

The newsletter of
The Acoustical Society of America

ECHOES

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Facets of Medical Ultrasound

by Ronald Roy

In one way or another, most of us have benefitted from medical diagnostic or therapeutic procedures that employ ultrasound. In this country, the most common use of ultrasound in medicine emerges from diagnostic applications, where scattered acoustic waves are used to create images of the body's internal structures. This typically involves the use of an external transducer, which generates a focused beam of sound that scans (either mechanically or electronically) across the region of interest. Variability in the acoustic properties of various anatomical structures results in backscattered acoustic energy, which is then displayed as an image.

The manner in which the information is processed and displayed varies with the application. For example, data for a conventional "B-scan" image is obtained by sweeping a beam of sound through tissue in a manner similar to a windshield wiper. The amplitudes of backscattered echoes are depicted in gray-scale on a computer screen, resulting in an image of the scanned region [see *Echoes* Vol. 2(4) (1992) for an excellent example]. If the information is processed in the frequency domain, then Doppler shifts associated with moving scatterers can be used to quantify certain facets of cardiovascular flow such as velocity and directionality. Higher frequencies (on the order of 10-100 MHz) yield enhanced spatial resolution, albeit at the expense of depth of penetration; high frequency sound is more readily absorbed by tissue, with the energy being transformed into heat. These diagnostic systems are typically limited to studies of those tissues and organs that permit intimate access for the imaging transducer. This includes imagery of the skin, the eye, and internal passageways (blood vessels, the esophagus), the latter made

possible by instrumenting catheters with miniature ultrasonic scanheads.

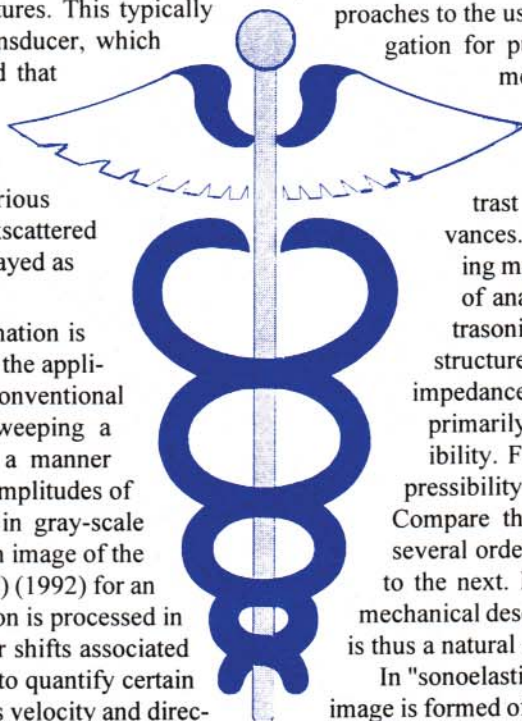
New imaging modalities

In keeping with the advance of technology, recent years have witnessed an explosion of alternative approaches to the use of acoustic and elastic wave propagation for purposes of diagnosis. The measurement of skin elasticity via shear wave

velocity and the introduction of stabilized microbubbles to increase the acoustic contrast of blood are examples of such advances.

Of particular interest is a new imaging modality based on the elastic properties of anatomical structures. Conventional ultrasonic imaging relies on scattering from structures that exhibit contrast in acoustic impedance, which for most biological tissues is primarily a function of the material compressibility. For soft tissues, the variation in compressibility is less than an order of magnitude. Compare that to elasticity, which can vary by several orders of magnitude from one tissue type to the next. Elasticity may be the most effective mechanical descriptor distinguishing tissue types and is thus a natural choice for acoustic imaging.

In "sonoelastic imaging" a conventional ultrasound image is formed of an anatomical region in its quiescent state. The region is then deformed and another image obtained. A point by point comparison of the two images provides a measure of the resulting deformation exhibited by the region in response to the applied stress. From this information, one can deduce the elastic properties of each tissue component in the region of interest. For instance, healthy breast tissue deforms readily whereas a carcinoma may not. Figure 1 depicts such a carcinoma imbedded in a tissue phantom (a gel-like material with acoustical



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Executive Director's note

*Will conciseness survive the electronic age?
And will we have enough time to read all our e-mail?*

Our Treasurer Emeritus used to preface his longer reports to the Executive Council with a quote from Blaise Pascal: "This letter would have been shorter, but I did not have the time." I was thinking of this recently while perusing a thick folder holding the many drafts written prior to my submitting an 8-page paper to the *Journal* in 1970. I was reluctantly preparing these same drafts for the recycling bin. If the number of drafts are an indication, I had struggled to shorten the paper by choosing more concise words and mathematics. In retrospect, my time was well spent as I reduced my page charges, made the *Journal* a little thinner, rescued the reader from excess information, and ultimately used fewer trees.

