Diagnosing cancer with radioantibodies

The notion of exploiting the body's immune system to treat cancer has been around for a few years now. And it has scored some coups. For instance, a vaccine that primes a cancer patient's immunity against cancer has saved some lives, and transfer factor, a chemical extracted from immune cells and injected into cancer patients, has helped some cancer patients overcome cancer. Efforts to use immunity as a diagnosis for cancer are also starting to bear fruit.

For instance, Chicago scientists recently devised an immune test for certain antigens prevalent in breast tumors and found that it can diagnose breast cancer in women (SN: 3/25/78, p. 180). And now Lexington, Ky., investigators report still another promising method — using radioactively labeled antibodies to diagnose various kinds of tumors — in the June 22 NEW ENGLAND JOURNAL OF MEDICINE.

The research that first made such a diagnostic tack possible was the discovery in the 1960s of a protein that seemed to be specific to the surface of cancers of the gastrointestinal tract. It was named the carcinoembryonic antigen (CEA). CEA has since been found not to be restricted to the gastrointestinal tract, nor, in fact, always to be specific for cancer. However, more CEA does appear to be present in tumors than in normal tissues. So David M. Goldenberg and his colleagues at the University of Kentucky College of Medicine at Lexington asked whether CEA might serve as a target for radioactively labeled antibodies specific to it, and thus alert physicians to the presence of tumors containing lots of CEA. They conducted a scientific study to find out.

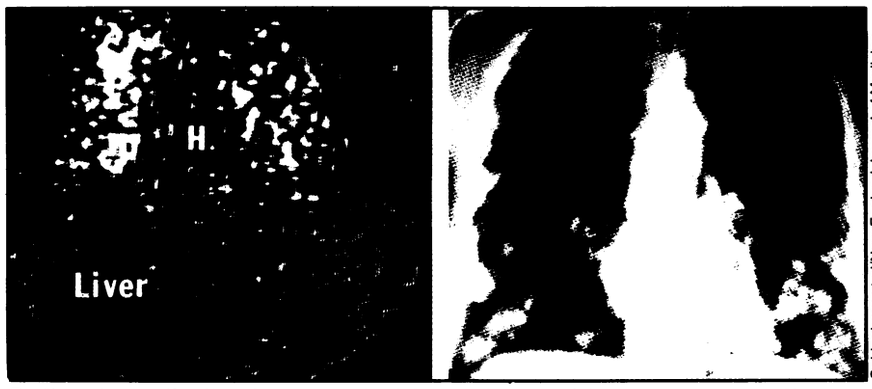
First, they made antibodies to the CEA antigen, purified them and labeled them with radioactive material. The researchers then injected the antibodies into 18 patients known to have diverse kinds of tumors. The patients' bodies were then exposed to a gamma scintillation camera, which was capable of imaging the radioactive antibodies in whatever area of the patients' bodies they settled.

The body scans revealed the antibodies honing in on select tissue sites in the patients, and all the sites had been shown by other diagnostic means to be the location of tumors. For instance, antibodies could be seen to aggregate over both the lungs of one patient, and X-ray diagnosis of the lungs of this patient indicated that a spreading tumor was present in this location (see illustration). What's more, the scans indicated evidence of tumors in four patients that had not been diagnosed by other means, but that were later confirmed by operation or autopsy. Thus the antibody imaging technique seems capable of diagnosing tumors.

Nonetheless, the technique is not foolproof. In one patient, for instance, spreading brain cancer documented with a computerized tomography scan was not seen on the radioantibodyscan, possibly because the radioantibody could not pass through the blood-brain barrier, a network of blood vessels in the brain that selectively keep certain chemicals out of the brain. Then there was one patient in whom neither a primary nor a secondary tumor could be identified by antibodies; this patient had a lymphocytic lymphoma, a tumor type known to be devoid of CEA.

Still another drawback of the technique: Tumor blood flow may aid antibody deposition in the tumors, but it may also hinder discernible tumor imaging because of increased blood-pool background radioactivity. However, CEA circulating in the blood of patients does not seem to affect radiolocalization of CEA-bearing tumors.

