasonic sensors with different frequency bands for passive and active methods can be assembled in small enclosures to function as low-bandwidth, human activity sensors. The simultaneous measurement of the footstep ultrasound and human body Doppler motion effects with sensor-coupled signal processing promises to provide improved capability for detection of humans for military, industrial, and home security applications. (See Fig. 1)

Ultrasonics

Working with US Army trauma surgeons, the Ultrasonics Research and Engineering Group has developed and tested several prototypes of its Remote Acoustic Hemostasis (RAH) device for battlefield combat casualty care. In collaboration with Tripler Army Medical Center and the University of Washington, the group has constructed an image-guided acoustic hemostasis device that combines a therapeutic high-intensity focused ultrasound (HIFU) array with a diagnostic ultrasonic imaging probe. The intent is for this device to be used for several echelons of care, both intraoperatively and in transcuatenous applications where internal bleeding is of concern, such as for patients with inaccessible hemorrhages requiring stabilization prior to battlefield evacuation. In addition to military medical applications, the group is participating in other collaborations to test HIFU efficacy in civilian trauma centers.

Continuing NCPA's legacy in the realm of sonoluminescence (SL), the ultrasonics group is working to push the energy-concentrating effects of acoustic cavitation to its extremes, in collaboration with SL pioneer (and former NCPA researcher) Felipe Gaitan. NCPA is also making fundamental contributions to the physics of propagation in highly dispersive materials, including recently published data on suspensions supporting negative acoustic group speeds.

Aeroacoustics

Aircraft noise associated with U.S. Navy Field Carrier Landing Practice (FCLP) missions has led to potential lawsuits by the public which has led the Navy to consider some very expensive costs for training relocation. In addition, carrier based military aircraft noise is the leading cause of hearing loss for military personnel, whose total cost to the U.S. government since 1977 is nearly 8 billion dollars. Starting with 1/10th scale model nozzles that are utilized on the F/A-18 E/F Super Hornet aircraft, the NCPA developed a promising noise reduction concept in their laboratory. They later evaluated this concept on a full scale F404 engine and achieved significant noise reduction at no loss of engine performance. This concept was patented on July 10, 2007 by the University of Mississippi, U.S. 7,240,493 B2.

The accurate optimized design of high speed aerospace vehicles requires full understanding of complex turbulent flow structure interaction. Currently, numerical simulation tools are being developed to accurately time couple a flow solver to a structural dynamics code. These numerical procedures, which are used to optimize the weight for an aerospace vehicle, require validation. Accurate validation of such numerical procedures with compliant and realistic vehicle structures is only possible using non-intrusive tools to measure flow and structural response. The new NCPA Mach 5 wind tunnel is a first of its kind; since its unique design permits study of high speed (up to Mach 5) aerospace model vehicles where both flow and structural response can be measured simultaneously. This tunnel is also used to study propulsion/airframe integration issues, sonic boom, Scramjet propulsion, rocket performance, and dynamic loads in modern weapons bays.

In an attempt to develop stealth aircraft, modern fighters and bombers utilize weapons bays to hide stores to reduce their radar cross section. Maximum aircraft and pilot safety would occur if one were to initiate a weapons release at high altitude and supersonic speed. However when weapon bay doors open for release of a weapon, the cavity is exposed to supersonic flow. An open cavity at supersonic speed produces intense acoustic pressure fluctuations that are so intense that it has been difficult to accomplish a weapons release that is stable and not tumbling. Using model facilities developed at the NCPA, concepts for reduction of the intense weapons bay acoustic levels were formulated and studied. The most successful concept, spoiler with powered resonance slots, was flown on the F111 aircraft in Adelaide, Australia in 2004. This concept reduced weapons bay acoustic levels to near those associated with the aircraft with doors closed when in supersonic flight at high altitude. A new concept that is currently in model scale has shown similar reductions at mach numbers to 2.

