problems but what happens to you there, how much death and dying you see," says how much death and dying you see," says Laufer. Specifically, three aspects of wartime experience emerge as crucial in predicting later problems: moderate to intense combat, loss of buddies, and witnessing or participating in abusive violence or atrocities. Says Laufer: "The study ignores them in a very fundamental way."

As CDC readily admits, the measure of combat exposure they used—military occupational speciality—provides only a rough indication of whether men saw combat and no sense at all of how intense it was.

Nor does the study begin to sort out the role of all the other factors, such as prior psychological problems or postwar setbacks, that are inextricably linked to adjustment in the aftermath of war.

Underlying all these studies is the question, Was the Vietnam war different in some way, and did it exact a higher psychological toll? There is no ready answer. Studies of the psychological aftermath of war began in earnest following World War II, but they tended to focus on distinct groups, such as POWs or men who broke down under combat. Only since Vietnam has the focus shifted to the average GI.

Although data are lacking, many suspect Vietnam was more stressful, for several reasons, including the guerrilla nature of the war, the widespread use of drugs, the suspected number of atrocities, and, perhaps most important, the unpopularity of the war and lack of support from home.

"War produces all kinds of casualties, both emotional and psychological," says Eaton. "Vietnam probably produced more than usual because of the guilt. People were unsure they were doing the right thing. And guilt is one thing that keeps emotional problems alive." As Eaton points out, natural disasters can also trigger PTSD, but invariably, it is of short duration. "Long-term trauma arises when there is someone to blame, especially if you blame yourself."

Laufer, on the other hand, is not so sure that Vietnam was more stressful than other wars. "The war experience sets people off from others and comes back and haunts their lives in more or less severe ways. This is not peculiar to Vietnam but is a characteristic of people who went to war."

What is different, he says, is that it is easier to examine these questions in the context of Vietnam because "it was a bad war." After World War II, says Laufer, "there was an environment that said this price was necessary. But in Vietnam, the price could not be justified. That does not mean both groups did not pay a price."

■ LESLIE ROBERTS

Health Workers and AIDS: Questions Persist

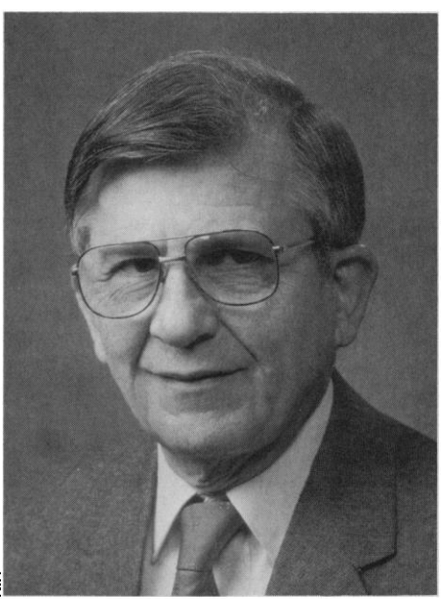
An NIH health worker injured in the lab now tests positive for the AIDS virus, but researchers are still uncertain why some workers exposed to the virus become infected and others do not

ANOTHER HEALTH CARE WORKER is infected with the AIDS virus, probably because of an injury at work. The incident, which occurred at NIH, is similar to several reported previously by the Centers for Disease Control (CDC) in Atlanta. The worker was injured while handling blood from a patient infected with the AIDS virus, called HIV for human immunodeficiency virus. "The fact that it occurred is tragic but there is nothing unusual about the accident," says Robert McKinney, director of the division of safety at NIH.

The incident underscores the need to explain why only a few health care workers exposed to HIV become infected while the vast majority do not. The recent case also calls attention to a controversial study by Burroughs Wellcome Co. in Research Triangle Park, North Carolina, to test AZT—alternately called Retrovir or zidovudine—in health care workers exposed to HIV before evidence of infection occurs.

"The work was routine and the individual was well trained," says McKinney, referring to the recent case. A vial containing HIV-infected blood accidentally broke in the worker's hand and cut through a glove and into the skin. An initial test for antibodies to HIV was negative but subsequent tests were positive, allowing health officials to conclude that the infection probably resulted from the accident. The accident is largely dissimilar to two reported cases of HIV infection in laboratory workers employed by companies under contract to NIH. Both of these people were handling material that probably contained high concentrations of virus and only one had a documented injury.

Combined data from surveillance studies of health care and laboratory workers at the CDC, NIH, and University of California indicate that more than 2200 people have been injured on the job while working with blood or other materials known to be contaminated with HIV. Sixteen—a number that includes the recent case—developed antibodies after being exposed to the virus at work. Another seven workers also have antibodies, but may have had them before entering the study. Researchers estimate the infection rate within this group at less than 1%. "It is interesting that a number of these workers seem to develop antibodies very rapidly after their initial exposure to HIV," says McKinney. Several experienced a fever soon after exposure to HIV, as the recently infected person did. But the basic question of why these people developed an infection, while other workers with similar exposures to HIV are not infected, remains unanswered.



NIH

Robert McKinney. *"The fact that the infection occurred is tragic but there is nothing unusual about the accident."*

Researchers are investigating a range of factors that may address the issue. One possibility, for example, is that an infected person who has diagnosed AIDS—as opposed to a person who carries HIV but is still healthy—is more likely to transmit the virus. Researchers do not yet know if a patient's stage of disease alters the risk to workers who are accidentally exposed to the patient's blood. Other factors include biological differences in HIV that may make some strains of the virus more infectious, biological differences in the person exposed

such as having an ongoing herpes virus or other infection, the amount of virus to which a worker is exposed, and the severity of the injury or exposure.

