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The Acoustical Society of America

ECHOES

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Infrasound Measurements During Hurricane *Katrina*

Ronald A. Wagstaff, Carrick Talmage, and Heath Rice

A hurricane produces "naturally occurring" infrasound of such a low pitch that humans are unable to hear it. We can measure the pitch and strength of infrasound with special low-pitch atmospheric pressure sensors. The pitch, strength, and course of progress, for a hurricane are important to various types of Earth scientists, whose job it is to keep all of us safe from the hazards that accompany hurricanes and other large storms. However, they can't do such a big and important job alone. They need help, some of which they get from specially designed low pitch measurement sensors, and corresponding data processing and analysis techniques that have been developed by fellow scientists and engineers. For example, newly developed data measurement equipment and data analysis techniques have provided valuable information about storms. This includes such necessary information as accurate location, spread, speed of advance, and the speeds and directions in which the winds in the storm are moving, which may be different from the overall direction that the storm is traveling.

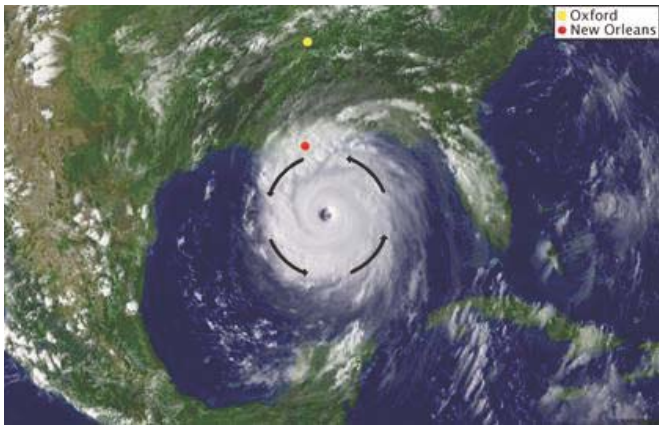

Figure 1. Satellite photograph of the Gulf of Mexico, while Hurricane Katrina, the cloudy mass, was present, and ravaging New Orleans (red dot). The yellow dot is Oxford MS, where the infrasound measurement sensors were located.

Consider the case of Hurricane Katrina, which occurred in the Gulf of Mexico during August of 2005, and devastated the city of New Orleans before moving on. Figure 1 presents a satellite photograph, with Katrina, identified by the white swirling mass of clouds centered about the eye of the hurricane, i.e., the "hole" in the middle of the cloud mass near the center of the figure. North is at the top of the figure, and east is to the right. Some of the clouds appear to be in the process of being stripped off to the northeast of the eye, unable to keep up with the high-speed counter clockwise rotational winds in Katrina, illustrated by the four arrows. As time progressed, Hurricane Katrina passed over New Orleans, leaving many parts of the city in rubble, and its residents seeking safe haven in other cities and states.

The arrows on the circle represent the directions of the counter clockwise rotating wind and wave fields of the hurricane at the surface of the Gulf of Mexico water mass. The northeast quadrant is the area in which the highest wind speeds and largest height of waves were generated, with corresponding low pitch infrasound. In the case of Katrina, that sector eventually passed over New Orleans as Katrina progressed, devastating the city and the surrounding area before moving on.

The effects of Katrina's winds were evident in a set of very low pitch, infrasound, acoustic data obtained by specially designed sensors that are capable of measuring acoustic signals at pitches lower than human ears can hear. The sensors were deployed in a vacant field near Oxford, Mississippi, about 400 miles to the north of New Orleans, safely out of harms way. The results of these measurements are presented in Figure 2.

The vertical axis of Figure 2 gives the strength of the processed and plotted infrasound results, ranging from -200 to 20, with 20 being the greatest value. The horizontal axis gives the pitch with a range from 0.14 to 0.6. The black curve at the top of the plot, identified by the name AVGPR, presents the average strength curve for each value of pitch. The detail is sufficient to form a continuous curve over the range of infrasound pitches included. The red curve in the middle, is identified by the name WISPR SC^2, and the

continued on page 5

We hear that . . .

• **Gerhard Sessler**, Professor at the Darmstadt University of Technology in Germany, received the Technology Award of the Eduard Rhein Foundation for "outstanding and internationally acknowledged achievements in numerous areas of technical acoustics."

