SDI: Paper pile grows on APS study

The American Physical Society (APS) recently added another stack of papers to the growing pile of opinions on the Strategic Defense Initiative (SDI) when it sent letters to 39 U.S. legislators defending its study on the feasibility of directed-energy weapons.

Included in the letters was a technical summary countering criticisms of the results and methodology of the APS study. The study, led by 15 physicists nationwide (SN: 5/2/87, p.276), first received criticism directly following its release in April for being outdated and failing to include kinetic-energy weapons, which the administration had decided to use after the report was written.

More recent criticisms, however, have focused on specific details in the April study, which concluded it will be at least a decade before enough progress can be made in science and technology to reach an informed decision on the feasibility of directed-energy weapons. Directed-energy weapons are beam devices, such as lasers, designed to intercept and destroy incoming missiles by beaming energy into them (SN: 2/15/86, p.106). Kinetic-energy weapons destroy an object by actually intercepting it with another projectile, such as a missile.

SDI proponents Lowell Wood of the Lawrence Livermore (Calif.) National Laboratory and Gregory Canavan of the Los Alamos (N.M.) National Laboratory recently presented their criticisms of the study to the House Republican Research Committee. Primarily, they take APS to task for its predictions of energy requirements for certain proposed weapons and for its estimates of the feasibility of countermeasures available to the Soviets. The documents also fault the APS study committee for not following proper review procedures.

Some of the major technical criticisms of the APS study:

• *Chemical lasers:* This type of laser produces a steady stream of reacting gases when two types of gases are mixed. Wood and Canavan charge that the summary of the APS study states chemical lasers have only been tested at about 200,000 watts and need to reach 20 million watts to be effective, while the body of the report cites that the lasers have been tested in the multimillion-watt level. APS admits to the inconsistency, blaming it on a clerical error stemming from security requirements that regulated and then changed which power levels could be published. APS plans to correct the error before the study is run in the July supplement edition of its journal, REVIEWS OF MODERN PHYSICS.

• *Excimer lasers:* This short-wavelength laser uses chemical reactions to deliver energy in intense pulses. Wood and Canavan say APS estimates that place a billion-watt power requirement on this laser for effectiveness are wrong and that when the report's own formulas are used, the figure decreases to 6 million watts. APS says the billion-watt estimate is for excimer lasers in a continuous-wave state and not for pulsed-laser operation. Calculating power levels for a pulsed laser, APS estimates that a 1-pulse-per-second laser would need 100 million watts, which still is 16 times greater than the 6 million watt estimate arrived at by Wood and Canavan. The remaining discrepancy exists, APS says, from varying target-spot size estimates. Explaining why the two groups would differ so much in their estimates, Nicolaas Bloembergen, co-chairman of the APS study, says, "There is never any disagreement of what equations to use; it is just a disagreement on what numbers to put in."

• *Neutral-particle beam:* Designed to penetrate deep into a missile or warhead, this weapon works by generating a beam of fast-moving atoms. The APS report is criticized on this point for saying the beam needs 1 billion watts of power to be effective, while Wood and Canavan estimate that only 30 million watts are needed. APS says its study was referring to a certain particle-beam accelerator, such as the space-based electron-beam accelerator, and not the power needed for the neutral-particle beam. APS says it will rework that section for clarity.

• *Free-electron lasers:* Known as FELs, these convert energy from accelerated electrons into laser radiation. The APS report says FELs will need 1 billion watts to be effective, while Wood and Canavan assert that they need only 10 million watts operating at 40 percent efficiency. APS argues that no such efficiency has been proven.

Frederick Seitz of the Science and Engineering Committee for a Secure World, a pro-SDI group based in Washington, D.C., that circulated about 100 copies of the Wood and Canavan report to legislators and others, says APS committee members "really haven't responded to the Wood and Canavan criticism."

Seitz faults the APS response for not being detailed enough. Possible acceptable responses, he says, would involve spending another year rewriting the report or putting Wood and Canavan on a committee that reviews directed-energy weapons.

APS, which eventually hopes to circulate its reply to all legislators, says it has no other plans to defend its study.

— K. Hartley

Kids' leukemia from parents' exposures?