In the last twenty years, many things have changed at NCPA. Underwater acoustic research has given way to more atmospheric and aeroacoustic projects. Technology that originated with U.S. Department of Agriculture research now benefits the Department of Defense. The ultrasonic group has moved from technology that explores healing the body to exploring alternative energy sources. But one thing that hasn't changed is NCPA's mission. As it enters its third decade, NCPA hopes to continue a tradition of excellence and remain a leader in acoustics research and education.

Henry Bass is the Frederick A. P. Barnard Distinguished Professor at the University of Mississippi and Director of the National Center for Physical Acoustics. He is a Fellow of ASA, and received the Biennial Award (now the R. Bruce Lindsay Award) in 1978. He was Director of the 1994, 1996, 1998, 2000, and 2002 Physical Acoustics Summer Schools.

George Atkins is Assistant to the Director at the National Center for Physical Acoustics, where her responsibilities include the marketing, business development and coordination of legislative affairs for the center. Prior to joining the NCPA in 2000, Ms. Atkins was employed with Pearson Education, marketing higher education texts and software to colleges and universities in the southeast.

Echoes from the ICA

Charles Schmid and *Thomas Rossing*

Photo by C. Schmid

The International Commission on Acoustics (2004-2007) at their board meeting held in Madrid, Spain September 2, 2007. Back Row (L to R): Tor Kihlman, Anders Bostrom, Antoni Sliwinski, Antonio Perez-Lopez, Samir Gerges, Luis Bento Coehlo, Giovanni Brambilla, Michael Vorländer,Nikolaia Dubrovsky, Chaohuan Hou, Philippe Blanc-Benon. Front Row (L to R): Gilles Daigle (Past President), Sonoko Kuwano (Secretary General), Philip A. Nelson (President), Hugo Fastl, Treasurer, Suk Wang Yoon (Vice-President)

Acousticians from around the world converged on Madrid for the 19th International Congress on Acoustics (ICA) September 2-7. More than 1300 papers were presented by authors from 50 countries. Also meeting jointly with the ICA were the Spanish National Congress on Acoustics and the Iberian Encounter on Acoustics. Two satellite symposia were held following the ICA: the International Symposium on Musical Acoustics (ISMA 2007) in Barcelona and the International Symposium on Room Acoustics (ISRA 2007) in Sevilla.

The opening session of the ICA included several welcoming speeches and a flamenco concert, followed by cocktails and tapas. The opening lecture on "Acoustics for the 21st Century" was given by Juan A. Gallego-Ju rez (Spain). Other plenary lectures during the week were by Sonoko Kuwano (Japan), Timothy Leighton (U.K.), Otto von Estorff (Germany), and John Bradley (Canada).

Some old-timers (including the second author) recalled that the 9th ICA in Madrid in 1977 was held in the center of the city and officially opened by King Juan Carlos I (who ascended the throne in 1975 upon the death of Francisco Franco). It was pointed out, however, that in these days of high security, having the King present at such a function would result in great inconvenience and long delays for the attendees. The Congress center located at the edge of the city was very comfortable, and an efficient subway system was available for sightseeing trips into the old city.

Social activities included the Carmen Roche classical ballet on Tuesday, an orchestral concert on Wednesday, and a gala dinner with music and entertainment at the Palacio del Negralejo on Thursday. The congress closed with cocktails and tapas on Friday. A full program for accompanying persons included visits to the Royal Palace, El Escorial monastery, Valley of the Fallen, the Prado museum, and the Reina Sofia museum (more than a few delegates "accompanied" the accompanying persons, too).

The 460-page Programme and Abstract book was a pretty formidable volume, but the proceedings were conveniently published as a special issue of the journal *Revista de Acustica* on a CD-ROM.

ISMA 2007

The International Symposium on Musical Acoustics was held at the beautiful Institut d'Estudis Catalans in the center of Barcelona, September 9-12, following the ICA in Madrid. Approximately 80 papers on various aspects of musical acoustics (strings, woodwinds, brasses, organ, perception, singing voice, piano, percussion, physical modeling, and instrument making) were presented. As in smaller satellite meetings, there was ample opportunity for in-depth discussion and socializing.