• **Laymon Miller** is the sixth recipient of the 2007 C. Paul Boner award from the National Council of Acoustical Consultants (NCAC). The award is presented to a member of the acoustical consulting community who embodies the qualities of the late Paul Boner—teacher, scientist, administrator, technician—and who has made outstanding contributions to the science of acoustics. Miller is a Fellow of ASA and a member of the Institute of Noise Control Engineering (INCE).

• **Lisa Zurk**, Director of the Northwest Electromagnetics and Acoustics Research Laboratory at Portland State University, received a Presidential Early Career Award for Scientists and Engineers at the White House. Zurk was nominated by the National Science Foundation from which she previously received a five-year, $400,000 NSF Career Award. Her teaching and research are in electromagnetics, acoustics, and computational methods.

• The National Academy of Engineering presented the 2007 Arthur M. Bueche Award to **Jordan Baruch**, President, Jordan Baruch Associates "for the promotion of the innovation and management of science and technology nationally and internationally, thereby enhancing the economy of the U.S. and developing nations." Baruch is a Fellow of ASA.

• **Michael Howe**, Professor of Theoretical Mechanics at Boston University, was awarded the 2007 Rayleigh Medal for his outstanding contributions to research, mainly in aeroacoustics stretching over almost four decades. The presentation was made by Colin English, President of the Institute of Acoustics at the Institute's recent Autumn Conference on Advances in Noise and Vibration Engineering at Oxford. The Rayleigh Medal is awarded without regard to age to persons of undoubted renown for outstanding contributions to acoustics. It is normally presented to a UK acoustician in even numbered years and an overseas acoustician in odd numbered years. Howe is an ASA Fellow.

• The Canadian Association of Physicists has honoured University of Windsor physics professor **Roman Maev** with the 2007 CAP Medal of Outstanding Achievement in Industrial and Applied Physics for his work in the field of acoustic microscopy. Maev holds the Natural Sciences and Engineering Research Council/DaimlerChrysler/University of Windsor Industrial Research Chair in Applied Solid State Physics and Material Characterization.

• **Bishwajit Chakraborty**, a senior scientist in the Geological Oceanography Division at National Institute of Oceanography, Dona Paula, Goa, is a recipient of the National Mineral Award -2006 for his significant contributions in the field of earth sciences and related fields under the National Mineral Award Scheme of the Ministry of Mines, Government of India.

• **Michael Canney** is the new chair of the Student Council. Michael is a doctoral student in Bioengineering at the University of Washington, where his research is focused on therapeutic ultrasound for noninvasive surgery. He has served on the ASA Student Council since the spring of 2005 as the representative for the Biomedical Ultrasound / Bioresponse to Vibration.

• **Emily Tobey**, Nelle C. Johnston Chair in Communication Disorders in the School of Behavioral and Brain Sciences at the University of Texas at Dallas, has been named a Sigma Xi Distinguished Lecturer for 2008-2009. Tobey, a Fellow of ASA and the American Speech-Language and Hearing Association, was named the University of Texas at Dallas Polykarp Kusch Lecturer, the highest honor an individual faculty member can receive from the University.

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.

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ASA Editor-in-Chief . . . . . .Allan Pierce
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From the Editor: Outreach

The ASA has a pretty good track record in the important area of outreach. Under the leadership of Uwe Hansen, the Committee on Education in Acoustics has often sponsored sessions on acoustics for high school and middle school students at ASA meetings. (If you haven't observed or participated in one of these sessions, you have missed a splendid opportunity to see how acoustics appeals to young people!) ASA has also sponsored workshops on acoustics for high school teachers.

On the website http://acoustics.org/demos.html there are links to some excellent demonstrations for teaching acoustics. The ASA's Science Writing Award for Professionals in Acoustics in 2002 went to the creator of a teaching website. The Committee on Education in Acoustics has sponsored sessions on acoustics laboratory experiments, acoustics videos, and even on textbooks for teaching acoustics. Uwe Hansen and I wrote a brief account of ASA's tradition of furthering acoustics education for the 75th Anniversary booklet. Acoustics outreach was one of the motives for creating *ECHOES* in 1991, and more recently *Acoustics Today* has had a strong outreach component. We have seen an occasional paper in JASA on acoustics education, but some of us would like to see many more.

One of the items in "Scanning the Journals" in this issue tells the sad tale about how an innovative NSF pilot program in outreach has been largely ignored by the science community. I would like to see ASA develop a proposal for an acoustics outreach project that might be funded by NSF or another organization. How about it, folks?