Today most drafts are composed on a disk. We have the *Journal* on CD ROM and an on-line version of it may be just around the corner. Many of us face a long list of e-mail messages every day. Most e-mail messages I receive and send are not "letter-quality" since we don't have the time. It remains to be seen if journal papers become less concise as we go electronic. Can societies maintain page charges as paper costs disappear and authors do the typesetting? More importantly, what does the future hold for peer-review, the very heart of respected scientific journals like ours? Will anyone and everyone get their paper up on the Internet in pre-print form? Norbert Wiener, the father of cybernetics once asked: "How do we keep the monkeys away from the typewriters?"

At this point I'm reminded that I was limited to 400 words, so I will conclude by asking you to join me in thanking the *Journal's* Associate Editors and the almost 1300 peer-reviewers who help make our *Journal* what it is (see pp. 3263-3268 of the June issue). And send me a concise e-mail on what your electronic crystal ball shows. I'll read it. charles@aip.org

—Charles Schmid



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 and ASJ to meet in Hawaii

After an interim of eight years the Acoustical Society of America (ASA) and the Acoustical Society of Japan (ASJ) are once more joining forces to meet in Honolulu. The meeting will take place at the Sheraton Waikiki Hotel on December 2-6, 1996. The program of this meeting promises to be as interesting and even larger than its predecessor. Over 1330 abstracts have been received, 359 of which are from the ASJ. There will also be a record 30 new ASA Fellows honored at the plenary session, four of whom are members of the ASA from Japan.

Most of the pertinent material about the meeting is contained in a new and improved "Call for Papers," which was sent to members at least two months ago. Included is information about the tutorial lecture, "Sound Transmission Through Structures—Protecting Occupants from Exterior Noise" presented by Ben Sharp on Monday Dec. 2, and the short course on Thermoacoustics given by Greg Swift scheduled for Saturday and Sunday, Dec. 7-8. Another short course, however, was not included in the Call: a course entitled "Auralization," which will be taught by Mendel Kleiner and Peter Svensson. It is also scheduled for Dec. 7-8.

Here are just a few highlights from the list of special technical sessions:

- ♦ Ocean floor surveys
- ♦ Acoustics of vocalizing animals
- ♦ Non-auditory physiological effects of noise on animals
- ♦ Medical ultrasonics and acoustics
- ♦ Traditional instruments of Japan and the Americas
- ♦ Community noise: Problems, regulations, and solutions
- ♦ Laser acoustics
- ♦ Acoustical imaging
- ♦ Robust speech recognition
- ♦ Earthquake acoustics

The Call for Papers also includes important information on airfare discounts and hotel accommodations. **Those wishing to attend the Honolulu meeting should make their arrangements AS SOON AS POSSIBLE** so as to avoid disappointment. Waikiki is a very popular tourist attraction and hotels become filled quickly. Also, the weekend of the Thanksgiving holiday is one of the busiest of the year for air travel.

Extra copies of the Call for Papers and further information on the meeting may be obtained by contacting the ASA national office: (516)576-2377 (fax), asa@aip.org (e-mail).

New ASA Officers and Fellows

Officers:

The results of the recent ASA election were announced at the Plenary Session of the Indianapolis meeting. Congratulations to President-Elect Lawrence Crum, Vice President-Elect Ilene Busch-Vishniac, and Council members Ralph Goodman and Sally Revoile. At the same session, then president Robert Apfel handed over the gavel to the new president, Stanley Ehrlich.

