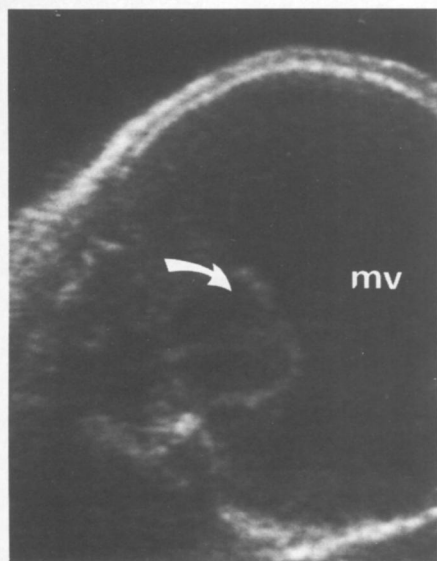


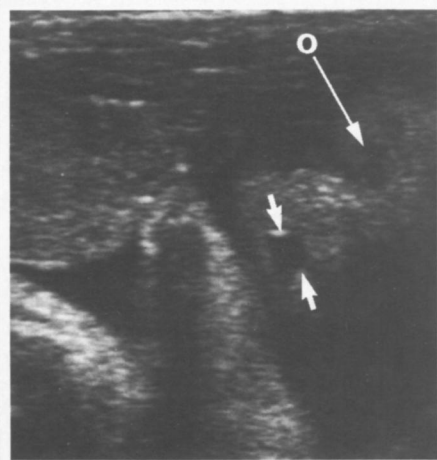
How Safe Is a Sonogram?

Prenatal ultrasound appears hazard-free, although some concerns persist

By KATHY A. FACKELMANN



The top sonogram shows a fetus with a serious congenital defect in which part of the brain fails to divide into hemispheres or lobes. The fetus in the bottom sonogram has a cleft lip.



Using a device about the size of a flashlight, a technician in a white coat slowly scans a pregnant woman's abdomen. On the monitor next to the bed, an image of the fetus appears on the screen. It's a girl!

Obstetricians estimate that more than half of all pregnant women in the United States receive an ultrasound test, a painless procedure that uses sound waves to reveal characteristics of a fetus. Ultrasound can be used to spot birth defects and other problems or simply to provide Mom and Dad with a glimpse of their baby-to-be.

Ultrasound works by transmitting high-frequency sound waves through body tissue. Those sound waves, inaudible to the human ear, bounce off the fetus and the mother's internal organs. The echo is translated into an image, called a sonogram, which can be displayed on a television-like monitor. There, parents may watch their unborn child yawn, suck a tiny thumb or simply float in the amniotic fluid.

Despite the procedure's popularity, scientific confirmation of its safety remains sketchy. Although many obstetricians recommend sonograms for all pregnant women, some advise against that gung-ho approach, contending that there is reason to approach this powerful imaging technology with caution.

Physicists know, for example, that extremely high-frequency sound waves can generate enough heat to destroy fragile body cells. Indeed, ophthalmologists use ultrasound to destroy certain cells in the eye when treating glaucoma.

Ultrasound scanners used during pregnancy rely on much lower-frequency sound waves, and studies conducted so far suggest the procedure is completely safe. However, there is a theoretical possibility that birth defects might result when fragile embryonic tissue is bombarded with sound waves. Even if no obvious, ultrasound-linked malformations appear, some researchers fear that fetuses ex-

posed to ultrasound might suffer subtle neurological damage, a problem that can surface years later as a learning disability.

Now, two separate studies bolster the view that ultrasound is safe. A Cincinnati research team reports finding no hazard of birth defects in baby rats exposed to ultrasound in the womb. And in a study of humans, a Norwegian team has found no link between *in utero* ultrasound exposure and the development of learning disabilities later in life.

No connection between ultrasound exposure and birth defects has ever been demonstrated in humans. Yet animal studies on this subject have yielded mixed results. Some investigators have documented a rise in malformations, while others have found no link between ultrasound exposure and birth defects. This ambiguity has led to the uneasy feeling that more research needs to be done to prove ultrasound's safety.

