tween different myosin genes, but in some of the genes introns fall in the middle of repeated structural units, units that code for a 28 amino acid repeat that constitutes the rod part of the protein.

These as yet unpublished data on myosin contrast markedly with those for collagen. Like myosin, collagen is composed of a multiple amino acid repeat, three residues in this case. But unlike myosin, these repeats as represented in the gene are never interrupted by introns. Collagen supports the modified exon-shuffling notion while myosin apparently does not.

A second problem example comes from the recently published data on human α_1-antitrypsin gene.* Savio Woo and his colleagues at Baylor College of Medicine, Houston, show that this gene has important homologies with chicken ovalbumin. And yet the number and position of the introns in the two genes is different. Antitrypsin has three introns while ovalbumin has seven, with possibilities for overlap limited to one pair.

One interpretation of these data is that the ancestral gene for antitrypsin and ovalbumin had as many as ten introns, seven of which were lost en route to one descendant gene, while a different three were shed en route to the other. Woo and his colleagues consider this unlikely and suggest that "some of the introns could be vestiges of transposable elements that had been inserted into preexisting exons of the two genes after their divergence from an ancestral gene."

This second interpretation—that of mobile introns—has also been invoked on a number of occasions to explain the disparity in number and position of introns in actin genes throughout the animal and plant kingdoms. It is certainly possible to argue that introns can insert and excise themselves, in the manner of transposable element, and those that happen to fall between regions coding for protein modules will be preserved because of the benefits of recombining exons. In other words, exon shuffling could be a secondary phenomenon following from propitious intron insertion. The one great drawback in the argument for intron mobility is the total lack of evidence of sequence structure in introns that is so characteristic of transposable elements.

The idea of exon shuffling and all that it implied was powerfully seductive, so much so that, as one commentator said, "it led people to enthusiastic over interpretation." The contrary examples provide a cautionary and provocative force.

—Roger Lewin

*M. Leicht *et al.*, *Nature (London)* **297**, 655 (1982).

Pulsed Neutron Sources Okayed

A Department of Energy (DOE) panel has reaffirmed that the Los Alamos National Laboratory should become the lead institution for U.S. pulsed neutron scattering research in the late 1980's. But, in a turnabout of previous policy, the panel also endorsed the continued operation of a pulsed source at the Argonne National Laboratory until Los Alamos is in full swing in 1986.*

There are two main sources of neutrons for neutron scattering, a technique that gives spectroscopic and structural information about a wide range of materials, from crystalline solids to biological molecules. Nuclear reactors, which emit a steady stream of thermal neutrons, are the mainstay of DOE's neutron scattering program. Accelerator-based sources of pulsed neutrons are expected to become increasingly important, however.

Los Alamos already has a pulsed neutron facility. Part of the beam from the laboratory's 800-million-electron-volt proton linear accelerator LAMPF is diverted to a tungsten target. Protons from the beam strip away neutrons from the nucleus. To enhance the usefulness of the setup, Los Alamos has just begun the construction of a $19-million storage ring that will collect protons from LAMPF and shape them so that the resulting neutron pulses are shorter and more intense. Most of the Los Alamos facility is being paid for by DOE's Office of Military Application, which is interested in the use of neutrons for weapons studies. This was part of the reason why an earlier panel (headed by William Brinkman of Bell Laboratories) recommended to DOE's Office of Basic Energy Sciences, which supports neutron scattering research, that Los Alamos rather than Argonne become the center for pulsed neutron studies (*Science*, 16 January 1981, p. 259). The new panel (also headed by Brinkman) reaffirmed this recommendation saying, "optimal use should be made of DOE resources to ensure a natural, gradual shift to and buildup of the Los Alamos facility by the 1986–1987 time frame," provided that its experimental hall is upgraded considerably.

The original Brinkman panel concluded that without a substantial increase in funding, DOE should not support two pulsed neutron sources, and recommended that Argonne's source, then just about to begin running, be terminated. DOE was unwilling to take such a drastic step and told Argonne to continue full operation through fiscal 1983 but begin winding down in fiscal 1984 and cease running in fiscal 1985.

Argonne has made the most of its opportunity. Although limited finances prevent running for more than 6 months per year, the reliability of the source is such that a neutron beam is available 90 percent of the scheduled time, and the intensity of the beam is close to the promised level. Some 70 experiments by researchers from 25 universities, industrial laboratories, and DOE laboratories were performed in the first 6 months of running. Argonne is establishing a large user community, with benefits both to U.S. neutron scattering and to the laboratory's security as a valued national facility. Louis Ianniello of DOE acknowledges that "we were reaching an irreversible decision point on what to do about Argonne's pulsed neutron source," and that this uncertainty was one reason for setting up the panel.

Although Argonne, which wants to expand to 8 months of running, could face severe financial restraints in fiscal 1983, the "big decision is for fiscal 1984 and beyond," says Ianniello. The Brinkman panel found that "Without question, [Argonne's pulsed neutron source] has demonstrated its value in a variety of experiments and will be effectively used for research in condensed matter physics, materials science, and molecular biology for the next few years if funding is available." It specifically called for funds to keep Argonne's source going through fiscal 1984.

In the end, however, it remains DOE's policy to shift pulsed neutron scattering research to Los Alamos, where the intensity of the neutron beam will be considerably higher than at Argonne. The life of Argonne's source may be prolonged, but not beyond 1986.—Arthur L. Robinson

*"Report of the Pulsed Neutron Research Review Committee" (unpublished). Panel members were: J. D. Axe, Brookhaven National Laboratory; R. J. Birgeneau, Massachusetts Institute of Technology; W. F. Brinkman (chairman), Bell Laboratories; H. A. Mook, Oak Ridge National Laboratory; and J. J. Rush, National Bureau of Standards.