Fellows:

The newly elected ASA Fellows were also announced at the Indianapolis Plenary Session:

Yves H. Berthelot	Lal C. Godara
Edward M. Burns	Dana S. Houglund
James V. Candy	Glenis R. Long
John E. Cole, III	Konstantin A. Naugolnykh
Nikolai A. Dubrovsky	Arthur N. Popper
Carol A. Fowler	David A. Preves
Thomas B. Gabrielson	James A. Simmons

ASA's mentoring program

The ASA Committee on Women in Acoustics has recently begun a mentoring program aimed at providing support and guidance for junior scientists by senior scientists. Mentoring is to help junior scientists relate successfully with the Society and also to help with career concerns. The program is open to all ASA members (not just women). Currently there are about two dozen participants, half of whom have requested mentors and half have volunteered to serve as mentors. The program is very informal and unstructured with each pair of participants (mentor and protégée) determining their own level of interaction. Anyone interested in participating should contact Alex Tolstoy (atolstoy@ipdinc.com or 808-735-8070).

Classroom acoustics debated

At the May meeting in Indianapolis, the meeting of the Technical Committee on Architectural Acoustics (TCAA) was the scene of a lengthy discussion on classroom acoustics. Robin Towne and Michael Nixon presented information on the inadequate acoustical conditions in many classrooms and the need for young children and those with hearing losses to have more favorable listening conditions than adults. As a result, the TCAA has formed a subcommittee to pursue the topic in greater depth. The subcommittee will develop areas of research and methods of interacting with other ASA committees and other societies to share its concerns for the acoustical environment in classrooms. A workshop to develop consensus on acoustical criteria for classrooms has been proposed but the date and location are yet to be established. This topic will be expanded in future issues of *Echoes*.

We hear that...

James L. Flanagan, winner of ASA's Gold Medal in 1986 and former President of the Society, has been granted the nation's highest science honor, the National Medal of Science. President Clinton has called this award "America's version of the Nobel Prize." The eight medalists will be honored at a White House ceremony later this summer. Flanagan, Director of the Center for Computer Aids for Industrial Productivity, and Vice President for Research at Rutgers University, is being honored for his leadership and innovation in bringing engineering techniques and speech science together to solve basic problems in speech communication. His previous research at Bell Laboratories led to the automation of many functions of the U.S. telecommunications network.



The National Academy of Engineering recently announced the names of its new members, among whom are ASA members **Akira Ishimaru**, Boeing Martin Professor of Electrical Engineering at the University of Washington, and **Wesley L. Nyborg**, Professor Emeritus of Physics at the University of Vermont.



Robert A. Frosch, Senior Research Fellow at Harvard's John F. Kennedy School of Government received the 1996 IRI Medal from the Industrial Research Institute.



The German Acoustical Society has presented the Helmholtz Medal to **Manfred R. Schroeder**, Professor Emeritus of the University of Göttingen, for "outstanding contributions to number theory and its applications to physics and acoustics."



The Association for Research in Otolaryngology presented its 1996 Award of Merit to the team of researchers, **Ruediger Thalmann** and **Isolde Thalmann** of Washington University in St. Louis for their pioneering work in inner ear fluid biochemistry.



Discover magazine has presented its 1996 award for Technological Innovation in the category of "Breaking the Sound Barrier" to **Blake Wilson** of Research Triangle Institute's Neuroscience Program for his contribution to new cochlear implant technology.



(...Ultrasound, continued from page 1)

properties similar to tissue) and imaged conventionally (S) and via elastography (E). Aside from the bright band due to the proximal echo, the elastogram offers superior contrast with fewer artifacts associated with specular scattering.

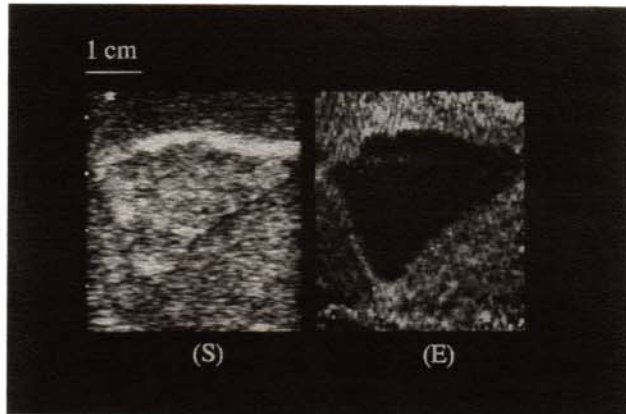


Fig. 1. Ultrasound images of a breast carcinoma where image S was generated with conventional ultrasound and E shows the same object using sonoelastic imaging (from J. Ophir et al., *European J. of Ultrasound*, 3, 49-70, 1996, reprinted with permission.)