Animal studies provide clues to ultrasound's effect on tissues, but they can also pose some logistical challenges. For example, how do you get a rat to hold still while zapping it with ultrasonic waves?

In the past, scientists often anesthetized pregnant rats in order to conduct experimental ultrasound tests. But this raised the question of whether it was the ultrasound or the anesthesia that caused any birth defects observed in the rats' offspring. Furthermore, anesthesia causes a drop in body temperature, explains neurotoxicologist Charles V. Vorhees of the University of Cincinnati. If ultrasound harms tissue by generating heat, then the anesthesia might have prevented injuries from the sound waves, he notes.

To resolve the lingering doubts about birth defects, Vorhees and his colleagues designed a study that relies on a group of very relaxed rats.

They began their experiment by placing 45 rats in black acrylic tanks of water in a series of training sessions. At first, the rats tried to escape by climbing the slippery tank walls. But after a few days they learned that the strategy was futile. Soon, the rats discovered that they could stay afloat by propping their feet against the side of the tank.

Once the rats had learned to remain calm and were pregnant, the team began the ultrasound test. On the fourth through the 19th day of pregnancy, the researchers placed 11 control rats in the tank of water for 15 minutes every day. The remaining 34 rats also floated in the water for 15 minutes daily, but they were exposed to sound waves at varying levels of intensity.

On the 20th day of pregnancy, the rats were killed and the fetuses removed. The team discovered no increase in incidence of fetal malformation and no decrease in

Sonograms: Ruth B. Goldstein/Amer. Inst. of Ultrasound in Med.

fetal body weight among the ultrasound-exposed animals, regardless of the ultrasound dose received. They present their findings in the December 1991 *TERATOLOGY*.

"It's an interesting study," comments Carole A. Kimmel, a teratologist at the Environmental Protection Agency in Washington, D.C. The new data add to previous evidence suggesting there is no link between birth defects and ultrasound exposure. Kimmel's own work, which involved anesthetized mice, also showed no risk of birth defects after ultrasound exposure.

Such work eases one fear. There remains the worry of many scientists that sound waves might have the potential to cause subtle brain damage in the fetus. That concern dates to a 1984 study indicating a possible link between prenatal ultrasound exposure and dyslexia, a type of learning disability in which children have difficulty reading.

Obstetricians generally order a sonogram between the 16th and 22nd week of pregnancy, a very important period in fetal brain development. During this time, fetal nerve cells travel to their final destinations in the brain. If a sonogram somehow disrupts that journey, could learning problems result?

A study led by Kjell Salvesen of the University of Trondheim, Norway, appears to provide a reassuring answer to that question.

Salvesen's team recruited 2,011 pregnant women attending obstetric clinics in central Norway between 1979 and 1981. Physicians gave half the group sonograms during the 16th to 22nd week of pregnancy. The remaining half, for the most part, did not receive an ultrasound test during pregnancy. (A few women in the control group got a sonogram if they experienced problems during pregnancy, such as bleeding.)

Eight to nine years later, the Norwegian scientists sent questionnaires to the women in the study, asking about their children's health. With parental consent, the researchers then contacted the teachers of all the children, asking them to assess each child's achievement in reading, spelling and arithmetic, and to give an overall score on school performance. The teachers did not know the children's ultrasound status.

In the Jan. 11 *LANCET*, Salvesen and his co-workers report that they found no differences in school performance between the two groups. If anything, the ultrasound-exposed kids did slightly better in school than the control group.

Because a teacher's assessment of a child's performance can be biased, the team also selected 603 of the kids for a special test designed to diagnose dyslexia. Trained examiners tested the children for intelligence, reading compre-

hension, reading speed and spelling. Kids whose reading ability fell far below their predicted skills, based on intelligence, were diagnosed as dyslexic.

Again, the team found no significant differences between the ultrasound-exposed youngsters and the controls. Test results classified 21 of the 309 ultrasound children (7 percent) and 26 of the 294 controls (9 percent) as dyslexic.

