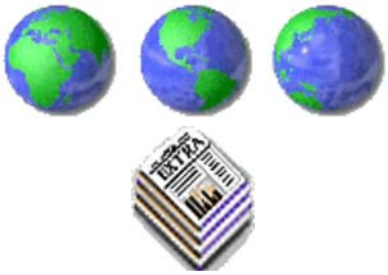
# Acoustical Society of America
# 145th Meeting Press Release



---

## EXPLORING SONOFUSION, DIFFERENT KINDS OF PERFECT PITCH, AND THE SOUND OF TOUCH AT UPCOMING ACOUSTICS MEETING

FOR IMMEDIATE RELEASE

Melville, New York, March 31, 2003

Is it really possible for sound to initiate fusion-energy reactions in a tank of liquid? Are there different kinds of "perfect pitch" in music? How does the air-filled sack in certain fish improve their hearing ability?

These and other questions will be addressed at the 145th Meeting of the Acoustical Society of America, to be held from April 28-May 2, 2003 at the Nashville Convention Center in Nashville, Tennessee. Over 600 papers will be presented. The ASA is the largest scientific organization in the United States devoted to acoustics, with over 7000 members worldwide.

## WORLD WIDE PRESS ROOM

We encourage you to visit ASA's "World Wide Press Room" (located at http://www.acoustics.org/press) before and during the meeting. By the week of April 21, the site will contain lay-language versions of selected meeting papers.

## PROGRAM HIGHLIGHTS

Here are some highlights from among the many papers being given at the meeting. Full abstracts of the papers mentioned below can be viewed by typing in the last name of the author or the appropriate paper code at the ASA Meeting Abstracts database: http://asa.aip.org/asasearch.html

. The first number of the paper code indicates the day of the talk, with "1" denoting the Monday of the meeting,"2" denoting Tuesday, and so on, up to "5" for Friday.



## ACOUSTICS FOR AIDING SOLDIERS AND EMERGENCY WORKERS

Michael Scanlon of the US Army Research Laboratory (mscanlon@arl.army.mil) will discuss a novel gel-based acoustic sensor that can monitor the health and performance of emergency workers (such as firefighters) and soldiers while they are performing their missions. Attached to the body, the gel sensor picks up sound waves corresponding to heartbeat, breathing rate, motion and voice. Using signal-processing techniques, it collects information on these vital signs. At the same time, the gel blocks out airborne noises which can obscure measurements of these body activities. The data from this device can be transmitted to remote locations for health assessment (Paper 3aBB6; see also http://www.acoustics.org/press/144th/Scanlon.htm) Nearly 50% of all combat-related deaths result from uncontrolled bleeding. A similar percentage accounts for civilian deaths due to trauma. Larry Crum of the University of Washington (lac@apl.washington.edu) will discuss progress in acoustic hemostasis, the use of ultrasound to stop internal bleeding. Acoustic hemostasis has shown promise in laboratory tests. While such an approach needs much further development, Crum and colleagues are working towards a portable ultrasound device that could be used to detect and stop internal bleeding at the scene of an accident (4aBB1).

## HELPING AVERAGE SINGERS SOUND BETTER

Help is on the way for aspiring vocalists who wish to sound like the winning contestants on "American Idol." Matthew Lee (mattlee@ece.gatech.edu) of Georgia Tech and Mark J.T. Smith of Purdue (mjts@purdue.edu) will present a system for digitally improving the perceived quality of an average singing voice. Their system precisely modifies vocal properties that can be termed the "spectral" or "formant" characteristics of the voice. Roughly speaking, these modifications adjust a singer's "resonances" which initially reflect the shape and size of the vocal tract. Using their technique, the researchers promise demonstrations of enhanced country singing (3aMU7). In other work, Eric J. Hunter and Ingo Titze of the University of Iowa (eric-hunter@uiowa.edu) have found that professional vocalists appear to sing in some parts of the audio spectrum to which listeners are most sensitive (3aMU8).