Message from the President

Gilles Daigle

As you read this column, I will have completed half of my term as ASA president. They say that time flies when you are having fun. Well time is certainly flying! This column is a bit eclectic, but I hope that you will find the information useful.

We had a nice intimate meeting in New Orleans. If you like smaller meetings, this was the one for you. I would particularly like to highlight the following activity during that meeting. At the initiative of Brandon Tinianov, Chair of the Technical Committee on Architectural Acoustics, the ASA participated in a Habitat for Humanity project. A total of 35 ASA members volunteered their time on a construction site in New Orleans on Saturday December 1st. Maybe we will see a short article on this in the near future.

I would like to report that the Acoustical Society Foundation (ASF) has recently announced that they are making available $20,000 for the purpose of additional scholarships. We are currently discussing with the ASF a number of specific proposals for the use of the funds.

Juan Arvelo currently serves on AIP's Committee on Underrepresented Minorities. He is chairing an acoustics session that is being organized for the joint annual conference of the National Society of Black Physicists (NSBP) and the National Society of Hispanic Physicists (NSHP) in Washington, DC, February 21-24, 2008. This will be the first time that an acoustics session is included in this conference. There will also be a poster competition and the ASA is sponsoring an award for the best poster.

The Spring meeting will be held in Paris from 29 June to 4 July, 2008. This will be the second joint meeting with the European Acoustics Association (EAA). The meeting also integrates two additional major European Conferences: ECUA, European Conference on Underwater Acoustics and EURONOISE, European Conference on Noise Control. The meeting is hosted by the Société Française d'Acoustique (SFA). Over 2,200 acousticians from around the world attended the first joint meeting in Berlin in 1999. Speculations are open as to the final attendance of this second joint meeting, but if you like large meetings, this will certainly be the one to attend. More information about the meeting and a little history of joint meetings with the EAA is provided by Bill Yost and Charles Schmid in the October 2007 issue of *Acoustics Today*.

The new ASA on-line publication *Proceeding of Meeting on Acoustics* (POMA) was launched on November 1st, 2007 by our Editor-in-Chief, Allan Pierce. I continue to be confident that this new publication is a step forward in bridging the academic and practical sides of the Society. Further, this publication will also serve to increase the electronic presence of the ASA.

In my "President's Perspective" published in the July 2007 issue of *Acoustics Today*, I announced the formation of four Task Forces in order to implement the recommendations resulting from the Vision 2010 Committee. I am happy to report that the Task Forces are moving forward. For example, a panel discussion was moderated during one of the Education sessions in New Orleans. Further, preliminary action has already been initiated to move on some of the task force recommendations. I hope to have the opportunity to provide specific details later in the year once all the Task Forces have finalized their recommendations.

As always, I would welcome your suggestions and comments which can be sent to asa@aip.org.

From the Student Council

Andrew Ganse and Michelle Vigeant

Did you get your fill of beignets in New Orleans? While the New Orleans ASA meeting overall was clearly more intimate than other recent meetings (read: smaller), it was filled with a number of student highlights.

Professor David Dowling of the University of Michigan was presented with the Student Council's Mentoring Award at the student reception. This is an ongoing award program, and students as well all other ASA members are encouraged to nominate ASA members for the Mentoring Award. Nomination forms are found in the "ASA Student Zone," the official student website of the ASA (www.ASAStudentZone.org).

The Student Council presented its third Grants and Fellowships workshop. Representatives from the National Science Foundation (NSF), American Institute of Physics (AIP), National Institutes of Health (NIH), Office of Naval Research (ONR), and the ASA's own Prizes and Special Fellowships Committee gave presentations and then joined break-out groups for discussions in individual fields. About 50 students attended this workshop and deemed it a great success. Thank you again to all the representatives for coming!

A new program started by the Mentoring Alliance provides a free Fellows' Luncheon ticket to one student in each ASA technical area and that student is hosted at lunch by a Fellow in their technical area. At the New Orleans meeting the tickets were raffled off at the student reception, but in the future the Student Council plans to distribute the tickets in advance of the ASA meeting.

The new president of the ASA, Gilles Daigle, joined the Student Council meeting to introduce himself and to clarify points for the upcoming Paris meeting. In particular, regarding student financial assistance, when students submit their abstracts (due January 10th) they must indicate that they are applying for funding. Students will be notified if they receive funding before the early registration payment deadline, which is February 8, 2008. Continually updated information about the Paris meeting can be found on the official meeting website (www.acoustics08-paris.org) as well as the "Prepare for Paris!" page of the ASA Student Zone website.