High intensity ultrasound therapy

It is widely accepted that imaging ultrasound is non-invasive, in that it exerts little or no influence on the organs or tissues that are being scanned. But the medical utility of ultrasound is by no means limited to imaging structures and diagnosing pathology. Sound interacts with matter in a number of ways, with scattering being only one of many possible scenarios. As ultrasonic waves propagate through a medium, some of the acoustic energy is absorbed and transformed into heat. This can result in a gradual rise in tissue temperature, a process called ultrasonic hyperthermia. In its mildest manifestation, gentle tissue heating has been shown to promote wound healing via a series of mechanisms still poorly understood. In more aggressive treatments, the rapid heating of tissue to temperatures in excess of about 60 degrees C can produce lesions. The effectiveness of such a treatment rests on the ability to selectively elevate targeted tissue temperature to therapeutic levels without adversely impacting the surrounding healthy tissue. Although the therapeutic value of such a procedure was recognized years ago, only recently have we seen such concepts enter the realm of clinical practice.

An excellent example of the therapeutic potential of high intensity focused ultrasound (HIFU) is the treatment of cancerous tumors. Since the rate and magnitude of tissue heating increases with increasing acoustic pressure amplitude, any ultrasound-induced heating is more or less limited to tissue residing in the focal zone of the HIFU transducer. Thus, *targeted* lesion formation is possible. Although straightforward in concept, this approach can be

quite complicated in practice. The thermal dose required to achieve a desired response will vary with tumor tissue type, the thermal properties of the tumor and surrounding tissue, patient geometry and anatomy, the harmonic content of the sound field, and so on. Moreover, the acoustic properties of the target tissue itself change as the lesion evolves, resulting in enhanced absorption and increased sound velocity. Such effects can alter the spatial characteristics of the focused field and can acoustically shield the distal portion of the target zone. Although the principle of transcatheter ultrasonic surgery has been effectively demonstrated, there is much to learn before HIFU can establish itself as a standard tool in the clinical arsenal.

And yes, bubbles also play a role

Not all therapeutic applications of high-intensity ultrasound involve heating alone. If the peak acoustic intensity exceeds a threshold level, it is possible to stress the tissue to the point where it fails, yielding a vapor cavity that fills with gas. Associated with this expanded cavity is a significant amount of stored mechanical energy that is suddenly released when the bubble collapses. This acoustic "cavitation" can spawn a host of effects, such as shock waves, microscopic fluid streaming and jetting, and free radical production (due to the high temperatures in the collapsing bubble). This violent activity, when properly harnessed, can be a vehicle for spatially localized therapeutic impact. Here are two such applications:

Extracorporeal shock wave lithotripsy is a well established clinical procedure for the treatment of kidney stones, employing a very high-intensity acoustic source to generate focused shockwaves that impact the stones and cause them to disintegrate. There is evidence to suggest that violent cavitation plays a role in this process. Current theory holds that vapor bubbles formed near the surface of the stone collapse in such a manner as to produce microscopic jets of high-velocity fluid that impact the stone surface, forming micro-fissures. This is not unlike the action of cavitation on the propeller of an outboard motor, where the activity is so energetic that the jets form pits on the metal surface.

Another recent development is ultrasound-enhanced thrombolysis. In this procedure, ultrasound is used to break down blood clots, either by direct mechanical action from cavitation or by somehow enhancing the uptake of thrombolytic drugs. Low-frequency ultrasonic experiments (on the order of 20 kHz) suggest that the presence of cavitation microbubbles can enhance the process, possibly because microscopic fluid streaming serves to break down boundary layers and thus facilitates the uptake of the drug into the clot. The role of cavitation in higher-frequency experiments (around 1 MHz) is not as clear, but there is some indication that bubble-induced microstreaming again can enhance the action of thrombolytic drugs.