## SMART DEVICE REDUCES COMMUNITY NOISE

While traffic noise is perhaps the most pervasive type of community noise, much residential-noise annoyance now comes from amplified sound at entertainment facilities, such as amphitheaters, dance clubs, and theme parks. Many communities set limits on how much noise can emerge from these facilities and other sources of noise. However, constantly changing sound levels inside an entertainment facility make it difficult to control the level of noise that it broadcasts to the outside world. Now, there is a novel system for controlling the level of sound that travels out of a business establishment. The system will be presented by Richard Peppin of Scantek, Inc. (PeppinR@ScantekInc.com) in Columbia, Maryland and Joan Casamajo of DICESVA in Spain. When a community noise limit is exceeded due to the amplified sound inside the facility, the system automatically reduces the sound output at the source by a specific amount to reach desired sound levels at the property line. If the sound level in the facility is so loud that it cannot be reduced to meet the limit, the volume is turned off (temporarily or permanently). The paper provides details of the design and examples of possible noise abatement scenarios. (3aNSb5)

## VIBRO-ACOUSTOGRAPHY: THE SOUND OF TISSUE

For at least 2000 years, physicians have diagnosed patients through palpation, the medical examination of tissue through the use of touch. To this day, palpation allows surgeons to find lesions that even advanced imaging techniques can miss. However, the results remain limited and highly subjective. Researchers have aimed to develop techniques that measure tissue's mechanical stiffness, as this can provide a more quantitative, objective version of the information obtained through palpation. James Greenleaf at the Mayo Clinic in Rochester, MN will discuss a technique called vibro-acoustography that uses ultrasound to provide both images of tissue and information on its stiffness. In the technique, ultrasound radiation pressure on a small region of tissue generates sound vibrations that yield information on the elastic characteristics of the tissue. Vibro-acoustography can potentially detect microcalcification within breasts, and promises to provide high-quality images of calcification within the arteries. It can detect mechanical defects in prostheses such as artificial mitral and aortic valves. In addition, the method can potentially be used in nondestructive evaluation of objects such as aircraft, for example, to test for structural weakness in aging airplane parts. Xiaoming Zhang, also at the Mayo Clinic, will present studies on the use of vibro-elastography in arterial tissue (Papers 3aBB2, 3aBB8, 3aBB9; for more information, contact Sara Lee, lee.sara@mayo.edu)

## THE SOUNDS OF COUNTRY MUSIC

Many papers at the meeting reflect the meeting's location in Nashville, the home of the Grand Ole Opry and a world center of country music. Robert Stone, an otolaryngologist recently retired from Vanderbilt University, will describe the acoustic and aerodynamic differences between Country-Western singing styles and normal speech (3aMU6). Ingo Titze of the University of Iowa (ingo-titze@dcpa.org) will present a voice simulator that re-creates adjustments in the lower vocal tract to mimic such vocal qualities as twang (3aMU4). Steve Haas (shaas@jhacoustics.com) of Jaffe Holden Acoustics in Connecticut will discuss the acoustical design of the Country Music Hall of Fame and Museum in Nashville. The newest major music museum to open in the United States, it uses the latest in acoustical technology to provide high sound quality and sound control. Haas will present some of the unique approaches and technologies that were first implemented in this facility. (5aAA3)

## EVIDENCE FOR DISTINCT TYPES OF PERFECT PITCH

Many famous musicians, such as Mozart and Beethoven, have possessed a talent called "perfect pitch." Traditionally, this has been defined as the ability to recognize or produce a musical note without first hearing a tone with known pitch. This ability is remarkable and uncommon. Whether perfect pitch is learned early in life or inherited has been a matter of great controversy. Historically, it has been difficult to address this question because conventional tests (such as note naming) have all required subjects to possess some amount of musical training. David Ross of the Yale School of Medicine (david.a.ross@yale.edu) and colleagues have developed a new paradigm for identifying people with "perfect pitch" that is independent of their musical ability. With it, they demonstrate that musical training is not required for the development of this skill. Further, they have proposed that individuals with "perfect pitch" may be divided more accurately into two distinct groups: (1) possessors of true absolute pitch (AP), who automatically recognize the pitch of any tone they hear; and (2) possessors of heightened tonal memory (HTM), who identify tones by comparing them to a "memory map" of musical tones. According to this model, the ability of people with HTM (but not AP) to identify tones should depend strongly on the physical properties of the tones. Ross and colleagues conducted a series of experiments designed to test this hypothesis directly. Individuals claiming to have "perfect pitch" were recruited and initially classified as having AP or HTM. Consistent with this model, the two groups differed significantly in their responses to various types of tones, suggesting that they may use different mechanisms to identify tones. These results may help reconcile the long-standing controversy between early learning and genetic theories of perfect pitch. (4aPPb4)