We look forward to seeing as many students as possible at the Paris meeting in the summer—bon voyage!

Andrew Ganse is a theoretical seismology graduate student at the University of Washington and the student representative for Underwater Acoustics. (aganse@apl.washington.edu) Michelle Vigeant is an architectural acoustics graduate student at the University of Nebraska in Lincoln and the student representative for Architectural Acoustics. (mvigeant@mail.unomaha.edu)

Echoes from New Orleans

Infrasonic Measurements and Calibration

Gunnar Rasmussen, G.R.A.S., Sound and Vibration, Denmark

The measurement of low frequency sound pressure levels call for special instrumentation not described in the present standards for sound level meters. Sound level meters are only specified for use in the frequency range above 20 Hz. At 20 Hz the tolerance of the weighting is ±2.5 dB and proper standardized calibration procedures including the microphone are non-existing. The consequence is the jump in standardized hearing threshold curves based on discrepancies in measurements reported over many years, as in Fig.1.

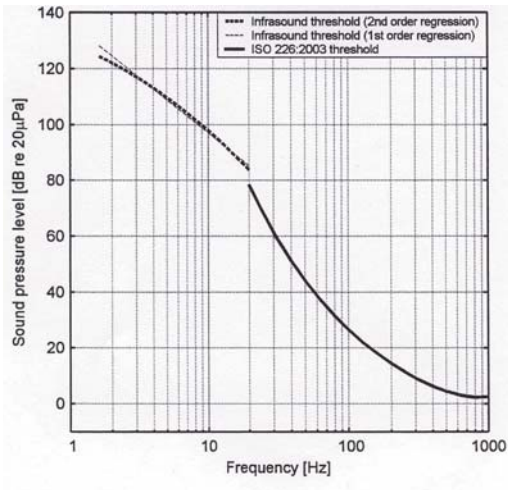


Fig. 1. Standardized hearing threshold above 20 Hz (ISO 226:2003) and proposed normal hearing thresholds for frequencies below 20 Hz.

The instrumentation used to measure the sound pressure in the infra sound range 2 – 20 Hz must be able to measure correctly in this frequency range. A normal type 1 sound level meter is not well suited. The tolerance on the frequency weighting alone below 20 Hz is ±3 dB and at 16 Hz it is +5 - ∞. This does not include the microphone in most calibration situations.

The calibration of a complete system is carried out by using a pistonphone at 250 Hz and a low frequency calibrator, e.g., G.R.A.S. 42AE for calibration from 250 Hz down to any desired low frequency limit.

A typical microphone-preamplifier low frequency response is shown in Fig. 2.

The low frequency calibrator which allows calibration to below 0.01 Hz is shown in Fig. 3. The calibrator will deliver a constant level of Pa independent of thermal heat exchange and system leaks over a wide frequency range up to more than 250 Hz.

The need for improved calibration technique and control of the tolerances is maybe best understood when we look at the spread in data leading to the jump in the standardized hearing thresholds above 20 Hz (ISO 226:2003) and the proposed normal hearing thresholds for frequencies below 20 Hz, which has been made by researchers concentrating on good low frequency data (H. Møller and C.S. Pedersen – Noise & Health 2004, 6:23. 39-59).

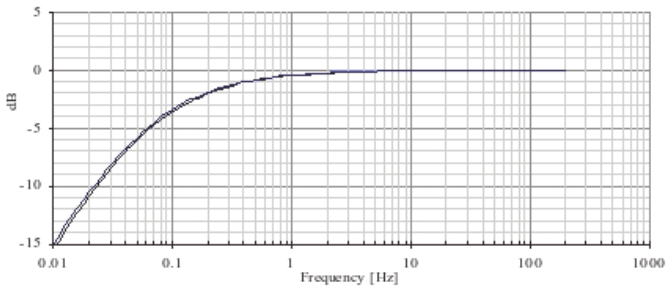


Fig. 2. Microphone and preamplifier combined cutoff.

Fig. 3. Low-frequency calibrator.

Session 4pMU honoring Max Mathews: T. Rossing, J. Smith, B. Atal, J. Appleton, J. Chowning, M. Chowning, C. Chafe, M. Mathews, D. Wessel, F. R. Moore

Tour of the levees conducted by the U.S. Army Corps of Engineers

Echoes from New Orleans

continued from page 1

magenta curve, at the bottom of the plot is the phase coherence (PC).

