Millimeter waves sound out cancer

A trio of techniques are being joined to augment the reliability and clarity of conventional ultrasound diagnostics. Initial results indicate they could ultimately match X-ray mammography for resolving soft-tissue (noncalcified) breast cancers in older women — even exceed mammography's ability to identify fibrous cancers in young women. A report of the research by Paul Carson, Charles Meyer, Ann Scherzinger and Thomas Oughton at the University of Colorado Health Science Center appears in the Dec. 4 SCIENCE.

As a woman gets older, the density of her breast tissue decreases and the tissue becomes more fatty. Early studies of X-ray mammography showed the technique to be potentially harmful and only marginally useful for imaging tumors in young, dense breasts. As a result, the National Cancer Institute recommends that except in extremely high-risk women, routine mammography be restricted to those at least 50 years of age.

However, while the risk of developing breast cancer increases with age, in rare instances women as young as 20 develop it. And it was ultrasound's potential for screening these younger women safely that first spotlighted attention on its possible role in cancer detection. Inherently a lower-resolution process than X-ray mammography, "ultrasound is sensitive to variations in soft tissue," Carson points out, "more so, probably, than mammography." For some young breasts, ultrasound would probably surpass mammography's ability to identify cancerous growths, Carson told SCIENCE NEWS, adding "but that has not yet been proven consistently and statistically."

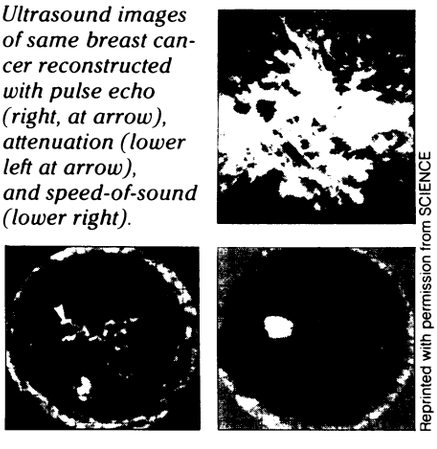
Conventional ultrasound listens to echoes reflected back from tissues. What Carson's team did was link two "through transmission" techniques — known as attenuation and speed-of-sound — to conventional pulse-echo ultrasound. As their name implies, through-transmission techniques create images from signals actually passing through the body. This restricts their use to "where you can get a transducer on both sides of the breast," Carson explains. "Ribs distort the sound beam too much, so only pendulous parts are imaged, but that's the majority of the breast in most patients."

The attenuation technique compares how much of the signal exits each line beamed through the breast against an identical signal passed through pure water. Computed-tomography reconstruction programs then create an image based on the attenuation per unit length at each point in the breast. "It's exactly analogous to X-ray CAT scanning," explains Carson, who along with Meyer, is now at the University of Michigan.

The speed-of-sound technique measures how long it takes sound to travel through the breast along a beam line. Carson says, "We do that for all the lines, all directions, to reconstruct an image of how long it took the sound to travel, per centimeter, at each point in the breast." These data relate to tissue density and hardness. Both through-transmission techniques were pioneered by the Mayo Institute in Rochester, Minn., Carson says.

So far, ultrasound imaging is slow. But Carson thinks it possible to "get up to one or two seconds per image or per slice — even doing all three techniques. The real question is whether ultrasound is something that will ultimately stand on its own or just complement mammography." One might consider "doing X-rays every five years and ultrasound in between," Carson suggests, "but even that's premature."

—J. Raloff



Ultrasound images of same breast cancer reconstructed with pulse echo (right, at arrow), attenuation (lower left at arrow), and speed-of-sound (lower right).

Heart drug approved

The U. S. Food and Drug Administration, which has long been accused of being too sluggish in the approval of new drugs, is making a decided effort to mend its ways. On Nov. 16 it approved a hepatitis B vaccine, the first new viral vaccine okayed by FDA in a decade (SN: 11/21/81, p. 327). And last week it gave the green light to a drug that can prevent second heart attacks.

The drug, timolol (trade name Blocadren), was approved on the basis of a Norwegian study reported earlier this year (SN: 4/11/81, p. 230). The study found that timolol could reduce second heart attacks and deaths related to second heart attacks by about 30 percent. According to FDA Commissioner Arthur Hull Hayes Jr., it is unusual for the FDA to base drug approval on a foreign clinical trial, but it considered the Norwegian one especially sound.

About 350,000 Americans are expected to be candidates for timolol. Without treatment some 50,000 of them would die of heart disease within two years. "Even if [timolol] can do half as well in practice as was done in the controlled Norwegian study," Hayes estimates, "we may save 7,000 to 10,000 Americans a year." □

Capturing a scrapie virus

Scientists have long tried to determine the chemistry of so-called "slow viruses," yet have failed because these agents are so small. Now, at last, they may have succeeded, at least as far as one slow virus, the scrapie agent, is concerned. It appears to be protein, without a nucleic acid core. This contrasts with conventional viruses, which are nucleic acids surrounded by protein coats, and with plant viroids, which are much smaller than viruses and cores of RNA without protein coats.

In 1978 University of Wisconsin researchers reported that the scrapie agent was probably a core of DNA without a protein coat (SN: 10/7/78, p. 245), causing a flurry of interest in the scientific community. However, neither these investigators nor others have been able to confirm that finding. Meanwhile, Stanley B. Prusiner and colleagues of the University of California at San Francisco have exposed highly purified scrapie agents to enzymes that inactivate DNA, RNA or proteins and have found that while enzymes that inactivate nucleic acids had no effect on the agents' infectivity, the enzymes that inactivate proteins almost completely destroyed it. Prusiner and his team also determined that a chemical that modifies amino acids in proteins destroyed the infectivity of purified scrapie agents. These findings, they write in the November PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, argue that the agent's infectivity is due to protein, not to nucleic acid, which is the case with plant viroids. And because they have not been able to find nucleic acid within the agents, the agents may possibly be composed solely of protein, which in turn could be coded by genetic material in the host cell.

In the opinion of Theodor O. Diener of the U.S. Department of Agriculture and the discoverer of plant viroids (SN: 2/12/72, p. 102), these results are "very intriguing," especially as they complement some of his own recent findings on viroids. While Prusiner and his co-workers have found that enzymes that inactivate proteins destroy the infectivity of the scrapie agent and that enzymes that inactivate the nucleic acids do not, he and his colleagues have found just the opposite. What's more, Diener and his colleagues have found, but have not yet published, that while the scrapie agent is not affected by zinc, viroids are rapidly inactivated by it, providing still further evidence that the scrapie agent and viroids are chemically distinct. However, Diener admits that all these results have destroyed the hypothesis that he put forth 10 years ago after he discovered viroids — that the scrapie agent would turn out to be like them because it is of a similarly low molecular weight.

—J. A. Treichel