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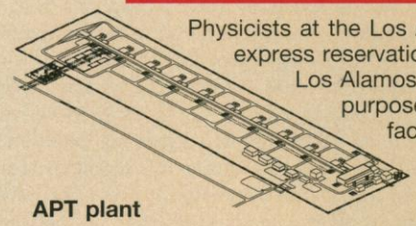
LETTERS

Accelerators, Endangered Species, and Garlic


APT plant

SOURCE: LANL

Physicists at the Los Alamos and Argonne national laboratories express reservations about using a proposed accelerator at Los Alamos (left) for both defense and basic research purposes, but a former director of one Los Alamos facility says it can be done. In other letters, scientists at the National Institutes of Health speak up in favor of the Endangered Species Act, and garlic's effect on mosquito larvae is discussed.

Multiple-Use Physics Facilities

The article "Could defense accelerator be a windfall for science?" by Jonathan Weisman (News & Comment, 18 Aug., p. 914), raises an important issue about multiple-use facilities, given their attraction during constrained budget times. Whether or not it is practical to use an Accelerator Production of Tritium (APT) plant both for tritium production for the nuclear weapons stockpile and for neutron beam research is a complex issue that requires careful analysis of the technical, operational, and end user issues. At present, neither the defense nor the research community believes that its needs can be met if it is forced to coexist with the other. We at Los Alamos believe that there are areas of research and development (R&D) that could be pursued jointly, but currently we are skeptical about a multiple-use facility because of the different operating modes and the tight APT schedule proposed to meet present tritium production requirements. As Los Alamos APT project leader Paul Lisowski is quoted as saying in the article, accelerator beam power would be adequate both for tritium production and for the neutron beam research *if* the present tritium supply requirements were significantly reduced. Whether or not the Administration or Congress will settle on a multiple-use facility will depend on an objective analysis of all the pros and cons. We believe that both communities owe the country their best judgment to resolve this question.

A related issue is raised in the article regarding whether defense research (rather than defense production) and basic research can be performed at the same facility. We believe that this issue is less contentious, particularly when the primary purpose of the facility (neutron beam research) is common.

We agree that the performance of the Manuel Lujan Jr. Neutron Scattering Center (MLNSC) at Los Alamos National Laboratory's Neutron Science Center (LANSCE) accelerator facility did not meet user expectations in past years in terms of overall availability. However, in our view, the problems had little to do with the fact that LANSCE engages in both defense research and basic research that uses pulsed neutrons. The problems we encountered at the MLNSC resulted more from the fact that it was an auxiliary activity at the Los Alamos Meson Physics Facility (LAMPF), whose primary mission was nuclear physics, and thus the MLNSC did not enjoy the same priority or amount of resources. LAMPF users, who numbered about 1000 at LAMPF's peak, were apparently happy with the reliability that was provided.

The upshot of this arrangement was predictable—the availability and performance of the MLNSC suffered. This problem parallels the one suffered by the Stanford Synchrotron Radiation Laboratory when it was an add-on to the Stanford Linear Accelerator. It has little to do with defense research and everything to do with prioritization, planning, and resources. Accelerator research facilities can be designed to provide reliable beams to multiple users, provided the user community is involved early in the planning, operational priorities are properly assigned, and resources are adequate. The European Organization for Nuclear Research (CERN) has successfully demonstrated this type of operation.

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We would like to remark on the article of Daniel Clery and Andrew Lawler (News & Comment, 17 Feb., p. 952), on that of Weisman, and on the letters of J. Michael Rowe and Louis Ianniello (21 Apr., pp. 349–350). With regard to the dual use of an accelera-

tor facility for production of tritium, we believe it is unwise to combine neutron scattering capabilities with tritium production functions because such a facility would be costly to run. If the stockpile of tritium-bearing nuclear weapons were to be reduced faster than tritium decays (it has a half-life of 12.3 years), then the need for replacing tritium in the stockpile would disappear. Support of the installation for tritium production would disappear, and the research community would inherit an installation that by present standards would be unaffordable to operate. It also remains unestablished whether tritium producers (which only need volumes of neutrons) and neutron beam sources (which must be compact and, for time-of-flight applications, pulsed) can realistically and productively be fitted together.