In this case, coherence means how well the detected signals conform to present knowledge of how other known infrasound signals have "behaved" in the past. Such things as how steady the amplitude has been over the time it took to acquire the data is very important to identify the difference between signals from noise.

Amplitude by itself is not significant. Noise also has amplitude, but it does not have "self control." It is unpredictably variable, that's what makes it noise. On the other hand, signals are deterministic. That's what makes them signals, and it also makes signal processing worth doing. Hence, a key to successful signal processing is to find a "behavior" that is a "personality characteristic" of the signals you are interested in, and then to design the signal processor to focus on that characteristic in order to identify that type of signal and ignore all else, including noise.

WISPR SC^2 is such a processor, as is the phase coherence. It is the magenta curve at the bottom of the plot. The characteristic on which it focuses, to identify signal from noise, is temporal coherence, i.e., systematic behavior of some parameter of a signal, such as amplitude, that can be counted on to have a predictable behavior. A simple behavior that almost always works is amplitude variations, or fluctuations, over a small time period, perhaps a few seconds. The fluctuations will generally be small for signals, and much larger for noise. A threshold can be set in the signal processor to pass everything with small fluctuations, i.e., signals, and to block everything with large fluctuations, i.e., noise.

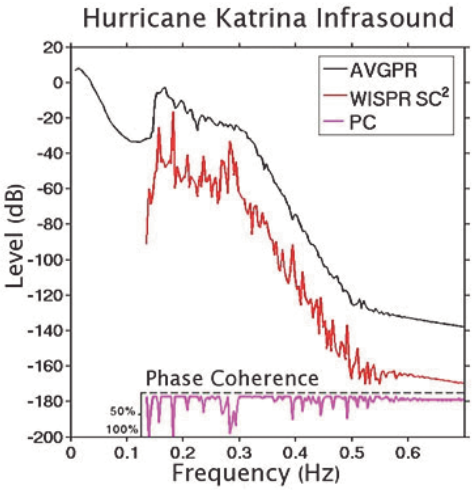


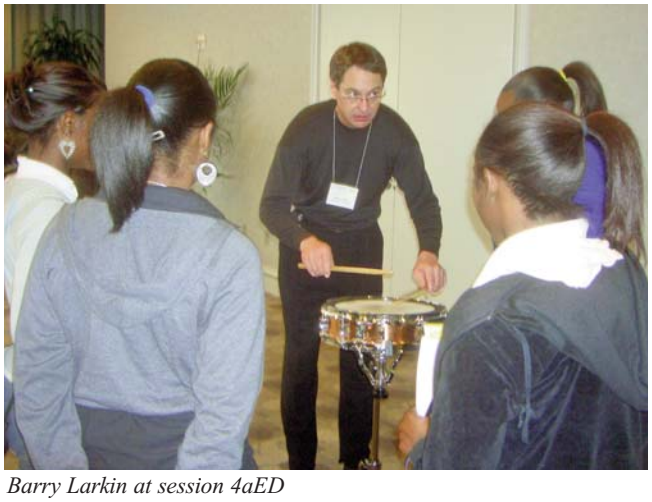
Figure 2. Strength versus pitch curves for the Hurricane Katrina infrasound data analysis: AVGPR, WISPR SC^2, and PC measured near Oxford MS, 400 miles away.

The AVGPR curve shows two broad local maxima at strengths of 10 and 0 and one local minimum at a pitch of about 0.1 with strength of approximately -30. There are no other significant features in this curve. This is not the case for WISPR SC^2, the red curve. There are several local maxima, the most prominent ones having isolated signal peaks at pitches of 0.14, 0.2, 0.22, 0.24, 0.27, and 0.29. There are also several other locally high peaks at greater pitches, but they are out of the infrasound range of general interest, which extends only up to pitches of about 0.4. One very popular infrasound range of interest is the pitches from about 0.1 to 0.3, which includes the six signals previously mentioned.

These WISPR SC^2 results represent a significant departure from what has been customarily displayed for infrasound. There is usually only a single curve, similar to the AVGPR curve at the top of Figure 2. However, WISPR SC^2 produces lines of considerable strength at various pitches that are easily identified by their substantial local maxima, as illustrated in Figure 2.