Depending on the clinical scenario, the therapeutic use of ultrasound for thrombolysis may involve the application

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Medical Ultrasound

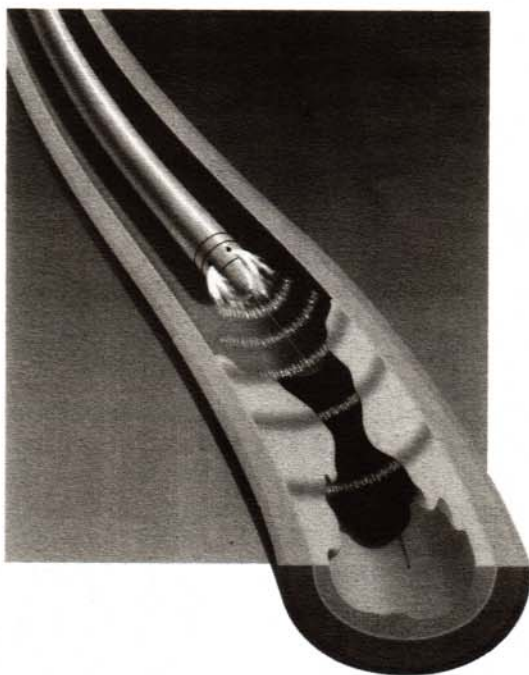


Fig. 2. Artist's conception of an ultrasonic catheter inserted in a blood vessel completely occluded by a blood clot bound in a stenosis. The small holes are ports for introducing clot-dissolving drugs. The thin wire guides the catheter during insertion. (Courtesy of EKOS L.L.C.)

(...Ultrasound, continued from previous page)

of moderate-intensity ultrasound via the insertion of a catheter. Although invasive, this procedure offers excellent targeting, even in acoustically remote organs. A Seattle-based company is in the process of developing an ultrasonic catheter for eventual clinical trials. An artist's mock-up of such a device is shown in Fig. 2.

It is evident from this brief survey that the application of ultrasound in medicine is quite broad in scope. Indeed, there are several exciting applications that are not discussed here, such as ultrasonic wound healing, ultrasonically-enhanced transdermal drug delivery, ultrasonic files for use in dentistry, and ultrasonic scalpels and cauterizers, to name a few. The clinical uses for ultrasound, especially for therapy, are far from mature. As we improve our understanding of the manner in which acoustic waves interact with biological tissues, we will surely refine and expand the ways in which ultrasound can help make us healthier.

Ronald Roy, Ph.D. recently joined the faculty of Boston University, where he serves as Associate Professor of Aerospace and Mechanical Engineering. His research activities include aspects of oceanic, engineering, and medical acoustics, with a particular focus on bubble-related physical acoustics.

Town Meeting

ASA Town Meeting raises important issues

This year's Town Meeting at the ASA spring meeting in Indianapolis was attended by about 150 people and generated discussion on three specific topics: meeting formats, proceedings, and meetings outside North America. Ira Dyer led off with comments about how the changing nature of ASA meetings has caused them to be less useful as a means of technical exchange than they were many years ago. He suggested that the ASA hold periodic workshops in which the Society provides a service, such as published proceedings. Jan Weisenberger, the second speaker, agreed that the satellite meetings are useful and suggested that their advantage is that they permit more thorough study of a particular topic. Some participants also noted that the tendency of the Technical Committee on Physiological and Psychological Acoustics to skip the Fall meeting has reduced its role in ASA affairs and diminished the interaction between it and other technical committees. Comments from the floor supported the idea of workshops and other experimental formats.

The discussion of proceedings began with the comment that the paper copying service is not working well in its current form. Several suggestions came forward, including (1) the production of a meeting proceedings based

on transcribed talks, as in the Physical Acoustics Summer School, (2) the generation of hard-copy proceedings, (3) creation of a virtual proceedings on the WWW, and (4) gathering the papers at the copy service into a CD ROM. Carr Everbach noted that the ASA Home Page had over 10,000 hits in April.

There was considerable discussion about the wisdom of holding ASA meetings outside North America. A few comments expressed concern about such meetings being "elitist" as they will be too expensive for many of our members. The suggestion that we need to be more global in our perspective if we are to retain our leading edge as a professional society met with some skepticism. President Bob Apfel, however, stated that since the next meeting of the International Congress on Acoustics will be held in the U.S. (co-sponsored by the ASA), it is not a bad idea to schedule an experimental ASA meeting outside North America (Berlin) in the six-year time period between foreign ICA meetings.

