Health, experiments of this type have to be performed in at least a P3 laboratory and many require P4 facilities, which are not yet available in the United States. (P3 is the second highest and P4 is the highest level of physical containment specified by the guidelines.) Chromosome-mediated gene transfer does not involve infectious agents and thus does not share this liability.

Moreover, Ruddle points out that the two techniques ought to be complementary rather than competitive. Gene transfer on chromosomes can be used to determine relative gene positions on the chromosome, whereas recombinant techniques are capable of providing much finer details of molecular structure. The result of a combined effort could be a highly precise picture of mammalian genomes.—JEAN L. MARX

Synchrotron Radiation: Large Demand Spurs New Facilities

From biologists to solid state physicists, researchers have taken to using the intense radiation emitted by electrons orbiting in synchrotrons and storage rings for a wide range of spectroscopic and x-ray diffraction experiments. Interest in this unique ultraviolet and x-ray light source has grown so fast that there are long waiting lines to get on the existing facilities, and projections are for a rapidly escalating demand for them over the next decade. Good news for researchers, therefore, is that the Administration's budget for fiscal 1978 includes funds to build an entirely new synchrotron radiation center at the Brookhaven National Laboratory and to substantially upgrade two existing ones at Stanford University and the University of Wisconsin.

Although it began in Europe in 1964 with the opening of the DESY synchrotron near Hamburg, the age of synchrotron radiation in the United States began in earnest about 8 years ago when the Tantalus I electron storage ring at the University of Wisconsin's Synchrotron Radiation Center at Stoughton became available for full-time use as a light source (Fig. 1). Tantalus I produces light from about 40 angstroms, which is near the boundary between ultraviolet and x-ray wavelengths (also called the "soft" x-ray region), to the ultraviolet. The operating energy of the storage ring is 240 Mev. Within the last 2 years, a similar ring (SURF II) came into operation at the National Bureau of Standards, but its radiation is somewhat less intense.

A big boost for American researchers came in 1974 when the Stanford Synchrotron Radiation Project opened its doors. The high energy of the SPEAR storage ring at Stanford (now at a maximum of about 4 Gev) permitted usable fluxes of x-rays with wavelengths as short as a third of an angstrom. Interest in the use of these so-called "hard" x-rays has mushroomed so fast that, in less than 2 years, the Stanford project has drawn the largest group of users of any of the American synchrotron radiation facilities.

Last year, synchrotron radiation received a bigger boost when the National Research Council issued a report recommending that the present 7 hard x-ray and 16 soft x-ray and ultraviolet experimental stations available in the United States be increased to 60 and 40 stations, respectively, to meet researchers' needs during the next 10 years. The pending budget request for new synchrotron radiation facilities was specifically designed to answer this projected need, providing for more than 80 new stations.

The Energy Research and Development Administration (ERDA) has asked for $24 million to be spent during the next 4 years on the construction of a National Synchrotron Light Source at the Brookhaven National Laboratory. Annual operating costs thereafter are expected to run about $2.1 million, not including research funds. The Light Source will actually consist of two storage rings. A large ring will store electrons at energies up to 2.5 Gev and will provide hard x-rays, while a smaller 700-Mev ring will serve users in the soft x-ray and ultraviolet regions. Scientists from both Brookhaven and the outside will compose an executive committee that selects the experiments to be run from the proposals submitted by researchers. Brookhaven scientists also plan to establish a strong in-house capability in the use of synchrotron radiation. Thus, although the facility is conceived to be a national one, in-house research could claim as much as one-half of the time available on the two storage rings, according to Mark Wittels of ERDA.

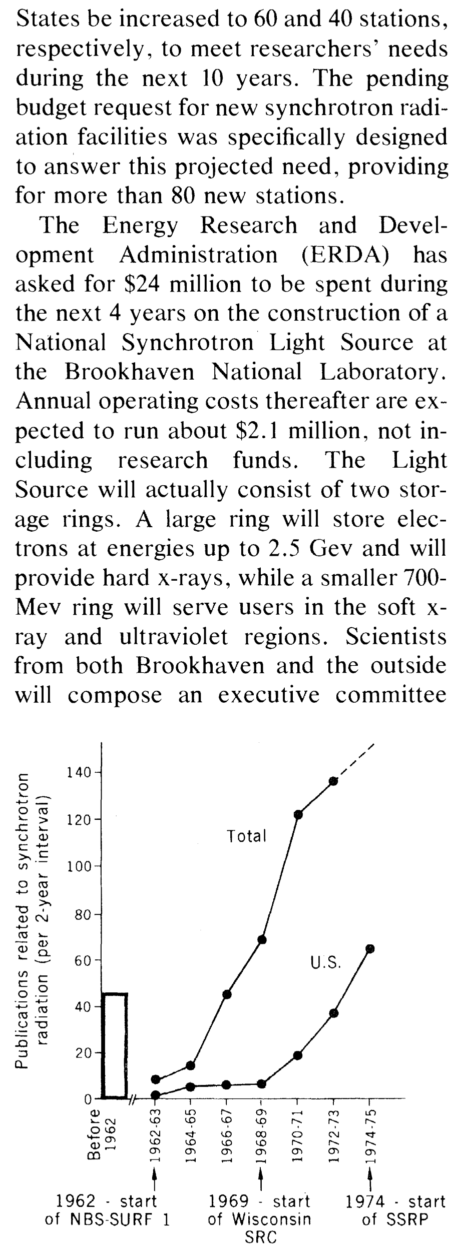

Fig. 1. Number of scientific publications in refereed journals reporting experiments using synchrotron radiation in 2-year intervals. The 5-year lag of American science behind foreign efforts has been attributed to a corresponding lag in the availability of synchrotron radiation facilities in the United States. [Source: Solid State Sciences Committee, National Research Council]

At the same time, the National Science Foundation (NSF) has requested funds to nearly triple the experimental capacity of the Stanford project. The plan is to build a second experimental hall for synchrotron radiation at a cost of $6.7 million. After it is completed in 1980, the new hall will primarily be used for hard x-ray experiments.

The future of the Stanford project is closely linked to the schedule of high energy physics research at the Stanford Linear Accelerator Center, which operates SPEAR. Unlike Tantalus I and SURF II, the SPEAR storage ring is mainly used for high energy physics. A much larger storage ring for high energy physics is being built at Stanford and will be completed sometime around 1980. When the larger ring is finished, there is what William Oosterhuis of NSF calls a pretty firm agreement with accelerator center officials that SPEAR will become available exclusively for synchrotron radiation research about half the time, thus greatly increasing experimental productivity.

The NSF would also like to build a new storage ring at Wisconsin to replace Tantalus I. To be called Aladdin, the new ring would have a higher energy of 750 Mev, so that useful intensities of synchrotron radiation could be obtained farther into the soft x-ray region with wavelengths as small as 10 angstroms. This region of the spectrum is especially interesting to many researchers, not only because it is relatively unexplored, but also because it is where elements with low atomic numbers that are associated with organic compounds absorb x-rays. The estimate is that Aladdin would cost $2.9 million to build over a 3-year period.—ARTHUR L. ROBINSON