## A "WATER HAMMER" POWERS UP SONOLUMINESCENCE

Exciting advances continue in the realm of sonoluminescence (SL), the conversion of sound into light. In the SL process, a sound wave enters a liquid tank, and produces bubbles that collapse and release ultrashort flashes of light. In a new experiment, Seth Putterman and his coworkers at UCLA have succeeded in "upscaling" sonoluminescence, so that SL can now produce light flashes with peak powers about a hundred times higher than previously possible. To accomplish this, the researchers employed a novel "water hammer" technique for generating SL. In ordinary plumbing, a water hammer can occur when the flow of water suddenly slows, generating a shock wave and a temporary vacuum that together violently shake the plumbing. In the SL version of the water hammer, researchers shake a 20-inch-long, 1.5 inch diameter cylindrical tube with a force of 2 g's. Filled with water and a small amount of xenon gas, the tube shakes so that water in each half of the tube travels in an opposite direction and temporarily creates a centimeter-high vacuum in the center. As the vacuum closes, it launches a large shock wave that generates sonoluminescence in the water, producing an output of approximately 300 million photons (about a hundred times larger than earlier SL experiments) that add up to a peak power of about half a watt. The larger photon output, Putterman says, makes it possible to perform more and improved measurements of the hard-to-understand SL phenomenon. (1pBB5)

## SONO(CON)FUSION: EVALUATING THE CHANCES AND CLAIMS OF BUBBLE FUSION

A wide range of speakers will be on hand during a unique, day-long symposium exploring the possibility of "sonofusion," the use of sound to trigger energy-producing nuclear fusion reactions. Researchers have long wondered if sound aimed at a liquid tank could create hot bubbles that collapse with so much pressure as to fuse atomic nuclei inside the imploding bubble. Although critics have questioned initial experimental results in sonofusion, even some conservative experts believe that sound-induced nuclear fusion remains in the realm of possibility. At the symposium, Rusi Taleyarkhan of Oak Ridge will provide an update and clarification of the initial experiment

which reported evidence on sonofusion (2pPA4). In their experiment, published last year in Science, a tank of deuterated acetone was exposed to sound waves and injected with neutrons in efforts to seed violently collapsing bubbles. However, a separate Oak Ridge group (Dan Shapira and Mike Saltmarsh), who will also speak at the symposium, worked carefully to replicate the experiment but failed to find any evidence for nuclear fusion (2pPA5). Other topics at the symposium include: a sophisticated sonofusion detector, which can record neutron arrival and a sonoluminescence flash within a nanosecond of one another (Carlos Camara, UCLA, 2aPA2); an analysis of the physics conditions necessary for achieving sonofusion (Lawrence Forsley, JWK Intl. Corp., 2pPA2); an inventory of the chemical yields and energy dissipation during the collapse of a hot liquid bubble (Yuri Didenko, U-Illinois, 2aPA4); investigations by a company that aims to produce energy through sonofusion (Felipe Gaitan, Impulse Devices, 2aPA3); the adaptation of therapeutic ultrasound techniques to produce hot bubbles for sonofusion experiments (Tom Matula, U. Washington, 2aPA5); first detection of high-energy UV (<<200 nm) light from the sonoluminescence spectrum (Robert August, NRL, 2pPA4). Panel discussions follow the morning and afternoon sessions. With speakers ranging from critics to proponents, the discussions are expected to be lively. (Sessions 2aPA and 2pPA; for more information on this symposium, please contact co-chair Tom Matula, matula@apl.washington.edu.)

## ACOUSTIC DETECTION OF COLLAPSED LUNG

Researchers will present investigations of non-invasive, acoustic methods for detecting pneumothorax ("collapsed lung"). In this condition, air builds up around the lungs, exerts pressure, and causes a lung to collapse (lose air). Pneumothorax thereby makes it difficult to breathe properly and supply the body with the oxygen it needs. Currently physicians diagnose this life-threatening condition by taking x-rays or CAT scans of the chest. However, Hansen A. Mansy (hmansy@rush.edu) of Rush Medical College and colleagues tested several different acoustic methods for detecting this condition. In their investigations, they measured and analyzed three different kinds of sounds to diagnose pneumothorax: simple breath sounds alone; externally introduced broadband sounds; and sounds generated by chest percussion (from gentle "tapping" on the chest wall). The presence of pneumothorax influenced the sounds measured in all three techniques, suggesting that acoustic techniques may be useful in diagnosing collapsed lung. (3aBB5)

## SWIMBLADDERS MAY ENHANCE HEARING IN SCHOOLS OF FISH

The swimbladder, a gas-filled chamber in the abdominal cavity of most bony fishes, is an organ that enables fish to maintain neutral buoyancy in water. However, it also responds to incoming sound. In response to acoustic pressure, the swimbladder radiates an acoustic field that enhances the ability of the fish's inner ear to detect sounds. When exposed to just the right pitch of sound, the swimbladder resonates at a specific frequency. According to recent experiments, the response of a swimbladder to a specific resonance frequency may control the hearing range of at least four species of fish. In addition, researchers have suggested that fish can further enhance their hearing ability by traveling in groups. When multiple fish are present, their swimbladders radiate multiple acoustic waves, which scatter amongst the group. According to recent analysis, this scattering effect may create an effective resonance over a broader range of frequencies. In paper 3aAO3, Mardi Hastings of the Office of Naval Research (Mardi_Hastings@onr.navy.mil) suggests the resonant scattered field created by relatively large schools of juvenile fish may enhance their auditory capability. On a superficial level, this effect is analogous to how bikers in the Tour de France reduce their wind resistance (and thereby pedal more easily) by traveling in a group.