—Ilene Busch-Vishniac, Vice President-Elect

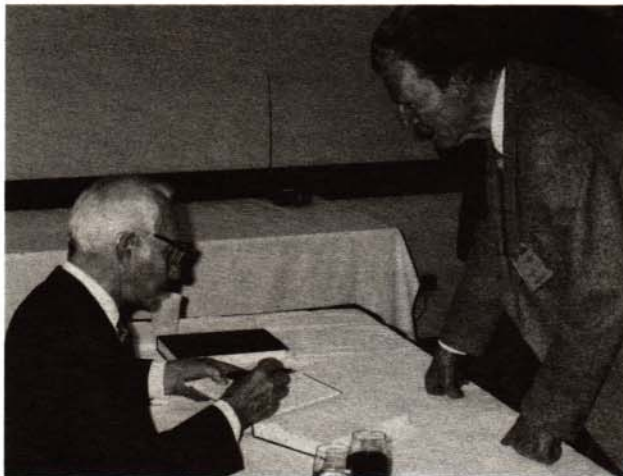
Editor's note: Do you have any opinions or suggestions on these issues or any others that the Society faces? If so, consider writing a Letter to the Echoes Editor.

Hunt Fellowship awarded

Mark Hasegawa-Johnson has been selected to be the 1996 Frederick Vinton Hunt Fellow. The title of his proposed research is "Estimation of Vowel Formant Targets Based on a Dynamic Representation of Formant Motion." He plans to perform his research at two different institutions. Half of his time will be spent at MIT under the guidance of Kenneth N. Stevens, and the other half at the Speech Processing and Auditory Perception Laboratory, headed by Abeer Alwan, in the Department of Electrical Engineering at UCLA.

The first Hunt Fellowship was awarded in 1978 and Dr. Hasegawa-Johnson becomes the 19th recipient. The fellowship honors Hunt's contributions to acoustics and supports a post doctoral year for each of the Fellows. Professor Hunt died in 1972 while attending the ASA spring meeting in Buffalo, NY. The motivation of his life's work had been expressed succinctly in a clause in his will which provided that should he be the last of his immediate family to survive, the largest portion of his estate would go to the Acoustical Society of America "to promote the science of sound and its usefulness to man."

The concept of the fellowship arose in conversations between John Bouyoucos, other officers of the ASA, and Professor Hunt's widow, Katharine B. Hunt. The financial backing for the fellowship was acquired with initial gifts from Mrs. Hunt during her lifetime, and major contributions from the Society and the Office of Naval Research, which had funded Hunt's research at Harvard for many years.



Leo Beranek inscribes a copy of his book, Concert & Opera Halls: How They Sound, for Henning von Gierke. More than 100 people attended his book signing reception at the Indianapolis meeting, where he signed over 50 copies.

New hearing protector guidelines supported

ASA President Stanley Ehrlich has written a letter to Carol Browner, Administrator of the U.S. Environmental Protection Agency, on behalf of the Society. The purpose of the letter is to request the EPA to review and revise its current regulation on the labeling of hearing protection devices. In doing so the ASA is supporting a request made previously by the National Hearing Conservation Association, emanating from the Task Force on Hearing Protector Effectiveness. The task force, consisting of representatives from government and professional organizations involved with hearing and hearing protection, recommended a primary label with a noise reduction rating (NRR) based on a "subject fit" methodology and employing a one standard deviation adjustment. A secondary label containing product specific instructions was also recommended. The task force also recommended that testing of hearing protector attenuation be conducted only in laboratories accredited by the Department of Commerce, and that product retesting should occur at least every 10 years but no more often than every 5 years. Further information may be found in Spectrum, the newsletter of the National Hearing Conservation Association (Vol. 12, no. 2), Milwaukee, WI, or by contacting NIOSH at 800-35-NIOSH.