Concerning a 5-megawatt pulsed spallation source (30 times the power of ISIS in the United Kingdom) most knowledgeable people believe that it can eventually be done. The Kohn panel (*1*) noted that if the Advanced Neutron Source (ANS) were not built, a 5-megawatt pulsed source would be needed. However, no one has yet clearly seen a particularly good way of accomplishing the 5-megawatt source or estimated what its cost might be, and it will take considerable time to work these problems out. Meanwhile, feasible concepts for a 1-megawatt, short-pulse source, the most versatile type, have already been developed and documented, with defensible estimates of costs and schedules. Such a source would exceed the capabilities of ISIS by a factor of six and in many ways exceed those of the Institute Laue-Langevin and cost about 25% as much as ANS. Proposals that a smaller source be built so as to be upgradable to 5 megawatts are attractive in principle but weak because the vision of the 5-megawatt upgrade is so dim. Moreover, the 30-fold jump, when existing experience already reveals engineering problems, calls for an intermediate step. It gives one pause to recall the many steps that lay between the Wright Flyer and the Concorde, which flies about 30 times faster.

Rowe properly calls attention to the upgrade of neutron facilities at the National Institute of Standards and Technology (NIST), which Clery and Lawler did not acknowledge. Great credit is due the NIST team for their accomplishment. But such upgrades represent at best a catching-up to the versatility and performance of the best reactor instruments, and not new capabilities on a world scale.

Ianniello observes that techniques other than neutron beam methods represent alternative ways to perform cutting-edge research. Yes, to some extent, but leaving off or putting off the neutron option surely means forgoing access to a hugely important range of information. So far, whatever shadow the new photon sources may cast on the fields where neutrons now hold sway is narrow; what more may yet be overshadowed is conjectural and the list is not exhaustive. Committees fully acknowledging the prospects for the photon sources endorse the construction of new, more powerful neutron sources because of their broad-ranging and still unique capabilities. The U.S. scientific community has waited a long time for a much-needed new, more powerful neutron source. A 1-megawatt pulsed source can be built now.

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References and Notes

1. *Neutron Sources for America's Future: Report of the DOE Basic Energy Sciences Advisory Committee Panel on Neutron Sources, Chair, W. Kohn* (DOE Report ER-0576P, U.S. Department of Energy, Washington, DC, 1993).

I am concerned about a comment attributed by Weisman to Walter Kohn to the effect that the experience of LANSCE shows that dual use of a major accelerator is not feasible. My own experience, as director of LAMPF from its beginning until 1985, is quite the opposite. We found multiple use to be efficient, stimulating, and cost effective. We often operated more than 10 channels simultaneously, with negligible interference, even with the weapons neutron research facility, which received all the beam it could use, as does LANSCE today. Design and scheduling conflicts that Kohn mentions did not materialize.

The only requirement, as far as I can see, is that the operators and researchers (many hundreds from scores of institutions, in the case of LAMPF) be motivated, competent, and reasonable, and that management be enthusiastic about incorporating user needs and advice in the decision-making process.

At the moment, LAMPF is providing high-quality, high-intensity beam to LANSCE without interference from other experiments. One hopes that the neutron scattering community will take full advantage of the capabilities already available.

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The Endangered Species Act

I represent 138 biomedical research scientists in areas such as drug development for AIDS, cancer, cardiovascular disease, pain relief, and the study of basic chemical and biochemical processes of health and disease. We believe that the progress of biomedical research and disease treatment depends on the maintenance of the greatest possible biological diversity in nature. Rather than allowing legislation currently before Congress to weaken one of our nation's most important laws, we implore the President and Congress of the United States to support reauthorization of a strong and effective Endangered Species Act.

Plants and their attendant microorganisms have provided an armamentarium for cancer chemotherapy: Doxorubicin is used to treat acute leukemia, Hodgkin's disease, other lymphomas, Wilms tumor, and several other cancers; bleomycin is used for the palliative treatment of squamous cell carcinomas; etoposide is valuable in combination chemotherapy against small cell lung cancer; vinblastine is one of the most effective single agents against Hodgkin's disease; vincristine is used in combination therapy against acute leukemia, where 90% remission can be achieved in children; and taxol provides a therapy for ovarian cancer.

Using morphine as a model, medicinal chemists have made alterations to the drug that have produced a variety of other medicines including methadone, used in the treatment of heroin addiction, and dextromethorphan, a common constituent of cough syrups. Moreover, the scientific study of morphine (derived from the poppy) and its chemical relatives has led to the discovery of opiate receptors in the brain and to novel approaches to pain relief and narcotics addiction.

The plant products digoxin and digitoxin are routine medications for heart failure, and ouabain is used in the emergency treatment of potentially fatal heart rhythm disorders. Another botanical product, quinidine, is prescribed for the control of certain heart rhythm abnormalities.

Animals provide indispensable models for the study of the origins and therapy of human diseases such as leprosy (armadillo), late-onset diabetes (monkfish), and injured heart muscle (Mexican salamander, an endangered species).

Discoveries are made regularly of novel, natural products that contribute to new drug design and advance our understanding of health and disease. A Chinese plant, *Artemisia annua*, for example, provides arte-