The magenta phase coherence, curve at the bottom of Figure 2 is an automatic detector of infrasound signals. It is displayed upside down. Its detector calculates the temporal coherence, i.e., repeatability of time-ordered sequences, of processed data. Results that match certain well known patterns are recognized and considered "detected."

The authors are at the National Center for Physical Acoustics, University of Mississippi, University, MS 38677.
This article is the lay language version of paper 1pPA3 presented at the 154st ASA meeting in New Orleans.



Barry Larkin at session 4aED

Three queens at the Accompanying Persons breakfast: Sharon DeMetz and Jeanne Richardson with Mardi Gras queen.

Scanning the Journals

Thomas D. Rossing

• **Hair cells of the inner ear** transduce mechanical vibrations arising from sound waves into electrochemical signals. At the apical surface each hair cell contains a bundle of stereocilia. According to a letter in the 6 September issue of *Nature*, two cadherins interact to form tip links that connect the stereocilia and are thought to gate the mechanoelectrical transduction channel. Cadherin 23 (CDH23) and protocadherin 15 (PCDH15) localize to the upper and lower part of the tip links, respectively. Ions that affect the tip-link integrity and a mutation in PCDH15 that causes a recessive form of deafness disrupt interaction between CDH23 and PCDH15.

A remarkable photo by the authors of this report appears on p. 112 of the October issue of *Physics Today*. In this photo, CDH23, tagged with a green fluorescent antibody, is found at the tail end of the tip link.

• Physicists have discovered a simple way to "store" light pulses in a material by converting them into **sound waves** according to an article in the 14 December issue of *Science*. The optical data pulses are converted into long-lived acoustic excitations in an optical fiber by means of stimulated Brillouin scattering. These stored pulses can be retrieved later, after a time interval limited by the lifetime of the acoustic excitation. In the experiment reported, smooth 2-nanosecond-long pulses were stored for up to 12 ns with good readout efficiency. This method can potentially be implemented at any wavelength where the fiber is transparent and can be incorporated into existing telecommunication networks because it operates using commercially available components at room temperature.

• "Stringing the fiddle: **the inner ear's two-part invention**" is the title of an article in the October issue of *Nature Neuroscience* which discusses the roles of CDH23 and PCDH15 in transduction by the stereocilia tip links. Physiological experiments illuminate channel function in a dazzling array of detail. Deflection of a hair cell's stereocilia bundle by ~100 nm opens ~100 transduction channels, located at the tips. Each channel is in series with a "molecular gating spring" of ~1 millinewton per meter stiffness that can stretch by >100 nm. Each tip link, about 170 nm long, appears as a twisted pair of strands 5 nm in diameter.

• Would-be conductors now have a system that allows them to change the **tempo and dynamics** of a virtual orchestra with the wave of a hand, according to a note in the 20 October issue of *New Scientist*. Audio and video recordings of a real orchestra are used to create the virtual orchestra. The would-be conductor wears an ewatch, a device the size of a wristwatch that contains accelerometers and tilt sensors. The ewatch records the user's hand movements and sends them to a computer, where software translates the actions into dynamics and tempo commands and feeds them to the virtual orchestra.

• People blinded early in life often develop **better hearing** than sighted people. According to a note in the 20 October issue of *New Scientist.* They do this by taking over the parts of the visual system that are easiest to adapt, the medial occipital. In sighted people the medial occipital plays a crucial role in registering visual signals by setting the thresholds at which they are noticed by the brain. Researchers played a series of sounds to blind subjects, each preceded by a cue warning the brain to pay attention. Brain scans showed that as subjects heard the cue their medial occipitals became more active, indicating that the brain uses the same region that alerts them to visual signals to prime them to listen for sounds

• "A Sound Use for Heat" is the title of an article on **thermoacoustics** in the November/December issue of *American Scientist*. The article focuses largely on the work of Orest Symko and his colleagues at the University of Utah (see *ECHOES*, Summer 2006 issue). Their work has been directed especially toward converting waste heat from computers, electronics, power plants, and automobiles into electricity. To accomplish this, the heat is first used to generate sound, which is then converted into electricity by means of piezoelectric transducers. The thermoelectric converters, which have no moving parts, can work with a temperature difference as low as 25 degrees Celsius, although larger temperature gradients increase efficiency.