Keynote lectures were given by Shigeru Yoshikawa (Japan), Joe Wolfe (Australia) and Jim Woodhouse (UK). Wind instruments (brasses and woodwinds) were easily the most popular subjects at the symposium. The proceedings, edited by conference organizers Joaquim Agulló and Ana Barjau, were published on a CD-ROM which was distributed at the symposium. Social events included a welcoming reception, a visit to the museum of musical instruments, and a dinner with the traditional concert by participants. The latter deserves special mention because of the jam session which featured jazz improvisation by skilled players of the tenora (the national instrument of Catalunia), HANG (hand-played steel instrument from Switzerland), the didgeridoo (aboriginal instrument from Australia), and many old and new instruments. It was a unique performance that probably will never (and should never?) be duplicated in musical annals.

ISMA organizers Joaquim Agulló and Ana Barjau

More photos on page 7.

ASA returns to New Orleans

The Acoustical Society will return to New Orleans for its 154th meeting, November 27-December 1. Always a favorite city to visit, the Crescent City has largely recovered from the floods that followed Hurricane Katrina in 2005. World famous for food, jazz, and history, New Orleans is up and operating again.

The program, which includes 600 papers and 32 special sessions, is a little smaller than some recent meetings, but it offers quality and variety. The annual Exhibit, which features exhibits of instruments, books, materials, and services, will open with a reception on Tuesday evening, November 27 and will close Thursday noon. Morning and afternoon refreshments will be available in the exhibit area.

A technical tour is planned with the U.S. Army Corps of Engineers on November 27 to view the New Orleans levee system and "ground zero" of the levees which failed during Hurricane Katrina. A tutorial lecture on "Weather and Acoustics" will be given by Alfred Bedard of the National Oceanic and Atmospheric Administration on Tuesday, November 27 at 7:00 p.m.

A short course on Bayesian Signal Processing, taught by James V. Candy, Chief Scientist of the Center for Advanced Signal and Image Science at the University of California, Lawrence Livermore National Laboratory will be held on Saturday, December 1.

The Technical Program organizing meeting (TPOM) in New Orleans organized over 600 papers into technical sessions.

Technical program co-chairs Juliette and George Ioup

Echoes from the ICA

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ISRA 2007

David Lubman

A second satellite symposium following the Madrid ICA —the International Symposium on Room Acoustics—was held at the Andalusian capital of Seville, at Seville University School of Architecture, September 9-12. It consisted of 6 keynote lectures, and about 75 contributed presentations—about 50 lectures and 25 posters. The room acoustics topics were far-ranging. Many were specific to new and historic concert halls, theaters, recording studios, historic churches and mosques, existing classrooms, open air and underground spaces. Some others focused on acoustic parameters to characterize spaces, and on room acoustic simulations. A CD-ROM containing the lectures was bound into the slim program book, which was much easier to carry around than the massive ICA program. The eight-person local organizing committee was ably chaired by Juan Jose Sendra of the host university.

Keynote lectures were given by Masayuki Morimoto (Japan), Nico Declercq and Cindy Dekeyser (USA). Ettore Cirillo and Francesco Martellotta (Italy), Xiang Ning and Jason Summers (USA), Michael Vorländer (Germany), and Jens Holger Rindel and Claus Lynge Christensen (Denmark).

Two scheduled tours were included. The first was to the historic and elegant Gardens of the Royal Alcázar of Seville. Attendees were treated to a lecture on its complex history followed by a gracious al fresco reception with abundant tapas (an Andalusian specialty), wines, and soft drinks. The second was an organ concert at the impressive great Cathedral in the center of Seville. Following the organ concert, some attendees walked to the nearby town center for a free municipal concert of light classics, followed by late dinners with their interesting and convivial colleagues.