On the whole, Goldenberg and his colleagues contend, the technique looks promising in the detection of tumors and might well prove a useful adjunct to other cancer diagnostic techniques now available. They also believe that the technique should become even more valuable as antigens more specific to tumors than CEA is are identified. Then, radioactively labeled antibodies to these antigens could be used instead of labeled antibodies to CEA, providing even more accurate diagnosis of tumors than CEA antibodies provide. □



Goldenberg et al/New England Journal of Medicine

Radioactive antibodies cluster over both lungs of patient (l.) suggesting cancer. X-rays of the patient's lungs (r.) indicate that the lungs are cancerous.

OTA backs growth of "onsite" solar

It reads like a hard-headed battle plan for the rise of "small is beautiful" solar. Cost comparisons. Equipment 10 to 15 years from now. Economics of growth. Federal policy for promotion and regulation. Legal problems. Integration with conventional utilities. Impact on foreign policy. And it doesn't stop there. The 525-page report, recently presented to Congress by the U.S. Office of Technology Assessment, makes a prediction as well, saying that small-scale solar equipment could compete with conventional energy utilities by the mid 1980s. All it takes, the report notes, is "aggressive federal support."

Congress asked OTA for the report in the belief that federal solar energy planners had ignored small, "onsite" equipment in favor of centralized generating systems. Onsite equipment is mounted on or near the building it serves. Although some generate electricity, many of these systems use the sun's thermal energy for direct hot water and space heating or for industrial process heating, air conditioning and refrigeration.

The report starts with performance comparisons of onsite solar equipment in Albuquerque, Boston, Ft. Worth and Omaha. The sites show wide climatic variation. But more important, they show a range of conventional fuel costs, which vary even more than the available sunlight. In each area, computer simulations were made for a single family dwelling, a 196-unit high-rise apartment, a shopping mall, a whole residential community and a variety of industries.

Sweeping generalizations are rare and give way in most places to detailed charts, tables and graphs. However, while testifying about the report before the Senate's Energy R&D subcommittee, Russell W. Peterson, director of OTA, said that if the whole "life cycle" and not just the initial cost of the system is taken into account, solar heat and hot water can already compete with electric utilities in many parts of the country. With federal support, he said, solar heat and hot water could also vie with oil and gas by the mid 1980s. Solar heat will not be able to compete with the direct combustion of coal before the end of the century. But solar electric systems could produce electricity at 4 to 10 cents per kilowatt hour by the late 1980s — and thus compete with centrally generated electricity. These predictions do not assume "breakthroughs" in research.

"Our analysis has indicated," Peterson said, "that by the end of the next decade, the range of costs which can be plausibly forecast for energy from onsite solar energy equipment will overlap the range of costs which can be forecast for nonsolar systems in energy markets representing

nearly 40 percent of present U.S. energy demands."

Estimates of future solar energy production are numerous and often contradictory (SN: 4/22/78, p. 243). What makes the OTA report unique is that it also grapples with major conflicts that must be ironed out before solar can spread. For example, solar equipment can use onsite storage for backup during the night or cloudy days — but it is usually cheaper to rely on conventional gas or electric backup. The report therefore digs into how more and more people going solar will affect utility rates. Another example: It is usually more efficient for an onsite electric-generating device to sell excess electricity to an electric utility, even at reduced rates, than to store it in batteries. The report not only points out that such sales are now prohibited in most areas, but it goes on to grapple with the web of problems that will arise when onsite producers start pumping power into a utility's grid.

Not just a nuts and bolts evaluation, the report also ranges into the means of making solar stick. "The primary barrier to the widespread use of onsite solar energy is not technology but economics," said Peterson during the Senate hearing. He noted that tax credits and research support are often given to utility-owned facilities. Federal policies, moreover, maintain low oil and gas prices, and thus discriminate against onsite solar equipment. Solar is growing. But to make a significant contribution to U.S. energy supplies before the year 2000, Peterson said that federal energy administrators should:

- Stimulate markets for onsite solar energy by allowing energy prices to rise to the cost of energy from new production facilities.
- Give tax credits, loan subsidies or other incentives for both consumers and manufacturers of solar devices.
- Resolve legal and regulatory barriers, particularly in utility law and in the area of "sun rights."
- Encourage international cooperation in solar research and demonstrations, especially in countries where solar energy may be commercially attractive before it enters U.S. markets.
- Ensure that adequate standards and testing facilities are available for solar energy equipment.