• The WGBH Educational Foundation, in association with Sigma Xi, has launched a website, sciencecafes.org, to promote the growing **Science Café** movement in the U.S., according to a story in the November-December issue of *American Scientist*. From a handful of gatherings a few years ago to more than 50 around the country today, the café format has proven that people of all ages and backgrounds enjoy talking about the latest developments in science. The largest at the time of my editorial "Café Acoustique?" in the Fall 2006 issue of *ECHOES* was the Denver Café Scientifique which draws about 150 people. Meanwhile, has anyone tried out the Café Acoustique idea, or even made a presentation on acoustics at a Café Scientifique?

• The history and appearance of renal (kidney) tissue in rabbits after **histotripsy** is the subject of a paper in the October issue of the *Journal of Endourology*. Histotripsy, defined as "noninvasive, nonthermal, mechanical (cavitational) tissue ablation," is an experimental type of bloodless surgery. The left kidneys of 29 rabbits were treated with 750-kHz bursts of ultrasound from an 18-element phased-array transducer. After 60 days only a small fibrous scar persisted adjacent to a wedge of tubular dilation and fibrosis underlying a surface-contour defect.

• "There's more to **yodeling** than meets the ear," according to an article in the December 22/29 issue of *New Scientist*. Kerry Christensen, who performed a mini-concert at the ASA meeting in Salt Lake City, can lay claim to being one of the world's most versatile yodelers. His repertoire of 1500 tunes includes Cajun yodeling as well as a number in which performs a series of rapid chromatic runs up and down the musical scale. Human voices have two distinct ranges that singers call the "head voice" and the "chest voice." There is a distinct gap between these two ranges, which is noticed most in inexperienced singers. Opera singers are experts at smoothing over this break, while yodelers accentuate it, says Ingo Titze of the University of Iowa.

• In August, the World Health Organization (WHO) released preliminary estimates of the number of Europeans killed or disabled by **exposure to noise**, according to a story in 22/29 December issue of *New Scientist*. For example, chronic and excessive traffic noise is implicated in the deaths of 3 per cent

of people in Europe with ischaemic heart disease. Noise kills in much the same way as chronic stress does, by causing an accumulation of stress hormones, inflammation and changes in body chemistry that eventually lead to problems such as impaired blood circulation and heart attacks. Next year the WHO will finalize its estimates of the damaging effects of noise and will also provide guidelines on exposure levels that are likely to cause harm.

- A brain transcription called FOXP2 is necessary in order for zebra finches to **learn to sing**, according to a paper in the Public Library open access journal *PLoS Biology* 5, e321 (2007). After a 3-month tutoring period with an adult bird, the songs of the birds with reduced FOXP2 were missing syllables and contained inappropriately repeated segments. Without sufficient FOXP2 normal developmental motor learning could not take place.
- A novel program at the National Science Foundation (NSF) to support **innovative ways of communicating science** has attracted few applicants, according to an article in the 30 November issue of *Science*. The 4-year-old Discovery Corps Fellowship (DCF) program, which gives 2-year, $200,000 grants to both postdocs and experienced investigators for research and outreach, has attracted few applicants, and in a time of tight funding, a new program solicitation that's about to hit the streets could be its last. Fellows say one big obstacle is that the scientific community, for all its handwringing about a scientifically illiterate public, still views outreach as a dubious activity for those on an academic career path.
- Two letters discussing spontaneous activity in **developing auditory systems** appear in the 1 November issue of *Nature*. Spontaneous activity in the developing auditory system is required for neuronal survival as well as the refinement and maintenance of tonotopic maps in the brain. However, the mechanisms responsible for initiating auditory nerve firing in the absence of sound have not been determined. Supporting cells in the developing rat cochlea are found to release glutamate, triggering discrete bursts of action potentials in primary auditory neurons.

Acoustics Trust

Mahlon Burkhard, Acoustical Society Foundation

During its recent meeting in New Orleans, LA the Board of Trustees of the Acoustical Society Foundation established the *Acoustics Trust*.

The *Acoustics Trust* is a special group of ASA members and supporters who have agreed to provide for the Acoustical Society's philanthropic activities in their wills and estate plans.

Membership in the *Acoustics Trust* is open to anyone at any time who wants to enhance and advance the member and public services of the Society with a bequest. Special recognition as an **Acoustics Trust Founding Member** will be given to anyone who has already included a bequest or who will make a bequest through a will or trust before December 31, 2009. Details of the estate are neither needed or desired to become a member of the *Trust*. By joining the Trust you are acknowledging that the Society's future is important to you

There are several ways to make a bequest to the Acoustical Society Foundation. You may leave the Foundation a specific dollar amount, a percentage of your estate or a portion of the residual of the estate after you have provided for those close to you. Each person's legal and financial situation will differ, and the laws applicable to estates and trusts vary from state to state. Accordingly, it is important that you consult with a professional adviser or attorney as you consider a gift to the Acoustical Society Foundation in your estate plan.