Cocktails and tapas were provided at a farewell lunch at the university. Many attendees hung on, reluctant to leave this stimulating meeting and their new friends.

Scanning the Journals

• A burst of sound can cause the resistance of certain manganese oxides, called manganites, to fall to about one hundred thousandth of its original value, according to a report in the 6 September issue of *Nature*. This effect, called **"colossal phononresistance"** is believed to be caused by interaction between electrons and quantized lattice vibrations called phonons. It has been known for some time that the electrical resistance of manganites can drop by as much as ten orders of magnitude when the materials are exposed to a magnetic field, an effect known as "colossal magnetoresistance." The researchers believe that the colossal phononresistance could be used to make terahertz radiation detectors and ultimately shed light on high temperature superconductivity.

Colossal phononresistance was observed when a short terahertz laser pulse was fired at manganite sample while monitoring the electrical resistance. The pulse, which is about 300 fs in duration, is long enough to create phonons at a frequency of about 17 THz but short enough to avoid exciting electrons and phonons at other frequencies. The resistance of the sample dropped dramatically for about 5 ns before returning to its original value.

• Orchestral tuning may be skewing note perception in people with **absolute pitch**, according to a paper in the 11 September issue of *Proceedings of the National Academy of Sciences*. People with this unusual talent often have trouble distinguishing G# and A# from A, which may be due to the fact that orchestras tune to A over a range of frequencies. Note identification appears to be more accurate on "white key" tones than on "black key" tones, possibly reflecting the primacy of white keys in the key signatures used during early musical training. The research also identified a gradual decline in pitch-naming accuracy with age, characterized by a perceptual shift in the "sharp" direction.

• The **sounds of the solar system** are woefully unexplored, according to a article in the 11 August issue of *New Scientist*. The European Space Agency's Huygens probe, which landed on Saturn's giant moon Titan in 2005, carried acoustic instruments that worked amazingly well. Five NASA landers, the twin Vikings, Mars Pathfinder, Spirit, and Opportunity, have beamed back spectacular images of the Martian landscape, but none of them has recorded any sound. A microphone was sent to Mars aboard the Mars Polar Lander in 1999, but it probably crashed when the engines that slowed its descent switched off too early. Because Mars' atmosphere is much thinner than Earth's, the average distance between molecules is about 120 times greater and sound waves attenuate very quickly.

In 1982, two Soviet Venera landers carried microphones and recorded the sound of the breeze on Venus. Comparisons with wind tunnels suggested there were gentle winds of about 2 kilometers per hour. The landers also heard deep rumbles that might have been thunder but could have been turbulent airflow. Between 1969 and 1972, astronauts on four Apollo missions left seismometers on the moon to record sound waves rattling through the lunar crust. This network of sensors beamed back data on moonquakes until 1977 when it was switched off to save money.

• Sound of certain frequencies cannot propagate through structures with a regular distribution of scattering centers, according to a paper in the 1 July issue of *Journal of Applied Physics*. This is called an **acoustic (or phonon) band gap**. Such phononic crystals have been the subject of intense investigation in recent years, and this topic forms an interesting bridge between the often uncorrelated disciplines of solid state physics, optics, and acoustics. In a rigid waveguide with periodic discontinuities, such as heating ducts, exhaust systems, and mufflers, these discontinuities are known to provide effective filtering mechanisms. An understanding of these structures can be enhanced by analyzing them as phononic crystals. In quasiperiodic structures, complicated transmission spectra, characterized by wide acoustic pseudo-band-gaps may result.

• **Surface acoustic waves** (SAWs) have been used to control quanta in order to create an acoustically driven single electron transistor, according to a paper in the March/April issue of *Physics in Canada (La Physique au Canada)*. Now the idea of using SAWs to transport single spins has spawned proposals of entanglement and quantum computation of spin qubits using acoustically driven systems. The field of spintronics, the control and manipulation of spins for information processing, has generated a significant amount of interest in both the academic and industrial communities.