## ACOUSTICS OF THE BANJO

The American five-string banjo is a unique musical instrument, according to researchers Joe Dickey of Johns Hopkins (dickey@jhu.edu) and Ray Wakeland of Penn State. No other instrument, they argue, permits players to make so many easy adjustments that affect musical tone. This explains why so many banjo players tinker with their banjo. As the researchers point out, the instrument is a combination of vibrating systems--plucked strings and a circular, drum-like membrane. Dickey and Wakeland will present a theoretical and experimental study of the banjo. They analyze how certain parameters, such as the tension of the membrane and the mass of the bridge, affect such banjo qualities as loudness, brightness, and the rate at which its sound decays. Their results demonstrate an agreement between the calculated effects of these parameters and the longstanding setup practices among banjo players--showing a convergence between the science and the art of this instrument (4pSA3)

## LISTENING TO NATURE'S ORCHESTRA WITH PECULIAR EARS

The hearing organs of many insect species have highly unusual designs. Scientists remain puzzled as to how some of these designs endow insects with their remarkable hearing capabilities. For example, tachinid flies can determine the direction of a nearby sound. Yet the fly's two ears are fused together--and located under the chin. David Yager of the University of Maryland (dy5@umail.umd.edu) will explore several examples of peculiar insect ears--and discuss how each of these hearing systems may work. (4aAB6)

## VIBRATIONAL COMMUNICATION IN TREEHOPPERS

As biologists are increasingly discovering, some species communicate through vibration rather than sound. Reginald Cocroft of the University of Missouri-Columbia (cocroftr@missouri.edu) and his colleagues have studied certain species of treehoppers, plant-feeding insects that communicate by sending vibrational signals through the stems of their host plant. Cocroft will discuss unique features of vibrational communication on plant stems. He will also discuss changes in vibrational signaling that occurred when certain treehopper species shifted to different kinds of host plants. When these changes in vibrational communication emerged, Cocroft suggests, they could have contributed to the divergence of treehoppers into various species. (4aAB5)

## ACOUSTICAL INSIGHTS ON THE CO-EVOLUTION OF SEALS

Acoustics can give biologists important clues on how closely related species have evolved together. Studying various kinds of seals around Antarctica, Jeanette Thomas, a professor at Western Illinois University (J-Thomas@wiu.edu) has found that underwater vocalizations in the seal species differ by mating system. Species of polygynous seals, males that mate with more than one female in the breeding season, produce up to 35 different calls in their repertoire. Solitary seals, those that live mostly in isolation, produce 10 kinds of calls. Curiously, monogamous species produce only a single type of call, resulting in what Thomas terms "the vocal monotony of monogamy." Moreover, the various kinds of seals use different frequency ranges, vocalization rhythms, and loudness changes to convey their species-specific calls. With the seals sharing the same general ecosystem, the species have apparently used acoustics to carve their own biological niches. (4aAB8)

## VIRTUAL AM STEREO AND SURROUND SOUND

Most listeners associate AM radio with dull, low-quality sound. But some acoustical engineers have grand plans for this much overlooked band. Selvakumaran Vadivelmurugan of Anna University in India (vselvakumaran@vselvakumaran.com) and colleagues propose a method for adding stereo and virtual surround sound to AM radio. They point out that AM radio has many advantages, such as low bandwidth, simpler circuitry, and the ability to transmit longer distances. While AM stereo has existed for some time, the researchers plan to take things a step further, with "AM surround sound" that incorporates multiple speakers such as those in a movie theater. To create virtual surround sound, they plan to make the most efficient use possible of an AM signal. This involves both psychoacoustic strategies-such as discarding the frequency ranges in the signal that humans can't hear very well-and technological ones, such as new signal-processing strategies at both the transmitting and receiving ends. The result, according to Vadivelmurugan, may enable "AM radio theaters" in the home. (2aAA13)

## REPORTER'S REPLY FORM

Please return the REPLY FORM if you are interested in attending the meeting or receiving additional information.

**REPORTER'S REPLY FORM**

 Return to 145th Meeting Archive  Return to ASA World Wide Press Room