A parent's workplace exposure to any of several classes of chemicals — particularly chlorinated solvents — or use of incense or pesticides around the home may increase children's risk of developing leukemia, according to a new study by researchers at the University of Southern California in Los Angeles. In fact, the study suggests, the leukemia risks posed by parental exposure to or use of some of these chemicals may be greater for young children than for developing fetuses.

While this is not the first study to suggest a tie between parental chemical exposures and childhood cancer, it is the first to link a child's leukemia with a parent's reported exposure — both before and after birth — to particular chemicals. Moreover, says John M. Peters, an occupational epidemiologist and one of the study's authors, though carbon tetrachloride, tetrachloroethylene and trichloroethylene are known animal carcinogens, this is only the second major published epidemiologic study to suggest strongly that these chlorinated hydrocarbon solvents are also human carcinogens. (The previous study, reported by Peters a few years ago, linked parental exposure to such solvents with childhood brain cancer.)

The new study, reported in the July JOURNAL OF THE NATIONAL CANCER INSTITUTE, surveyed 123 pairs of Los Angeles County families. Each pair contained one family with a leukemic child under 10 years old and one family with a healthy child (matched for age, race or ethnicity, socioeconomic status and sex).

A father's workplace exposure to chlorinated solvents increased his child's risk of developing leukemia, and the risk increased with frequency of exposure — to eight times the expected rate when fathers encountered the solvents at least weekly (levels of parental exposure were not measured). Peters surmises that fathers exposed their children, who may have ingested or inhaled traces of the chemical brought home on the fathers' clothes or breath. Similar exposures to spray paint, cutting oil, methyl ethyl ketone and dyes or pigments also showed signs of increasing a child's risk of developing leukemia — again in a pattern that increased with dose — although the study's sample size was too small to be statistically significant.

More surprising were the notably increased risks, during nursing and pregnancy, associated with a parent's use of either incense or household and garden pesticides. The pesticide finding "is certainly consistent" with scores of studies linking these chemicals to cancer, says Shelia Hoar Zahm of the National Cancer Institute in Bethesda, Md., and an author of a study (SN: 9/13/86, p.167) linking a major pesticide to lymphomas, a class of tumors related to leukemias. What's rela-

tively new here, Zahm points out, is a pesticide-cancer link affecting children.

Peters says the California researchers, not expecting household chemicals to contribute much to leukemia risk, failed to collect data on specific pesticides used, incense or pesticide use after a baby's delivery and whether incense burning accompanied use of recreational drugs. To resolve some of the questions these data have raised, the researchers are now in the process of conducting a follow-up survey of the original families.

– J. Raloff

Oral vaccine sought for hepatitis B

Each year in the United States, approximately 300,000 people become infected with the hepatitis B virus – a major cause of acute and chronic hepatitis, cirrhosis of the liver and liver cancer. In the Third World, hepatitis B is even more prevalent, despite the availability of effective hepatitis vaccinations since 1982. Why haven't more people opted for immunization?

Widespread U.S. immunization has been hampered by the high cost of the vaccine (about $115 for the required three-shot regimen) and an apparent unwillingness, even among high-risk individuals such as health care professionals and drug abusers, to undergo the injection series. Internationally, these problems are exacerbated by the shortage of sterile syringes and the need to keep the vaccine refrigerated.

Now, however, researchers report significant progress toward developing an oral vaccine against hepatitis B – one that would require no special handling or paraphernalia and may be cheaper to produce.

Paul P. Hung and his colleagues at Wyeth Laboratories in Philadelphia published the results of their work in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.84, No.13). The research team started with a live adenovirus vaccine, which in tablet form has proved effective in inducing immunity against adenovirus respiratory disease in humans. They then spliced into the adenovirus genome the coding sequence for hepatitis B surface antigen – a molecular conformation that, when recognized by the body's immune system, triggers the production of antibodies against hepatitis B. In the experiments, hamsters were inoculated through their noses with the hepatitis-B-spliced viruses, which subsequently replicated in the animals' lungs. Within 33 days, all of the hamsters had produced antibodies to both adenovirus and hepatitis B.

"Our results demonstrate the potential utility of recombinant adenoviruses as live oral vaccines," the authors conclude. And although they are unwilling to predict when the experiments may progress to human clinical trials, they say that "On the whole, these data indicate a good prospect for developing recombinant adenovirus vaccines that will effectively immunize humans against [hepatitis B]."