To join the Trust, simply complete a pledge form and return it to the Acoustical Society Foundation. Request a pledge form or more information from the Foundation's Interim General Secretary, Paul Ostergaard, at 1-814-474-4634 or email: leadoxide@alum.mit.edu.

New ASA Fellows. Top row: Brandon Tinianov, Ronald Wagstaff, Vladimir Ostashev, R. Glynn Holt, Jean-Pierre Hermand, Sarah Hawkins; Bottom row: George Fisk (ASA Vice President), Steven Finette, William Ellison, Bruce Douglas, Dimitri Donskoy, Jeffrey Boisvert, William Ahroon, Gilles Daigle (ASA President).

Acoustics in the News

•Twenty-two varieties of beaked whales roam the seas, diving as deep as a mile to feed on bottom-dwelling squid and small fish on the dark ocean floor. According to a story in the October 15 issue of the *Washington Post*, the realization that sonar can disorient or frighten whales sufficiently to leave them beached and dying has spurred protests and lawsuits. The Navy first denied but now acknowledges the problem, but it has resisted efforts to limit testing of their sonar, saying it is essential to national security. The Navy has now funded a $6 million project to learn more about beaked whales and their response to sonar and loud ocean noises. The goal is to learn more about beaked whales by attaching sophisticated motion detectors to record the timing, depth and angles of their dives and ascents to see how the animals react when exposed to sounds approaching the intensity of sonar signals. Beaked whales can dive for periods as long as 85 minutes.

•Test sections of asphalt rubber in the Seattle area are drawing favorable comments, according to a story in the December 17 issue of *The Seattle Times*. Recent tests show older asphalt registers about 105 decibels when measured with a microphone on a rear wheel of a vehicle about 2 inches above the pavement. Brand-new conventional asphalt registers about 100 decibels, while new rubberized asphalt tends to be about 95 to 96 decibels. Pound for pound, asphalt rubber and polymer asphalt are more expensive than conventional asphalt, but since they're placed at half the thickness, they end up costing about the same. However, the life span of asphalt rubber tends to be several years shorter. Since 1988, the Arizona Department of Transportation has used asphalt rubber in more than 3,000 miles of pavement overlays. Arizona now recycles 70 percent of its used tires back into the highways, eating up about 1,500 tires per lane mile of highway.

•Quiet hotels were the subject of two articles in *The New York Times*. Although luxury hotels have often made efforts to "soundproof" their rooms, an article in the October 21 issue describes efforts by AmericInn, a mid-range hotel chain, to reduce room noise by using masonry blocks filled with sound-absorbing foam, in addition to drywall that is 5/8-inch thick instead of 1/2-inch. It also installs gaskets and door sweeps to minimize hallway noise and obtain a Sound Transmission Class test of 50 or higher. The Fairmont Vancouver Airport hotel recently created a "quiet zone" on its sixth floor for daytime sleepers. Loews Hotels have been offering guests free sound-masking machines that emit white noise for light-sleeping guests.

An article in the October 2 issue cites other examples of construction with double-glazed windows and insulated walls. Older luxury hotels often were built "like the Maginot Line," with enormous thick walls but when hotels add plumbing or wiring to such a structure they have a temporary noise problem. Some hotels, especially in the luxury market, deliberately encourage the kind of bustle and excitement in lobbies and bars that can lead to noise seeping into guest rooms. One hotel was recently built with 8-inch thick walls between rooms.

•A federal judge limited the Navy's ability to use mid-frequency sonar on a training range off the Southern California coast, according to a story in the January 4 issue of the *Washington Post*. The court ruled that the loud sounds would harm whales and other marine mammals if not tightly controlled. The order banned the use of sonar within 12 nautical miles of the coast and expanded from 1100 yards to 2200 yards the "shut down" zone in which sonar must be turned off whenever a marine mammal is spotted. The judge also forbade sonar use in the Catalina Basin, an area with many marine mammals. The decision is a blow to the Navy, which has argued that it needs the flexibility to train its sonar operators without undue restrictions.

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