

MEDICINE ■ Vaccines enlist the body's own defenses to fight certain hard-to-treat tumors

A shot in the arm for cancer therapy

■ Almost two centuries after vaccination first triumphed over infectious organisms that invade the body from outside, the same preventive strategy is being harnessed against the invader from within—cancer.

Paradoxically, it is the cancerous tissue itself that is providing the raw material for these new vaccines. In tests now under way in several laboratories, vaccination with an extract of tumor cells removed during surgery appears to dramatically boost a patient's ability to fight off a recurrence of the disease.

If preliminary results are borne out, cancer vaccines could provide a much needed line of attack against some of the most intractable forms of the disease as well as a desirable alternative to conventional radiation and chemotherapies, which often have serious side effects. In the longest running trial, Dr. Ariel Hollinshead of George Washington University reported that 75 percent of early-stage lung-cancer patients who received the vaccine after surgery were alive five years later—compared with only 33 percent of patients who had surgery alone.

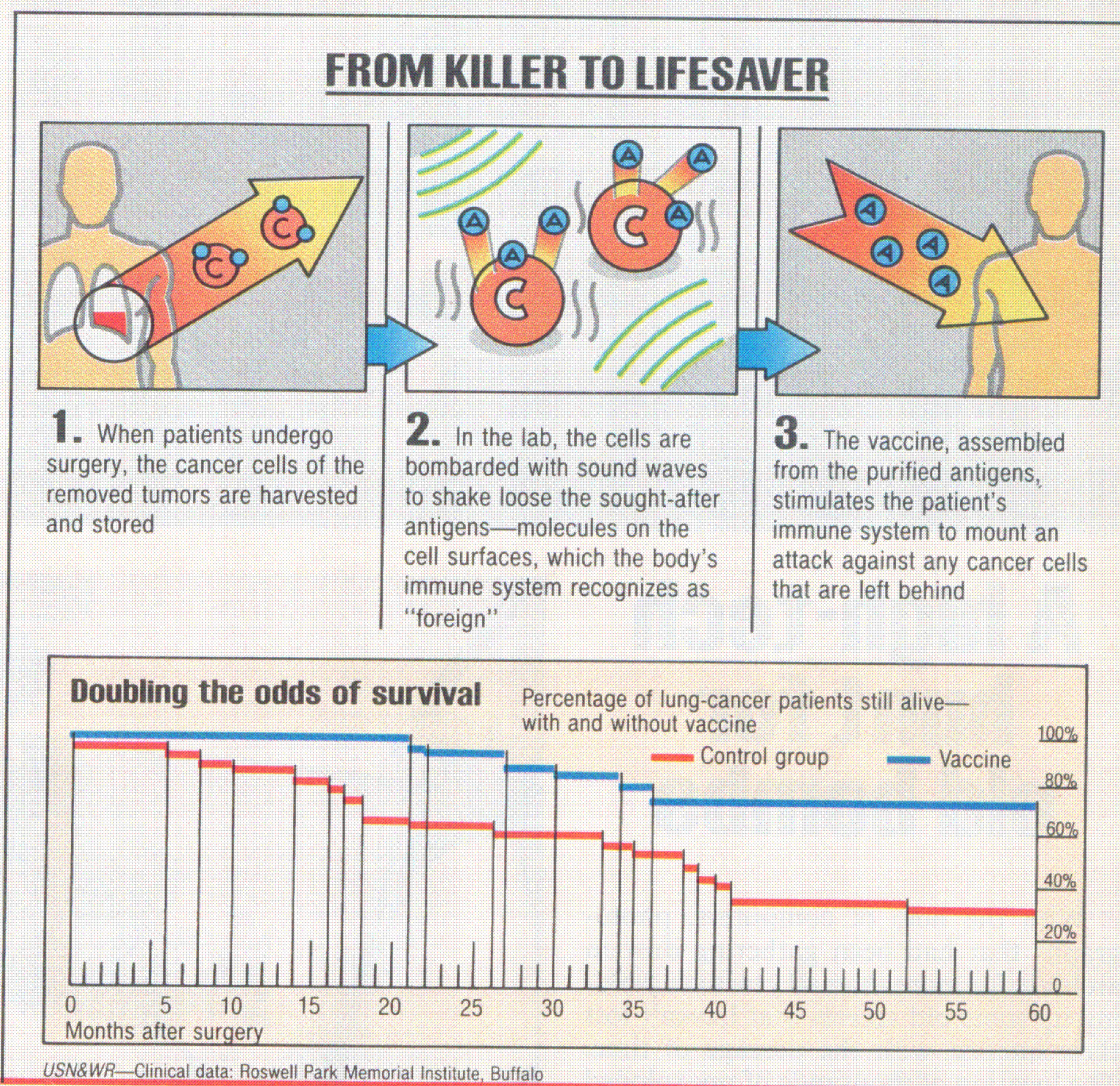
Vaccines against colon cancer and melanoma—the deadliest form of skin cancer—have increased long-term survival by 30 percent or more in a small number of patients now being studied. Human tests are just beginning for vaccines against leukemia and cancers of the ovaries, bladder and pancreas.

Priming the immune system

The theoretical plus of a vaccine is that it works with the body's own disease-fighting mechanisms. "I believe healthy people get cancer all the time," says Hollinshead. "Only their immune systems wipe out the tumor cells before there are any symptoms." While chemotherapy and radiation have been crucial in improving survival rates for many cancer patients, they have disadvantages: Besides causing side effects like nausea and hair loss, their toxicity actually tends to depress the immune system.

A vaccine, by contrast, primes the immune system to this task. When the body is exposed to a foreign invader, its natural response is to manufacture antibodies or other immune agents that seek out and neutralize the invader. A vaccine is thus made from a derivative of the foreign body that it's designed to fight—a killed or weakened polio virus, for example, is used in polio vaccines.

Because tumor cells form from ordinary cells within the body, however, the immune system has a difficult time rec-



ognizing them as foreign—and so the immune response is often weak. But careful study has revealed that cancer cells do exhibit minute differences in some of the chemical identity tags, called antigens, that are carried on the cell surface. In concentrated form, these tumor antigens will usually elicit a strong immune response and are now being exploited in vaccines.

Some research groups are making the vaccines out of antigens harvested from the patient's own tumor cells. Better results have been obtained by pooling many different patients' tumor antigens. "As a tumor grows," explains Hollinshead, "new antigens may emerge on its surface, so it makes sense to inoculate the patient with as broad an array of tumor antigens as possible."

A \$100 million business

The therapy typically costs \$5,000 per patient, though the price may fall once methods of mass-producing the vaccines are developed. A number of labs are working on techniques for growing the tumor cells in laboratory cultures, which could provide a continuous supply of the antigens. Some 30 biotechnology compa-

nies have jumped into this area, and with good reason: The U.S. market could reach \$100 million per year by the mid-1990s, according to biotech analyst Peter Drake of Vector Securities International in Chicago. Hollinshead has already applied for a patent on her vaccine.

Still, as much as a decade of testing remains to be done before vaccines could be generally available. "Right now, immunization holds out the most promise for cancers that have not spread to other parts of the body," says Frank Rauscher, vice president for research at the American Cancer Society. "That's the case in about 30 percent of cancers across the board. But if more researchers can corroborate the work, the vaccines might be tested to see if they could prevent cancer altogether."

Hollinshead is already eyeing the possibility of vaccinating high-risk groups, such as asbestos workers who smoke cigarettes—prime candidates for lung cancer. "When they come to me worried about a dry cough," she says, "that's when I'd like to pull out my vaccine." ■

by Kathleen McAuliffe