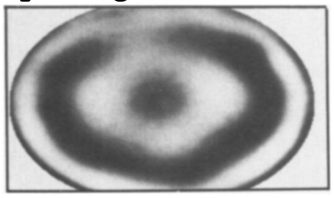
Technique zaps and maps lungs, heart



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ACT cross section of lungs (black curve) and heart (center).

No two parts of the body conduct electricity in exactly the same way. Researchers have now taken advantage of those differences to create an inexpensive imaging technique called adaptive current tomography (ACT). In ACT, the image's color or contrast varies with the tissue's resistance to electrical current.

Developed by mathematicians, engineers and biologists at Rensselaer Polytechnic Institute in Troy, N.Y., this technology relies on mathematical magic. A complex algorithm derives each image from data gathered by 32 electrodes placed in a circle around a patient's chest, says biomedical engineer Jonathan C. Newell, who coordinates the project.

Each electrode sends and receives tiny currents to and from all the other electrodes. Rather than travel straight across the body to opposite electrodes, says Newell, a current will follow the path of least resistance — snaking around bone, for instance. All these currents emitted from the electrodes create a complex array of data, he says.

For imaging, the computer program first uses the voltages picked up by each electrode to calculate the resistance of the adjoining tissue, Newell explains. It then skips over the outermost layer of tissue and reconstructs the resistance of the next layer, repeating the procedure until it has mapped the whole cross section.

Though lacking fine resolution, the blurry images may still prove useful. "We expect [ACT] can be used for monitoring for water in the lungs," says Newell. This potentially dangerous buildup, called pulmonary edema, often escapes early detection. However, even a little water will alter the resistance of the lungs enough for ACT to sense a problem, says Newell. This fall, he plans to have physicians evaluate this potential application in people who have undergone surgery.

A tissue's resistance decreases 2 percent for every Celsius degree of increase in its temperature, so the new technique may be useful as a remote thermometer in certain cancer treatments, Newell adds.

Modern alchemy makes diamonds with CFCs

By reworking a 2-year-old technology for making diamond films, Texas chemists have come up with a way to destroy chlorofluorocarbons (CFCs) and possibly make money at the same time.

Laws prohibiting the use of Freon and other CFCs will take effect during the next few years, leaving many companies with lots of useless CFCs. Current disposal techniques involve burning CFCs, but that process leads to acidic vapors and carbon dioxide, a greenhouse gas, says John L. Margrave, a chemist at the Houston Advanced Research Center in The Woodlands, Texas.

Margrave and his colleagues propose to use CFCs to stabilize the conversion of methane to carbon in their patented process for chemical vapor deposition of diamond films on substrates at relatively low temperatures. In June, the researchers announced that they had demonstrated the economic feasibility of this process, which causes the chlorine in a CFC to link up with methane's hydrogen, promoting diamond formation. The rest of the CFC becomes a sellable solvent, says Margrave.