• A simple **hearing test** may help identify babies at risk for sudden infant death syndrome (SIDS) according to a paper in the July issue of *Early Human Development*. Hair cells in the inner ear may play a role in transmitting information to the brain about levels of carbon dioxide in the blood, the study suggests. Injury to hair cells may disrupt respiratory control and predispose infants to SIDS.

• **Music engages the areas of the brain** involved with paying attention, making predictions and updating the event in memory, according to a paper in the August issue of *Neuron*. Peak brain activity occurred during a short period of silence between musical movements when seemingly nothing was happening. Magnetic resonance imaging (MRI) was used to determine what parts of the brain were working during each activity. The goal of the research was to look at how the brain sorts out events, but it also revealed how musical techniques used by composers 200 years ago help the brain organize incoming information. The attention of listeners at a concert may wander, but at the transition point between movements, their brains respond in a tightly synchronized manner, the study suggested. Subjects in the study listened to music on noise-canceling headphones inside the noisy MRI chamber.

• **"Dying for some peace and quiet"** is the title of a special report on noise in the 25 August issue of *New Scientist*. The World Health Organization suggests that thousands more people around the world may be dying prematurely or succumbing to disease through effects of chronic noise exposure. The death toll from noise exposure may be as high as 210,000 deaths annually. Figures in the UK suggest that noise

complaints to local government offices have increased five-fold in the past 20 years. On 1 July, after receiving a record 354,378 complaints about noise in 2006, New York City updated its 30-year-old noise code to take account of modern noise sources such as loud stereos, car alarms, and air conditioners. Even when we sleep, our ears, brain, and body continue to react to sounds, raising levels of stress hormones such as cortisol, adrenalin, and noradrenalin.

- AMPA (α-amino-3-hydroxy-5-methylisoxazole-4- propionic acid) receptors in **auditory neurons** drop temporarily after exposure to a loud sound, decreasing the neuron's sensitivity to subsequent noise, according to a paper in the 9 September issue of *Nature Neuroscience*. The function of such recycling in a part of the brain associated with learning and memory is not clear, but the researchers suggest that in auditory neurons it may optimize the handling of sound's large dynamic range.
- Researchers have shed new light on the **hearing process** by identifying two key proteins that join together at the precise location where energy of motion is turned into electrochemical signals that can be interpreted by the brain, according to a paper in the 6 September issue of *Nature*. Cadherin 23 D (CDH23) and protocadherin 15 (PCDH15) interact to form tip-link filaments in sensory hair cells. The researchers first created antibodies that would bind to and label short segments of CDH23 and PCDH15 proteins in the inner ears of rats and guinea pigs. Using fluorescence and electron microscopy studies, they showed that CDH23 was located on the side of the taller stereocilium and PCDH15 was present on the tip of the shorter one, with their loose ends overlapping in between. When conditions were right, the two proteins wound themselves tightly together.
- The **"loudness war"** is discussed in an article entitled "The Future of Music" in *IEEE Spectrum* (August). The smoking gun of the loudness war is overcompression of the dynamic range of recorded material in order to increase the average loudness level. Psychoacoustical studies have indicated that people judge how loud a sound is based on its average loudness, not its peak loudness. As far back as the 1960s, record companies began engaging in loudness battles when they observed that louder songs in jukeboxes tended to be played more often. Furthermore, many people listen to music in their cars, on trains, in airport waiting rooms, at work, or in a dormitory where the background noise level is high. People will be able to hear soft passages only if the dynamic range is compressed. Whether the loudness war can end and give rise to the next generation of high-fidelity audio depends heavily on the attitudes of consumers.
- The FOXP2 gene, which has been implicated in the evolution of human language, may have also helped bats develop their **echolocation ability**, according to a note in the 19 September issue of the open access journal *PloS ONE* (Public Library of Science). Previous discoveries have shown that mutations in this gene lead to speech defects. Like speech, bat echolocation involves producing complex vocal signals via sophisticated coordination of the mouth and face. The involvement of FOXP2 in the evolution of echolocation adds weighty support to the theory that this gene functions in the sensory-motor coordination of vocalizations.
- A new study of ancient reptile fossils has pushed back the date for the **earliest known ear** by 60 million years and generated a new hypothesis of why hearing evolved in the first place, according to a note in the 12 September issue of *Science*. An ear capable of hearing airborne sounds evolved independently at least six times among terrestrial vertebrate groups, including mammals, lizards, frogs, turtles, crocodiles, and birds. Yet although these ears differ in some details they all share certain features such as an eardrumlike membrane to capture sound vibrations and small bones to transmit the sounds to the inner ear. Based on the fossil record, the earliest known ears of this type date to 200 million years ago or later.

