AAAS

From our reporters in Toronto at the annual meeting of the American Association for the Advancement of Science

Ultrasound viewing of the breast

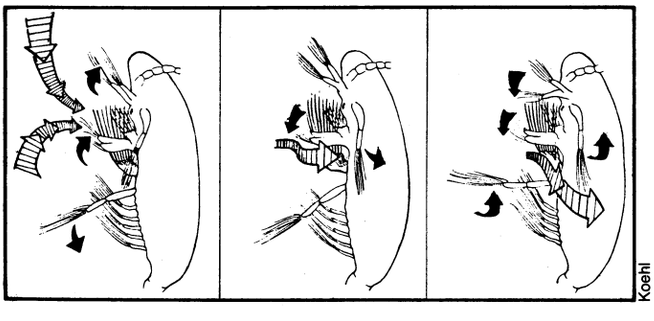
Early detection of breast cancer requires identification of lesions less than 5 millimeters in size, but the X-ray techniques that achieve such resolution are under fire because of possible damage from radiation. Ultrasound, a medical tool patterned after the sonar technique used to detect objects under water, depicts breast lesions as dark spots on a gray background, but the devices now available are not as good as X-rays for detecting fine details. Scientists from the Ontario Cancer Institute, however, report two new systems that may improve dramatically the resolution of the ultrasound technique.

In one of the novel methods, an ultrasound source concentrates its beam on a small spot, producing good resolution for the zone near the focal point. By electronically changing the focal length, a composite can be made from several sharply focused images. John W. Hunt reports that this technique can pick up smaller lesions with better resolution than the current "pulse-echo" system. "It looks like this is going to work," he says.

The other new system takes advantage of the focusing properties of conical beams that converge to a line of focused ultrasound. Structures near the line of focus emit secondary ultrasound waves that can be detected by a receiver in a system devised by Stuart Foster. A tomographic image is generated by moving the transmitter and receiver as a unit, so that the line focus scans a plane. In a mastectomy sample, the technique has resolution better than 1 millimeter. Hunt says, "It's quite amazing what it does." Averaging several scans taken across the sample 0.5 millimeters apart gives "an image with excellent grayscale and exceptional resolution," Hunt and Foster conclude. "Because of the great improvement of the image quality using these new ultrasound devices, we believe that these have considerable potential in breast scanning and [in scanning] many other accessible organs in the body."

Active eating in a syrupy sea

Textbooks say that the tiny floating crustaceans called calanoid copepods passively filter their diet of even smaller algae and protozoa from the surrounding water. Now, high-speed movies show that the 1-millimeter-long animals actively capture their meals. They flap their feeding appendages and fling and close their mouthparts to trap small parcels of water that contain food particles, reports Mimi A.R. Koehl of the University of California at Berkeley. They propel water (striped arrows in diagram below) with appendage movements (solid arrows). Koehl points out that because of the small size of the copepod, the physical forces it confronts are quite different from those affecting a larger organism moving through water. Viscous forces are far more important to the small crustacean than are inertial ones. "In the viscous world of a copepod," Koehl explains, "water flow is laminar, bristly appendages behave as solid paddles rather than open rakes, particles can neither be scooped up or left behind because appendages have thick layers of water stuck to them, and water and particle movement stops immediately when an animal stops beating its appendages." Koehl says copepod eating habits are of particular ecological significance because these abundant crustaceans play a major role in the transfer of energy along marine food chains.



Koehl

More to (and in) primary memory

The brain has been underrated in its ability to "keep in mind" information, according to Robert A. Bjork of the University of California at Los Angeles. Primary memory, a term approximately equivalent to "short-term" memory, has been viewed as a limited repository in which a few items of current importance can be maintained briefly in a highly accessible form. All items in this temporary storage have been considered to be equally accessible and equally susceptible to loss. Recent results of experiments by Bjork contradict this traditional view and indicate an unexpectedly extensive capacity for primary memory.

The length of a string of words, letters or numbers that a person can repeat is the standard measure of primary memory. And most people can recall about seven items. Bjork became suspicious that as subjects are reporting the first part of the list, they are forgetting the later items. He calls this loss output interference.

In recent experiments Bjork showed subjects three groups of four characters—digits, letters or symbols. Then he asked them either to report the members of just one group or to recall the members of all three groups. He found that on the average 10 items were available to those reporting just one group, but only eight were available to those asked to give all three groups. In further tests Bjork discovered that the order in which subjects were asked to report the groups of characters strongly influenced the extent of recall. Reporting first the set learned last allowed the greatest recall; reporting first the set learned first allowed the least recall. "To get optimal output," Bjork suggests, "recall the easy things first."

In another set of experiments, subjects were asked to repeat two lists—one made up of common, easily pronounced words and the other of obscure, difficult-to-pronounce words. Bjork finds that recalling the easy words before the difficult ones allows the greatest total recall. "Items in primary memory are not all-or-none in that they differ in terms of how difficult they are to retrieve and in terms of how susceptible they are to output interference," Bjork concludes. He predicts that taking into account output interference and variable accessibility will show that one can keep in mind more material than had been thought.

Mens sana in corpore sano

A sound mind in a sound body—we've all heard it and now research is proving it. Abdel Wahab El-Naggar of the University of Hellwan in Cairo, Egypt, says, "Serial processing, those mental processes primarily associated with the left hemisphere of the brain, improve significantly in middle-aged men after a moderate physical fitness program." He bases this conclusion on research he conducted at Purdue University. For the study, 48 men, average age 42 years, were divided into two groups. Half the men exercised about 1½ hours a day three days a week for four months. The other half were sedentary types who did not exercise regularly. Ten tests, 5 that assess right and 5 that measure left hemisphere functioning, were administered before and after the physical fitness program. "Results," El-Naggar says, "indicate that serial processing was enhanced with improvement in physical fitness levels." Right hemisphere functioning, he suspects, will improve with a more intensive program.