RLE celebrates 50th Anniversary

The Research Laboratory of Electronics at MIT will celebrate its 50th anniversary November 1-2, 1996. The two-day event, "50 Years of Technological Impact and Innovation" will include receptions, symposia, a jubilee dinner party, and the opening of the RLE's exhibit in the Compton Gallery of historic artifacts and photographs. The Saturday afternoon session will feature keynote addresses by science historian James Burke and MIT President Charles M. Vest. All students, faculty, and staff who have been part of RLE since its founding in 1946 are invited to attend the festivities. For information contact Dorothy Fleischer (617)253-4653 (phone) or dot@rle.mit.edu (e-mail).

Conference on hearing aid research - Abstracts on web

The 4th conference on Issues in Advanced Hearing Aid Research was held at the UCLA Lake Arrowhead Conference Center, May 27-31. The meeting was co-sponsored by the House Ear Institute and the ASA, and chaired by Arthur Boothroyd, with Sigfrid Soli, Claus Elberling, and David Fabry as co-chairs. About 120 people from 10 countries attended, including experts in signal processing, transducer design, psychoacoustics, clinical audiology, and speech and hearing science. Abstracts for the poster and lecture presentations, along with the authors' e-mail addresses, may be found on the WWW under ASA's Home Page (<http://asa.aip.org/>).



Support needed for Russian infants program

Several ASA members have contributed to the support of the Russian Early Intervention Institute in St. Petersburg. The Institute was formed by Dr. Elena Kozhevnikova, a psychologist, and Dr. Inne Chistovich, an engineer, and is the first of its kind in Russia to provide evaluation, diagnosis, and remediation in speech, hearing, and cognitive disorders in infants. Under the leadership of Corine Bickley of MIT, the Russian staff is cooperating with clinicians and faculty at various U.S. institutions, including MIT, Massachusetts General Hospital, and Galaudet College. Also participating in the exchange and fund-raising are James Pickett, Robert Berkovitz, and Sally Revoile.

Lacking professionals in pediatrics, the Russian scientists have adopted simple diagnostic procedures originally

developed in Sweden, and have trained parents as "therapists." They now have three satellite facilities in St. Petersburg and have begun to give workshops in other Russian cities. Although the principal professionals retain appointments from the Pavlov Institute, they are working virtually without salary. There is a great need for equipment, books, runs of journals, and, of course, monetary donations.

Any such support may be made through the American Medical Resources Foundation, P.O. Box 343, Lexington, MA 02173, and by specifying "*toward activities of the St. Petersburg Early Intervention Project.*" Phone (617)863-2363, fax (617)674-2420. (The Foundation engages in medical education and shipping of resources to needful third-world hospitals and medical facilities.)

Additional information may be obtained from James "Mac" Pickett at (207)667-5036 (phone), (207)667-6648 (fax), macp@celestat.com (e-mail).

Physics News Update available

The American Institute of Physics offers a subscription to *Physics News Update* via the internet. To add or delete yourself from the list automatically, send a message to <listserver@aip.org> leaving the subject line blank and, in the body of the message, merely specify either `<add physnews>` or `<delete physnews>`.

Acoustics in the News

Newspapers

The New York Times featured several articles related to acoustics in recent months. In the article "Laser Weapon Obliterates Graffiti, Not Missiles," science writer Malcolm W. Browne describes a portable laser that cleans graffiti from walls and statues, without damaging underlying surfaces, by means of photoacoustic stress waves (Sun., April 21). In "How America Is Muffling Its Highways (Sun. June 2), Matthew L. Wald writes that the need for barriers exceeds the ability of state and Federal agencies to pay for them. For example, the Colorado Department of Transportation has an approved list that will extend to the year 2020. Barriers usually cost about \$1 million per mile and reduce noise by 5-10 dB. *The Times'* "Environment" section carried a piece called "Buzz, Honk, Click: Bats Reveal Presence to New Sonar Device" by Suzanne Possehl (6-7-96). The article reports on the use of a computerized system that transduces the high-frequency sounds made by bats into the audible range for humans. Thus researchers

are able to catalogue the calls of bats, facilitating conservation planning.