While that study seems to dissolve the dyslexia link, Salvesen is not ready to extend blanket approval to ultrasound during pregnancy.

"I will not say that ultrasound is [completely] safe, because there could be other [problems] that we didn't examine in these children," Salvesen told *SCIENCE NEWS*.

In addition, he notes that the ultrasound machines used in his study are now becoming obsolete, with many hospitals relying on higher-energy devices that produce sharper images. "The technology is rapidly developing, and these safety studies will always come 10 years after the devices have been taken into general use," he says.

No one can say with certainty that the higher-energy ultrasonic devices cannot harm a fetus, says Vorhees. Heat isn't the only way in which ultrasound might theoretically damage tissues, he adds. Sound waves may cause microscopic bubbles in body fluids to oscillate and sometimes collapse, Vorhees says. Scientists don't know whether such problems can injure the fetus.

The scientific uncertainty over ultrasound led the Food and Drug Administration to advise against sonograms during pregnancy unless there is a problem such as bleeding, a family history of birth defects, or some other medical reason for the procedure, including advanced maternal age. FDA specifically warns against using ultrasound "frivolously" — simply to watch the baby float in the womb or to learn the baby's sex.

FDA's recommendation follows the lead of a National Institutes of Health panel convened in 1984, which concluded that pregnant women should obtain an ultrasound test only when medically necessary (SN: 2/18/84, p.102).

This runs counter to the trend among obstetricians, who are ordering more and more sonograms. Most believe that ultrasound can provide valuable information, even in low-risk, problem-free pregnancies, and they say they are satisfied that the studies conducted so far have established the technology's safety.

"I don't have any concerns whatsoever," says Anthony R. Scialli, an obstetrician and reproductive toxicologist at Georgetown University in Washington, D.C. "I think most obstetricians share my opinion."

Scialli believes routine use of ultrasound during pregnancy would benefit many women, especially those with un-

diagnosed problems. If cost were no barrier, he says, he would recommend a sonogram during the first six to eight weeks of pregnancy and again at 18 weeks. Each ultrasound procedure costs \$250 to \$350. Insurers pay for the test in high-risk pregnancies or if a problem develops but generally don't pay for routine procedures used as preventive measures, Scialli says.

An ultrasound test during the first trimester can accurately date a pregnancy, he adds. Although most women can trace their pregnancy back to a missed menstrual period, sometimes bleeding will occur after the egg is fertilized. If the obstetrician relies on the menstrual history, the due date may be wrong, Scialli notes.

An early sonogram can also identify ectopic pregnancy, a dangerous condition that occurs when the fertilized egg begins to develop outside the uterus. Many women with an ectopic pregnancy don't realize they have this condition until complications develop. Because the tissue outside the uterus cannot sustain an embryo, the pregnancy cannot proceed normally. With an early diagnosis via ultrasound, doctors can remove the embryo immediately, lessening the mother's risk of severe bleeding and other problems, Scialli says.

"We've all seen instances where ultrasound has been invaluable," he adds. □

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belt or closer to the poles, at least in the beginning.

Getting away from the populated mid-latitudes would also keep the kites out of the major air traffic corridors, thereby circumventing another major restriction. Researchers cannot simply float a kite high in the atmosphere anywhere they wish: In the United States, Federal Aviation Administration regulations prohibit flying kites that weigh more than 5 pounds above modest altitudes.

Balsley says these restrictions need not ground the kites entirely in populated regions. Meteorologists may be able to apply for special permits, something Balsley did when his group test flew the parafoils on Hawaii's big island. "This doesn't seem to be an insurmountable problem," says Balsley.

For now, funding presents the biggest hurdle. The Christmas Island crew is awaiting NSF's reaction to their \$1.4 million proposal for building and testing several of the larger, high-altitude kites over a four-year period. Taylor says the answer should come within the next few months.

In an era of increasingly complex and problem-prone aviation technology, perhaps funding officials will find some appeal in reviving one of meteorology's simpler tools. □