Opening session of ICA

Jam session at ISMA included two HANGs and a Catalunian tenora

Acoustics in the News

• Monkeys prefer silence to music, according to a story in the 3 August issue of *Science*. Tamarins and marmosets were placed in an apparatus with two chambers, each rigged to play music whenever an animal entered. In one experiment the musical choices were a flute lullaby (65 beats per minute) and Allec Empire's "Nobody gets Out Alive" (370 beats per minute). The monkeys spent about 2/3 of their time on the lullaby side, showing that they prefer slower tempos, but given the choice of silence, lullabies, or a Mozart concerto, they spent most of their time avoiding music altogether. A similar experiment with humans showed a distinct preference for music, especially lullabies. The study suggests that some of the acoustic preferences that underlie music are unique to humans.

• Japanese researchers have developed a humanoid robot system that can understand and respond to simultaneous speakers, according to a story in August issue of *Scientific American*. Such auditory powers mark a fundamental challenge in artificial intelligence—how to pick out significant sounds amid the hubbub. This is known as the cocktail party effect, and most machines do no better than humans. The robot's listening program employs what is known as computation auditory scence analysis which incorporates digital signal processing and statistical methods. It first locates the sources and then separates the sounds with computation filters. The system compares the processed information with an internal database of 50 million utterances in Japanese to figure out which words were spoken.

• Migratory bird calls, which are very different from birds' normal songs, are used to track avian flight paths and numbers, according to a story in the 18 September issue of *The New York Times*. They are high-pitched and clipped, each burst just a fraction of a second, and it took years for ornithologists at Cornell University to come up with what has been called "the Rosetta Stone of night calls," a link between the vocalizations and the particular syrinxes behind them. Researchers suspect that they tell a bird what its night-blinded eyes cannot: who's out there, where are they headed, and should I follow their lead? Arrays of microphones eavesdrop on the nocturnal bird banter and so keep a tally of aerial traffic.

• "Decibel levels" at NASCAR races are dangerously high, according to a story in the 26 August issue of *The New York Times*. A recent NIOSH (National Institute for Occupational Safety and Health) study reported that the noise level of 43 cars during a race is roughly equivalent to the noise of a jet engine. According to results presented at a "gathering of the Acoustical Society of America" peak sound levels exceeded 140 dB (see paper 4pNSb7 at the Honolulu meeting). "I think the exciting part about NASCAR is the noise," said one young fan. "It's energy. Energy makes it that much better." Seven-time champion Richard Petty has blamed racing for his hearing loss and now wears a hearing aid.

• The latest explanation for the "song of the dunes"—an eerie booming sound emitted by some sand dunes—is stoking the controversy fuelled by rival theories, according to a note in the 20 September issue of *Nature*. Two groups of researchers, previously collaborators, put forward two opposing theories (see "Scanning the Journals" in the Winter 2007 issue of *ECHOES*). Now a team at the California Institute of Technology says they are both wrong. The latest measurements suggest that the booming frequency doesn't depend on grain size at all. The researchers think that layered structure enables the surface to act as a kind of waveguide for acoustic energy, rather like the way an optical fiber channels light. Dunes that do not have this layered structure do not sing at all.

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