scheme is that only PS I can transfer electrons to ferredoxin and that plastoquinone is the obligatory link in electron transport from PS II to PS I.

If this currently accepted scheme is correct, says Arnon, neither ferredoxin nor $NADP^+$ should receive electrons when the function of plastoquinone is blocked by chemical inhibitors. However, Arnon says that when he did just that—blocked plastoquinone function with chemicals such as dibromothymoquinone—electrons *did* flow to ferredoxin as long as the protons ($H^+$) also liberated during water-splitting were helped across the plant membrane. Arnon therefore proposes a new role for plastoquinone — that of proton shuttling — and an alternative mechanism to PS I and II.

According to Arnon's scheme, an oxygenic photosystem replaces PS II, and an anoxygenic photosystem replaces PS I. The oxygenic photosystem consists of two light events—one that transfers electrons to ferredoxin and the other that helps plastoquinone sweep protons from inside the plant membrane. ATP is formed in the anoxygenic system.

While such a mechanism probably never will replace the currently accepted one, what it will do is "force people to present data that support the conventional scheme," Bolton says. "Any theory of photosynthesis has to be subjected to periodic challenge to make sure it does represent as close to reality as we can make it." □

## Tracking a cancer

Epidemiologists, the sleuths of medical science, tracking down the characteristics and causes of mysterious diseases such as legionellosis and toxic shock syndrome, are following a third trail—the outbreak of a rare and often rapidly fatal form of cancer.

The cancer, called Kaposi's sarcoma, usually affects only two out of every three million Americans annually. But in recent months Alvin E. Friedman-Kien of New York University Medical Center in New York City and some other investigators have diagnosed 41 cases of this cancer among homosexual men. None of the victims apparently knew each other, suggesting that the cancer is not contagious. On the other hand, the victims shared certain characteristics that might help epidemiologists eventually explain the outbreak of the cancer. For instance, most of the patients had frequent sexual encounters with many different partners. Many had been treated for herpesvirus, cytomegalovirus, hepatitis B virus as well as parasitic infections and had used drugs such as LDS and amyl nitrite. A number of the men were also found to have severe defects in their T and B lymphocytes, immune cells essential for fighting cancer and infectious diseases. □

## Less drastic surgery for breast cancer

Radical mastectomy has been the usual procedure for treating breast cancers that have spread to the underarm lymph nodes. But now there is an indication that this operation — removal of the entire breast, the lymph nodes and the chest muscles—may be more than is necessary. Breast and lymph node removal, followed by a recently devised combination drug therapy, may be sufficient, according to a report in the July 2 NEW ENGLAND JOURNAL OF MEDICINE.

Bernard Fisher of the University of Pittsburgh School of Medicine and colleagues studied 1,863 breast cancer patients who had the less drastic surgery and whose lymph nodes had been determined to be cancerous. Two to four weeks after surgery half of the patients started getting L-phenylalanine mustard and 5-fluorouracil. They continued to receive this treatment between June 1977 and May 1980. The remaining patients were treated with the same two drugs plus an antiestrogen drug — tamoxifen citrate. The two treatment groups were similar in age, location and size of tumor, duration of symptoms and degree of lymph node involvement. Breast tumors removed from 1,414 of the patients were also analyzed for the number of cell receptors for estrogen that they contained.

Fisher and colleagues report that women older than 50 years of age on the three-drug regimen whose cancers were estrogen-dependent and who had one or more underarm lymph nodes initially positive for cancer experienced significantly greater cancer-free survival than did women on the two-drug regimen. These results have important treatment implications for such women because breast cancer patients are at the greatest risk of relapse during the first two years after surgery. However, women under age 50 on the three-drug regimen did not experience any more cancer-free survival than did the women on the two-drug regimen, with the possible exception of women in this age group with four or more underarm lymph nodes initially cancerous and with many estrogen receptors in the breast tumors.

In a related study, whose results appeared in the same journal, Umberto Veronesi and colleagues of the National Cancer Institute in Milan, Italy, reported that with small, recently discovered breast cancers removal of a fourth of the breast and postoperative radiation are as effective in halting spread of the disease as is radical mastectomy. □

## Child brain tumor: Comes with the job?

When cancer strikes a child, is parental exposure to chemicals to blame? Recent studies by John M. Peters and colleagues of the University of Southern California School of Medicine in Los Angeles indicate that in cases of brain tumors the parents' occupational exposure to chemicals may be a culprit.

Peters and co-workers — whose study appears in the July 10 SCIENCE—matched 92 cases of brain tumors in children less than 10 years old with 92 healthy control children. (Cancer is second only to accidents as a leading cause of death among children. In the cancer category, leukemia claims the most lives of children, brain tumors the second most.) The researchers questioned the parents of these case and control children about their occupations before and during the pregnancy and at the time the case children were diagnosed. Information sought included whether chemical solvents, dust or other fumes were inhaled; whether chemicals contacted skin or clothes; whether radioactive materials were involved; and whether protective equipment or clothing was used on the job. The researchers then analyzed the data, adjusting for potential confounding variables such as parental patterns of food consumption, drug use, alcohol use and smoking habits.

The results of the analysis indicate that parents of affected children reported more exposure to chemicals than did parents of controls. For example, "Mothers of cases reported skin exposure to chemicals more than three times as frequently as mothers of controls," Peters and colleagues report. Also, fathers of cases reported exposure to paints seven times as frequently as did control fathers. Moreover, while only two fathers of controls had been employed in the aircraft industry, twelve case fathers worked in that industry either during the time of pregnancy or at the time the child's brain tumor was diagnosed. Peters and co-workers cannot yet explain this particular increased risk, although they note that exposure to trichloroethylene (a solvent) was mentioned by two aircraft industry-employed case fathers.

Could such results merely indicate a recall bias? While "it is possible that the mother of a child with a brain tumor might recall more episodes of exposure than a mother of a control," say the Los Angeles researchers, "mothers of cases were twice as likely to have worked during the years before pregnancy, a result that is very unlikely to be due to the bias. Also, the information on where (which industry) the mother and father worked is unlikely to be biased." The researchers conclude, therefore, that an adverse chemical effect could have been transmitted to the case children via the mother during pregnancy or nursing, via parents' soiled worked clothes or via a genetically damaged reproductive system of the father. □