In May, Burroughs Wellcome announced a new study to test AZT in health care workers exposed to HIV in accidents on the job. The program is unusual because it tests AZT in people recently exposed to the virus who show no signs of infection. The company will monitor levels of viral proteins and antibodies in the workers for a year. The trial is a controlled, double-blind study, in which half the people who participate will receive drug and the other half will receive a placebo.

"Right away we knew that there would be some logistical problems with the company's study," says Julie Gerberding of the University of San Francisco and San Francisco General Hospital. First it will take at least several thousand participants to be able to determine whether AZT prevents infection because the actual infection rate is so low—estimated at an average of 0.4 to 0.5% among health workers who stick themselves with contaminated needles. Second, AZT kills bone marrow cells in many AIDS patients, a risk of toxicity that is unknown in healthy people exposed to HIV, but that could be greater than the risk of becoming infected. Third, it may become increasingly difficult to justify why only health care workers, and not people who fear exposure to HIV because of sexual contact or other means, should be allowed to participate in the study. Fourth, workers who suspect they are getting placebo instead of AZT may not comply with the terms of the study and obtain the drug by some other means.

As an adjunct to the Burroughs Wellcome study, the National Institute of Allergy and Infectious Diseases (NIAID) has just applied to the Food and Drug Administration for permission to give AZT to all health care or laboratory workers who have had massive exposure to HIV. Current thinking is that people exposed to large quantities of virus may be more likely to become infected and for that reason should receive AZT as a matter of course. Other workers exposed to smaller amounts of HIV are regarded as more appropriate for the Burroughs Wellcome study. "The question we will have to study is what constitutes a massive exposure versus a small one," says Deborah Katz of NIAID.

Gerberding tells workers who have been exposed to HIV what she would do in a similar situation. "Personally, if I had a needlestick and not a very severe injury [with HIV-infected material], I would enroll in the study and risk the toxicity," she says. ■ DEBORAH M. BARNES

Space Science Looks to the Future—Cautiously

The next decade could be exciting—if everything goes as planned; meanwhile, a new report looks to the 21st century

AFTER YEARS OF NEARLY unrelieved bitterness and frustration, American space scientists are beginning to speak in tones of (very) cautious optimism. At a recent symposium* celebrating the 30th anniversary of the National Academy of Science's Space Science Board, in fact, the speakers could point to a number of positive signs.

For one thing, the long hiatus in flight opportunities seems to be coming to an end. Thirty-one months after the catastrophic flight of the space shuttle Challenger on 28 January 1986, its sister ship Discovery is scheduled to fly on 4 September.

Furthermore, if that flight goes well—and *if* the revived shuttle program can attain its planned flight rate of 12 flights per year in the 1990s, and *if* the National Aeronautics and Space Administration's (NASA's) $9-billion budget continues its multiyear rise toward the $13-billion to $14-billion level promised by President Reagan, and *if* the agency's science and application programs continue to receive their traditional 20% share of the budget—then the coming decade should see space science missions being launched at a rate not seen since the 1960s, when Mariners, Pioneers, and Explorers went aloft at an average frequency of seven or eight per year. The list presented at the symposium by NASA's space science and applications head Lennard Fisk was a long one, ranging from the Hubble Space Telescope to the Galileo mission to Jupiter. All of these near-term missions are well along in planning and development, he said, and two-thirds of them are already funded. Indeed, he said, given the assumptions listed above, "all this is completely doable."

Of course, no one looking at that long chain of *if*'s can be very confident that Fisk's schedule will hold for long. Nonetheless, now that NASA has quit chasing after commercial payloads for the shuttle, and now that the Pentagon is planning to transfer most of its shuttle payloads to expendable rockets, the scientists can be reasonably hopeful that their own backlog of missions will eventually fly. And when that happens, they will even have a blueprint for what to do next: the 30th anniversary celebration also marked the official release of the Space Science Board's report on *Space Science in the Twenty-First Century*,† which has been in preparation for 4 years.

Outgoing board chairman Thomas Donahue of the University of Michigan emphasized two caveats for readers of the report. First, he said, the schedule implied by its subtitle, "Imperatives for the Decades 1995 to 2015," really means "the two decades or so *after* the currently planned missions are finally flown."

Second, the recommendations are not a list of priorities; without the data from the upcoming missions, said Donahue, the board members could see no rational way of setting such priorities. Nor could the board do much to estimate cost; the recommended missions are so far off and so broadly defined that the estimates would be little more than guesses.

That said, however, the report offers a cornucopia of possibilities in each of six disciplines:

■ **Earth sciences.** The board recommended a continued emphasis on studying our planet as a global system—a theme dramatized by the recent international agreement on chlorofluorocarbons, the ozone hole, the midwestern drought, and the renewed concern over the carbon dioxide greenhouse effect. In the 21st century the board would like to see missions that include a set of five global monitoring satellites in geostationary orbit (two provided by the United States); a set of two to six lower altitude instrument platforms providing high-resolution, global coverage from polar orbit (two or three provided by the United States); a global network of ground-based sensors, perhaps using NASA satellite technology for autonomous operation in remote locations; and advanced computer systems for archiving and analyzing the torrents of sensor data, and for building better theoretical models of Earth processes.

■ **Planetary and lunar exploration.** Here the board emphasized the importance of understanding the origin and evolution of

* "Space Science in the United States: A Celebration of the Past—A Vision of the Future," held 27 and 28 June 1988 at the National Academy of Sciences, Washington, D.C.

† *Space Science in the Twenty-First Century: Imperatives for the Decades 1995 to 2015* (National Academy Press, Washington, DC, 1988).