Two recent articles in *The New York Times'* "Science Times" section, both authored by William J. Broad, pertain to acoustics. In the article, "Anti-Sub Seabed Grid Thrown Open To Eavesdropping" (7-2-96), the author describes in some detail the exciting new sounds available to researchers as the federal government opens its \$16 billion Sound Surveillance System to civilians. Universities, ocean institutes, and private companies are beginning to study such sounds as whale songs and volcanic eruptions, as well as those from man-made sources. A week later, Mr. Broad wrote about the origins, celebration, and playing of the steel drum, with a detailed discussion of its acoustics in "Picking Up Good, and Subtle, Vibrations From Steel" (7-9-96). The author refers to an article in the March 1996 issue of *Physics Today* by acousticians Thomas Rossing, Scott Hampton, and Uwe Hansen, quoting them as saying the steel drum is "probably the most

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Acoustics in the News

(...News, continued from page 7)

important new acoustical (that is, nonelectronic) musical instrument developed in the 20th century."

The *Chicago Tribune* carried an article by Karen E. Klages (5-12-96) entitled "Sounds of Silence," which provides tips from several Chicago-based acoustical consultants on low-budget methods for reducing the effects of unwanted sound in your home. Included along with information on caulking and insulating, is pragmatic advice, such as asking your neighbor to take his loudspeakers off shared walls or to lift them off the hardwood floor. A May 15 article in the *San Diego Union-Tribune* by Scott LaFee, "Music sounds a different note based on keys learned from mom," reports on a paper presented at ASA's Indianapolis meeting by Diana Deutsch. In her work on musical perception and "illusion," one of Dr. Deutsch's findings is that pitch perception appears to be related to one's geographical origin.

The *Boston Sunday Globe* (6-23-96) featured the life and work of Leo Beranek, and how, at age 81, he has produced yet another "magnum opus," *Concert and Opera Halls: How They Sound*. The article, "Leo Beranek's spent his life making sound judgments" is by Richard Dyer. In *The Dallas Morning News*' "Discoveries" section, author Ruth Flanagan describes how scientists can glean information about the interior of the sun by measuring the speed of sound through the sun's interior. These sound waves are generated by violent "sunquakes" or churnings of internal gasses. (See also the related article by Malcolm Browne in *The New York Times*, 10-24-95, reported earlier in *Echoes*, Winter 1996.)

Magazines

The May 17 issue of *Science* included a short article called "Eavesdropping on Ants," which describes the research of Robert Hickling reported at the recent ASA meeting in Indianapolis. His work shows that fire ants, previously thought to communicate via chemical messages, also produce various acoustical signals, depending on their circumstances. A later article on the same subject,

"Ant Talk" appears in the August issue of *Discover* magazine.

Two other articles on animal communication recently appeared in the popular press. In the May 25 issue of *Science News*, the article "Whale Chatter" by Tina Adler reports on the sounds used to communicate by various types of whales, with emphasis on transient killer whales. The author makes reference to the article by McDonald, Hildebrand, and Webb, "Blue and fin whales observed on a seafloor array in the Northeast Pacific," (*J. Acoust. Soc. Am.*, 98, 1995). The cover story of the March issue of *Smithsonian* is, "Snatching scientific secrets from the hippo's gaping jaws" by David M. Schwartz. The author explores the acoustical communication of the hippopotamus, whose bellows can reach 115 dB. Of particular interest is the way hippos can communicate successfully in their two different acoustical media: air and water.

The special "Conference 1996" issue of *US Black Engineer* contains the article, "Mastering the Science of Sound" by Carla Adair Hendricks. The article pays tribute to ASA Silver Medalist James West, describing his many contributions to acoustics, especially to the sound quality of the telephone and other acoustical devices.

Two recent publications on architectural acoustics may be of interest. The May issue of *Building Design & Construction* ran the article, "Acoustics: Sealing the building envelope" by John Gregerson, which contains suggestions by acousticians Neil Shade and Chris Savereid for designing noise reduction into buildings so that "after-the-fact corrective fixes" may be avoided. The other is an article in the June issue of *The Atlantic Monthly* by Witold Rybczynski, "Sounds as Good as It Looks." The article is yet another complimentary piece about the Seiji Ozawa Hall, this time amusing and somewhat theatrical, but it also delves into the subject of concert hall acoustics in general. It includes a discussion of the varying demands of 20th century concerts ("from Bach to Gorecki") and also discusses Leo Beranek's new book on concert hall acoustics.



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