Biomedicine

Joanne Silberner reports from the Interscience Conference on Antimicrobial Agents and Chemotherapy in Minneapolis.

Cold-fighting cells

The immune system has two ways of dealing with foreign invaders — with a generalized response, called cellular immunity, and a more specific response that involves antibodies. Susan C. Kiley and her colleagues at the Food and Drug Administration in Bethesda, Md., and George Washington University in Washington, D.C., are studying the action of cytotoxic T lymphocytes, cellular immune responders that attack foreign or infected cells. They have found a genetic factor in the ability of the cellular immune system to fight flu viruses.

They added T lymphocytes from 51 people to influenza-A infected cells. Cell types were defined by their HLA genes, a set of genes coding for proteins involved in cell recognition. There was a correlation between genetic subtype and disease-fighting ability — cells bearing HLA-DR4 genes were better able to kill infected cells, and HLA-DR7 cells were less able, than the rest of the subtypes tested. "The cells of some people seem to be more reactive in response to infection by viruses than others," says Kiley. "We speculate that means they're more protective, but that would have to be followed up in future studies."

Herpes babies

Cesarean sections are not a blanket herpes preventive for babies born to mothers with active genital herpes, according to a study by the Centers for Disease Control in Atlanta.

Katherine M. Stone and her colleagues collected data on U.S. babies born with herpes from October 1983 through March 1985. Ten of 190 babies reported to the Atlanta-based agency had gotten the disease, which has a two year survival rate of about 60 percent, despite having been delivered by cesarean section to keep the baby from encountering the virus in the birth canal.

Cesarean sections can and do prevent most cases of neonatal herpes, Stone says, but adds, "The important thing is that there are other modes of transmission." Possibilities include the virus crossing the placenta or getting into the amniotic fluid, or a person with a cold sore kissing the baby, she says.

Hepatitis B vaccine: Onward and upward

There already is a blood-derived vaccine against hepatitis B, but that doesn't mean there isn't room for improvement. An experimental, yeast-engineered recombinant DNA vaccine has recently proven successful in adults and infants (SN: 7/27/85, p. 55), and now researchers are reporting good results with a recombinant vaccine manufactured by a mammalian cell line. An estimated 800,000 or more people in the United States and 200 million people worldwide are carriers of the hepatitis B virus, which can cause chronic liver disease and liver cancer.

The currently marketed vaccine is produced from the blood of infected people. While the safety of the product has been proven, the source — hepatitis B carriers — could eventually disappear. "If vaccine prevention works," says Martin Rosenberg of Smith Kline & French Laboratories in Philadelphia, who chaired a session on recombinant vaccines at the meeting, "there will be no future source of the vaccine."

John M. Zahradnik and his colleagues at Baylor College of Medicine in Houston and Georgetown University in Washington, D.C., vaccinated 20 healthy men with a mammalian recombinant vaccine and 20 men with the currently marketed vaccine. Within four weeks, 70 percent of recombinant vaccinations "took," compared with only 25 percent in the other group; eventually 95 percent of the men in both groups were protected.

"Our vaccine seems to be more immunogenic [than the current vaccine] and that may be important in the long run," says Zahradnik. Another advantage: The U.S. Department of Health and Human Services projects that the price of the recombinant vaccine will be less than that of the one now in use.

Science & Society

From our reporter at the National Institute of Medicine's symposium on the Medical Implications of Nuclear War, in Washington, D.C.

New estimates of radiation lethality . . .

A preliminary analysis of data from a new survey of acute deaths among Japanese residents who had lived within 1,300 meters of the atomic-bomb hypocenter in Hiroshima suggests that the radiation dose required to kill 50 percent of those exposed — the LD-50 — may be four times lower than previously thought. "My thesis is that the deaths that occurred after the first day were nearly all due to radiation exposure," as opposed to the explosion itself or its resulting heat, explains Joseph Rotblat, of the University of London, in England. He used data collected by two Japanese teams of researchers. The data list when individuals died, how far they were from ground zero at the time of the blast and the nature of any building materials that might have provided shielding from radiation.

Half of the acute deaths — those between 1 and 60 days after the blast — occurred within a distance of 892 meters from the point on the earth's surface that was directly below the blast. Rotblat computed radiation doses likely throughout this region for the various types and quantities of radiation that are estimated to have been emitted by the bomb. (These figures were based on preliminary calculations suggested at a U.S.-Japan joint workshop on atomic-bomb dosimetry earlier this year.) His calculations result in an LD-50 for human bone marrow of 154 rads — or one-quarter of the 600-rad bone-marrow dose that he reports "is being used in estimates of radiation casualties in a nuclear war." Rotblat says the 600-rad figure had been derived partly from animal data and partly from data on the few human radiation-accident victims (many of whom had received medical treatment); it was not derived from data on Japanese bomb victims, he points out — largely "because of the alleged difficulty in separating [their] radiation mortality from that caused by blast or heat."

. . . and potential deaths from superfires

U.S. government estimates of urban-fire casualties that might be triggered by the detonation of a 1 megaton (MT) nuclear bomb have been based on the assumption that the casualty rate for any given peak shock wave pressure, or "overpressure," would be similar to that experienced in Nagasaki and Hiroshima. But research by Theodore Postol, a senior analyst at Stanford University's Center for International Security and Arms Control, calls that assumption into question. His calculations indicate that the 15 million deaths this scaling rule suggests might result from 100 1-MT bombs dropped on cities would underestimate — by a factor of two to four — the likely fire deaths.

The thermal energy delivered to regions experiencing similar peak overpressures varies with bomb yield. For example, the 5 pounds per square inch (psi) overpressure zone for a 1-MT bomb would likely experience at least 3.5 times more heat than the 5-psi overpressure zone associated with the 0.15-MT Hiroshima bomb. The zone in which blast-initiated fires develop also scales up with bomb yield. For example, Postol's data indicate that the fire-zone radius associated with a 1-MT blast could be eight miles, and that the 5-psi overpressure zone might be as far as three miles inside this fire zone's perimeter. If true, that might give blast survivors only 10 to 30 minutes (or less) to escape before small fires coalesced into a giant "superfire" — with gale force winds circulating poisonous combustion gases and with ground-level temperatures above the boiling point of water. This prospect does not support the earlier speculation that even 30 percent might escape the 5-psi zone relatively unharmed or that only about 30 percent would die outright.

Finally, Postol's data indicate that cities don't have to be as dense — and hence, fuel-rich — as Dresden during the 1940s to support a superfire. The higher winds that would accompany the 1-MT bomb's larger fire zones might be able to whip up even a lightly built-up, burning city into a firestorm, he says.