"It's certainly an unusual approach," says Stephen C. Hadler, chief of epidemiologic activities at the Centers for Disease Control's hepatitis branch in Atlanta. Because hepatitis is not normally contracted by oral or nasal routes, he told SCIENCE NEWS, "one would anticipate major difficulties" in inducing high levels of hepatitis antibodies in the blood following oral inoculation. If effective, however, "an affordable oral hepatitis vaccine would have major potential advantages," he says, "especially in the Third World, where it is most needed." In comparison to intramuscular injections, oral vaccinations are much more likely to gain wide acceptance, and they cut out the potential for inadvertently transmitting other diseases with syringes, Hadler says. "The market would be huge."

Exactly how much such a vaccine would cost is still a matter of conjecture, however. A spokesperson for Wyeth says the oral vaccine would "probably be cheaper" than the current vaccinations, but one hepatitis specialist at Merck Sharp & Dohme – makers of the only hepatitis B vaccines currently sold in the United States – says he knows of no data to support that claim.

Meanwhile, other fruits may emerge from Hung's research. For example, the team may have helped settle a long-standing question about the function of a particular gene sequence in the adenovirus genome. That sequence, known as the E3 region, indirectly blocks the expression of immune-cell-attracting antigens on adenovirus-infected cell surfaces, leading scientists to hypothesize that the E3 region is part of the mechanism by which an adenovirus avoids detection by the body's immune system. In accordance with this view, Hung found that adenoviruses whose E3 regions were excised in order to make room for the hepatitis B splice did not survive as long as did adenoviruses whose hepatitis splices were placed elsewhere, leaving the E3 region intact. *– R. Weiss*

ELF under suspicion in new report

Exposure to electromagnetic fields like those emitted by appliances and residential power lines apparently can affect behavior in laboratory animals and may increase the risk of childhood cancer, concludes a recently released report on a five-year program funded by the New York State Power Lines Project. But researchers failed to prove a definite cause-and-effect relationship between the extremely low-frequency (ELF) fields studied and the biological and behavioral effects observed, leaving the debate over the danger of ELF exposure still simmering.

Established by the New York Public Service Commission in response to public concern over power line construction, the $5 million project included 16 studies of possible health effects from 60-hertz electric and magnetic fields, which are commonplace in residential and work environments. As pointed out in the oversight committee's report, most of the research studies found no effects from ELF exposure. There were, however, some thought-provoking results in terms of cancer risk and behavioral changes.

In an epidemiologic study of the Denver area, David A. Savitz of the University of North Carolina in Chapel Hill classified houses on the basis of their proximity to residential power lines and the intensity of ELF exposure (SN: 2/14/87, p. 107). Savitz and his co-workers concluded that the cancer risk among children in higher-exposure homes is 1.7 times greater than that among children in lower-exposure homes, and that the chances of developing leukemia in particular are 2.1 times greater.

Perhaps even more disturbing are the studies that found learning and neurological effects from ELF exposure, project leader David O. Carpenter of the State University of New York at Albany said in an interview. Among those were rat experiments by Kurt Salzinger and others of Polytechnic Institute of New York in Brooklyn. Pregnant rats exposed to ELF fields for 30 days developed temporary learning problems, detected when the scientists tried to train them to release food by pushing levers. Their offspring, exposed both in the womb and for nine days after birth, developed permanent learning deficits.

Ironically, Klaus-Peter Ossenkopp of the University of Western Ontario in London, Canada, told SCIENCE NEWS he was surprised to find a beneficial effect in rats with epilepsy: Magnetic fields like those associated with ELF exposure may actually decrease the length and severity of epileptic seizures. "One might explore the whole phenomenon as a therapeutic approach," he suggests.

Ossenkopp also discovered that magnetic-field exposure diminishes the painkilling effects of drugs like opium, as well as those of the opiates made by the body – an inhibitory effect seen in the rats only at night.

Carpenter emphasizes that there is no need for panic over the negative findings, but he says the results are significant enough to justify more research, as well as a reevaluation of how electrical power is distributed. *– D.D. Edwards*