SYNCHROTRON RADIATION

Swiss Plan Next-Generation X-ray Source

VENICE, ITALY—Swiss physicists are hailing a decision by their government last month to allocate $1.5 million to study the construction of a new x-ray source that would put Switzerland in the big leagues of synchrotron radiation research. The planned facility, called the Swiss Light Source (SLS), would use a circulating beam of electrons with an energy of up to 2.1 gigaelectron volts to produce lower energy "soft" x-rays. If the government follows through on the planning grant with construction funds—as many now expect—the $135 million facility could be up and running by 2001.

SLS planners say that the machine would use superconducting bending magnets to produce the world's brightest and most coherent x-ray beam—some have dubbed it the first fourth-generation synchrotron source. What is important, says Wilfred Hirt of the Paul-Scherrer Institut (PSI) in Villigen, who originally proposed the project, is that "the SLS will be pushing current techniques to their physical limits, maximizing the brilliance."

Synchrotron radiation, the light given off by particles as they speed around a curved path, was originally considered a nuisance by the designers of particle accelerators. Now researchers are building accelerators for the express purpose of exploiting the intense beams of x-rays they produce. The past several years have seen a profusion of new third-generation sources, which use banks of magnets known as insertion devices to coax the circulating electron beam into producing ever finer and more intense x-ray beams. Three giant sources of higher energy "hard" x-rays have all come online during the 1990s: the U.S. Advanced Photon Source, the European Synchrotron Radiation Facility, and Japan's SPring-8. And these have been joined by new soft x-ray sources such as the Advanced Light Source in Berkeley, California, and Elettra in Trieste, Italy.

The SLS is going to go one step further, says PSI's Gottfried Mulhaupt, who was named head of the SLS project earlier this year. Although brilliance increased by three or four orders of magnitude going from second- to third-generation machines, Mulhaupt explains, the coherence of the x-ray beams—the degree to which all the waves move in step—produced by these machines has been low. It is hoped that the superconducting magnets of the SLS will bring about significant improvements in brilliance and coherence. With these features, Mulhaupt says, "you can carry out experiments like [x-ray] holography, opening up structural analysis and the study of complicated molecules or proteins." SLS planners are also designing in the possibility of using the machine as input into free-electron laser sources, further boosting the machine's potential (*Science*, 16 February, p. 902).

Switzerland's Interior Department will produce a formal proposal for the SLS later this year, and a final decision is expected in December. Researchers are confident it will give the green light: According to Giorgio Margaritondo of the Ecole Polytechnique Fédérale in Lausanne, who was recently elected coordinator of Elettra's experimental division, the planning funds are "a significant decision, given that Switzerland is traditionally quite careful in its research investment, even at the planning stage."

–Susan Biggin

Susan Biggin is a writer in Venice, Italy.

TOXICOLOGY

Chemicals Behind Gulf War Syndrome?

Ever since the Gulf War ended in February 1991, another type of battle has been raging: over what—if anything—might have caused "Gulf War syndrome," the mysterious collection of symptoms, including headaches, fatigue, short attention spans, aches, and rashes, reported by many of the men and women who served in that war. Indeed, there have even been questions about whether the syndrome is a true disease. Barely a month ago, for example, the U.S. Department of Defense announced that an $80 million evaluation of long-term health problems in soldiers who served in the Persian Gulf War had failed to identify a specific disease that could account for their complaints, let alone a single cause.

But a privately funded team of toxicologists and epidemiologists may have hit upon an explanation for at least some of the problems experienced by Gulf War vets. Last week, at the annual meeting thrown by some of the societies of the Federation of American Societies for Experimental Biology,* the team, led by Mohamed Abou-Donia of Duke University Medical Center in Durham, North Carolina, and Robert Haley of Texas Southwestern Medical School in Dallas, presented the first of a series of experiments designed to pin down Gulf War syndrome. They found that simultaneous exposure to two or more of the insecticides and drugs used by Gulf War soldiers damages the nervous system of chickens, even though none of the chemicals causes problems by itself. Combinations of the chemicals had been tested in animals before, but only in acute toxicity studies aimed at determining their LD_{50}s, the amount required to kill half the animals exposed.

The new results, which will also appear in the May issue of the *Journal of Toxicology and Environmental Health*, look promising because the range of symptoms the chickens develop is similar to those the veterans describe. "What we see in the chickens resembles very much what humans show," says Abou-Donia, the animal study's leader, who presented the group's results at the meeting.

Researchers caution that the study's relevance is far from certain; the afflicted veterans, they say, may not even have been exposed to the chemicals at issue. "The Abou-Donia study has an unknown relationship to Gulf War illnesses," says neurotoxicologist Peter Spencer from the Oregon Health Sciences University in Portland. Haley agrees: "It's one study, the implications of [which] are still uncertain."

But even if the work, which was funded by Texas billionaire and erstwhile presidential candidate H. Ross Perot, doesn't solve the mystery of Gulf War syndrome, toxicologists say it highlights another important problem: the need for more research on the potential toxicities of multiple chemical exposures. "I see the [work] as something of a warning flag," says Raymond Yang, a toxicologist at Colorado State University in Fort Collins.

For their study, Abou-Donia and his colleagues worked with adult hens, an animal the U.S. Environmental

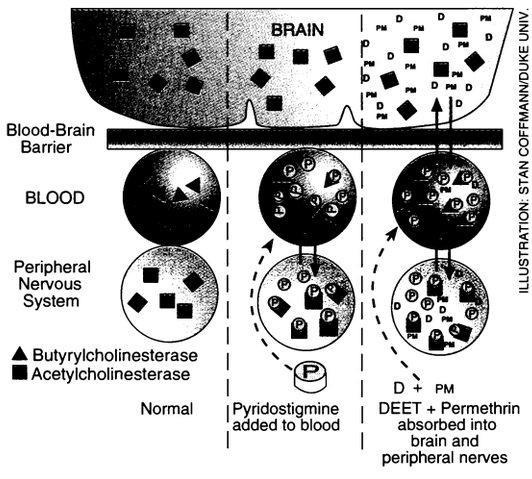

ILLUSTRATION: STAN COFFMANN/DUKE UNIV.

Stymied protectors. If enzymes get bound up by an anti–nerve gas drug (P), insecticides (D, PM) can sneak into the brain and nerves.

* Experimental Biology '96 was held in Washington, D.C., from 14 to 17 April.