the surviving cancer cells struggle to reassert themselves against the body. Killing a competitor means more resources for the nascent tumor, he says.

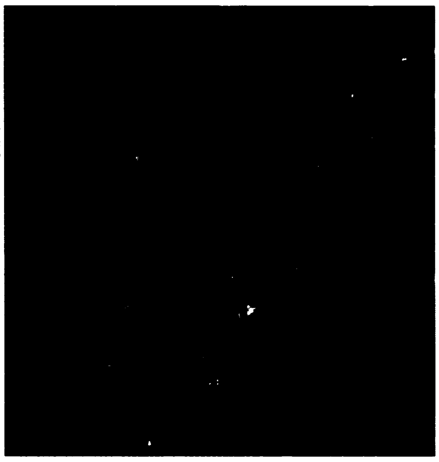
Cancers may kill T cells by using molecules other than FasL, suggests Claude D. Gimmi of the Dana Farber Cancer Institute in Boston. Her research team found that some lines of breast cancer cells were patrolled by an unusually small number of T cells. Mammary glands normally express small amounts of an antigen called Death Factor-3 (DF3)/MUC1, which causes apoptosis in activated T cells. Perhaps, the scientists reasoned, the breast cancer cells overexpressed that molecule.

To test their hypothesis, Gimmi and her colleagues removed DF3/MUC1 from tumor cells in the test tube and watched T cells proliferate rapidly amidst the disarmed cancer. Then, they compared lymphocyte proliferation in three lines of breast cancer cells that don't carry the death factor molecule to one that does. T cell apoptosis occurred only in the tumor cells armed with the DF3/MUC1, they report in the December 1996 NATURE MEDICINE.

"It wouldn't surprise me if we find other, as-yet-undiscovered mechanisms that will be kind of startling," says Dan L. Longo of the National Institute on Aging in Baltimore. "But, in retrospect, we'll say it makes sense. The tumor is trying to adapt to a hostile environment."

In Longo's view, tumors evade the immune system by using a combination of methods to avoid or disarm T cells. Complicating the search for a cancer cure, it's likely that no two malignancies employ the same mix of methods, even within the same type of cancer. Future therapies may hinge on discerning each growth's distinct weapons and disarming the rogue cells case by case.

Whatever means healthy cells use to dampen the immune response are probably taken up by tumors and pressed into


Galle/NATURE MEDICINE

In studies of liver cancers, stained apoptotic T cells (blue) float lifelessly amid FasL-expressing tumor cells (green). Normal liver cells are colored red.

expanded service, says Longo. "If there's a gene in the repertoire, cancer will find a way to use it."

The message of these findings is that the conventional picture of a hypervigilant immune system is "dead wrong," according to Drew Pardoll of Johns Hopkins University in Baltimore. He argues that many healthy cells manipulate lymphocytes to keep T cells from latching onto their surfaces and destroying them.

"There's a tendency to focus on just one mechanism du jour," says Pardoll. He predicts that researchers will find tumors employing up to 10 stratagems to dodge the immune response. Discovering and cataloging every one offers the best hope of eventually giving physicians the upper hand in the battle against cancer.

If tumors avoid the immune system by failing to produce Fas, Tschopp argues, an effective therapy might be to force the cancer cells to produce that surface molecule. In cases where malignancies have FasL on their surfaces, injected antibodies might lock onto the molecule, gumming it up before it can wreak havoc. "Now we know the means to fight back," Tschopp says.

Other researchers also see medical promise in unearthing cancer's evasive tactics. "Actually, I'm very excited," says Pardoll. "We can now really study what's going on in tumors and intervene at a molecular level." □

Physics

Peeking inside an electron's screen

Standard references and textbooks describe an electron as a stable elementary particle. Typically, they specify values for its mass, electric charge, and spin, and they sometimes mention vaguely that an electron's charge appears concentrated in a point. However, there's both more and less to an electron than such a bare-bones description indicates.

According to modern quantum theory, the space surrounding an electron is not empty but filled with a boiling sea of so-called virtual particles, which continually blink into existence in oppositely charged pairs, then almost immediately disappear again. Since the 1930s, theorists have proposed that these virtual particles cloak the electron, in effect reducing the charge and electromagnetic force observed at a distance.

By forcing electrons and positrons (the oppositely charged, antimatter counterparts of electrons) to collide head-on at sufficiently high energies, researchers have now penetrated the virtual-particle screen and made the first measurements confirming that an electron's electromagnetic influence increases as the distance from the particle's central core decreases.

"As we probe the cloud, getting closer and closer to the core charge, we see less of the shielding effect and more of the core," says David S. Koltick of Purdue University in West Lafayette, Ind. "This means that the electromagnetic force from the electron as a whole is not constant but rather gets stronger as we go through the cloud and get closer to the core."

Koltick and his coworkers report their findings in the Jan. 20 PHYSICAL REVIEW LETTERS.

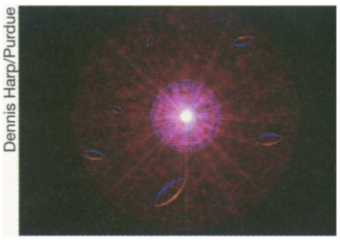
The experiment was performed by members of the TOPAZ detector group at the TRISTAN particle accelerator of the National Laboratory for High Energy Physics in Tsukuba, Japan. The accelerator was operated at an energy of 57.77 gigaelectronvolts to enable them to penetrate the screen without creating other particles.

From their data, the researchers obtained a value of the fine structure constant, a number that characterizes the inherent strength of the electromagnetic force. As expected theoretically, the newly obtained value of 1/128.5 is significantly larger than the 1/137 observed for a fully screened electron.

"Ours is a clean measurement of the electromagnetic effect," Koltick says. In higher-energy experiments at other accelerators, the effect is swamped by additional factors, including the strong force, which holds neutrons and protons together in an atomic nucleus and binds quarks into protons and neutrons. Those factors make it difficult to distinguish the relative contributions of the nuclear and electromagnetic forces.

"The observed properties of an electron derive from an interplay between the particle and the vacuum," Koltick notes. "We have to go much deeper to learn more about the 'bare' electron."

Pulling aside the virtual-particle curtain opens up new possibilities for revealing the naked truth about electrons. —*I.P.*


Dennis Harp/Purdue

Artist's visualization of an electron as a central core (bright spot) surrounded by a cloud of virtual particles, which appear and disappear in pairs—one particle positively charged (blue) and the other negatively charged (yellow). Faint white lines radiating from the electron core represent its electric field.