The OTA report noted that onsite solar "runs against the trend toward centralization which has characterized the energy industry over the past four decades." Whether or not the report will become a well-thumbed text for the "small is beautiful" crowd remains to be seen. Yet one positive response has already come from Senator Frank Church (D-Idaho), chairman of the Energy R&D subcommittee, who said that the report should become "required reading" for college-level energy courses. □

Fingerprints revealed in the laboratory

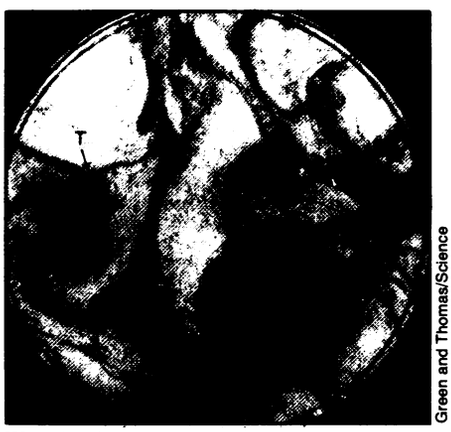
Elementary, my dear Watson. Those prints weren't made by fingers, but by foreskin cells grown in laboratory culture.

Patterns of arches, loops and whorls resembling features of human finger ridges can appear in a laboratory-produced layer of skin cells, Howard Green and Judith Thomas report in the June 23 SCIENCE. The patterns reflect intrinsic skin cell properties that may help to explain how human fingerprints develop during embryonic growth.

Green suggests that the movement of embryonic skin cells winds the digital ridges into their characteristic swirls. Because the ridges are curved when they are first seen in embryos, researchers previously assumed the ridges emerge already in their definitive pattern.

Ridges of skin cells can form by different processes. In the embryo the ridges peak over epidermal folds, where the proliferation of skin cells is greater than in the surrounding area. Laboratory ridges arise when two masses of cells growing on a plate collide. But the forces generating curvatures of the ridges in culture should also be acting on embryonic fingers, the Massachusetts Institute of Technology researchers say.

Complex ridge patterns are characteristic only of the palms and soles of primates.



Green and Thomas/Science

Whorls of ridges make cultures of human skin cells resemble fingerprints.

Yet in laboratory culture, the patterns are produced by skin cells from different locations and by related cells. All the cells observed to make whorl patterns in culture, or in primates, are keratinocytes. The investigators suggest that the pads underlying primate palms and soles permit skin cells freer movement than elsewhere on the body, a freedom also found in cells in culture.

If movement is crucial, cells burdened with the mass of an extra chromosome should be hindered in pattern formation, Green suggests. Other investigators have reported fingerprints of diminished complexity among people with extra, genetically inactive X and Y chromosomes. The slight difference in male and female fingerprint complexity may result from the extra bulk of the second X chromosome (compared to the smaller Y).

Besides uncovering factors that contribute to the molding of individual dermatoglyphs, Green hopes studies of skin cells in culture will provide clues to greater mysteries of control of cell movement and of local influences on development. □

The born-again spleen

Beyond the expression, "Venting your spleen on someone," the spleen is a lesser-known body part indeed. But it does some important things for the human body. It is a large organ of the lymphatic system located near the stomach that functions as a blood reservoir, blood and lymph filter and as a source of antibodies. It is the chief organ involved in the destruction of worn-out blood cells.

Now an intriguing ability of the spleen has been discovered — the ability to regenerate after it has been virtually destroyed, and at a site different from its original one. True, the liver and small intestine can also regenerate if mostly destroyed, but only at their home sites in the body.

Specifically, Howard A. Pearson and his pediatrics-surgery team at Yale University School of Medicine report in the June 22 NEW ENGLAND JOURNAL OF MEDICINE that 13 out of 22 children who had emergency splenectomies because of trauma to their spleens gave evidence of forming new spleens one to eight years later, despite the prevailing opinion that spleen rejuvenation is rare. And the new spleens seemed to form, not at their original locations, but by sending a few spleen cells remaining after surgery to the small intestine. The cells then used blood circulation from the small intestine to get established and to replicate themselves, eventually forming a new spleen. □

Press goes to Peking

A 14-member delegation of government scientists, headed by Frank Press, President Carter's science advisor, will fly to the People's Republic of China for four days of talks from July 6 to 10. Stress will be on areas of interest to the Chinese, such as agriculture, energy and medical research. This is the first time that China has agreed to government-to-government talks on science and technology. The heads of the National Aeronautics and Space Administration, the National Science Foundation, and the National Institutes of Health will also go. □