the 6D orbit. If that happened, there would only be two electrons left in a valence orbit; nobelium ought to be plus two instead of plus three.

And that's just what Dr. Silva and his colleagues discovered. The analysis was made using what Dr. Silva deprecatingly describes as standard, classical chemical methods, made unique by the remarkable speed that the short-lived elements required. Because they decayed so quickly, only a few atoms of the element could be picked up in a single test; the experiments had to be run hundreds of times.

One of the tests run at the California laboratory depended on the fact that a plus-three actinide is insoluble in ammonium chloride, while a plus two is soluble. Mixing traces of nobelium in ammonium chloride solution, the experimenters hooked up a five-volt battery to a platinum wire dipped in the solution and a platinum plate at the bottom of the solution container.

If the nobelium was insoluble, as it would be if it were plus three, the voltage would tend to deposit it on the platinum plate. If it were plus two, it would be in solution and would not be deposited on the plate.

Measuring on the plate for radioactivity of the particular kind emitted by nobelium, the experimenters found very little. They conclude that, unlike all the other actinides, nobelium does not have a plus-three valence; the conclusion was confirmed by other experiments of a similar nature.

The nobelium used in these experiments was obtained by bombarding plutonium 244 with oxygen ions accelerated to 160 million electron volts.

Moving up the scale, the experimenters produced lawrencium 256, an isotope with a half-life of 30 seconds, by bombarding californium 249 with boron 11 atoms. Running the same kind of chemical experiments, they found that this time the actinide had a valence of plus three. What happens is clear, says Dr. Silva. With the 5F ring filled to capacity, the next electron is free to move back into the valence position in the 6D ring.

The results on nobelium were startling, because the element appears so completely to take the plus-two valence.

"We expected to get some plus-two observations," says Dr. Silva, "but not the overwhelming proportions we did get."

The experiment also makes clear just who first discovered nobelium, a controversy that raged for 10 years before being settled by a compromise last year (SN: 9/16/67 p. 274). A European team claimed to have synthesized the element, but scientists at Berkeley later challenged their method.

"The Europeans based their claim on having found a radioactive plus-three element," supposing that nobelium, like the other actinides, had that valence, says Dr. Silva. "But our experiments show that if they got a plus-three actinide, it wasn't nobelium."

Because of the nobelium brou-ha-ha, the international committee that confirms discoveries of new elements hasn't yet acted on Russian claims to have synthesized element 104.

"They're a little gun-shy, I guess," says Dr. Silva. When it is discovered, scientists expect it to have a valence of four, like hafnium, element 72.

But because the higher number elements should be even more short-lived than nobelium and lawrencium, the classical chemistry used in the present experiments probably won't work. Some new detection means will have to be devised.

SCIENCE TEACHERS

Changes: slow, experimental, overdue

NEA/Joe Di Dio

A far cry from collecting tadpoles: Schools experiment with new curricula.

For at least 70 years educators have been arguing that children would learn better by doing things than by being told things. Last week in Washington the message was still: Change the medium.

As some 8,000 science teachers gathered at the annual convention of the National Science Teachers Association, their leaders and lecturers decried the traditional means of teaching science, which have been aimed more at producing professionals in the various fields than at making whole populations scientifically literate.

Since a program aimed that broadly should begin early, attention was focused on elementary education. The last decade has seen a number of efforts to reform elementary science curricula; the basic idea seems to be replacing lectures by the teacher with student activity. But the activity demanded by the new curricula is not the sort that has been done for years past, such as planting beans or collecting tadpoles. Rather it seeks to encourage the pupils to view a natural situation the way a scientist would, to reason in a scientific manner, and to elucidate for themselves basic principles that underlie the details of different disciplines.

For example, Prof. Morris H. Shamos, president of the association, reports that he achieved a good deal of success in presenting to middle elementary school children a series of lessons from a curriculum reform project he

Science Service, Inc. is collaborating with JSTOR to digitize, preserve, and extend access to *Science News*. www.jstor.org

is involved in, based on the principle of conservation of energy. This is a long way from tadpoles; curricula of similar sophistication have been or are being produced by several working groups.

Four major programs under government funding include a California group's "Science Curriculum Improvement Study," the American Association for the Advancement of Science's, "Science—A Process," the Watertown, Mass., "Elementary Science Study" and the New York University-based "Conceptually Oriented Program in Elementary Science." In addition many school systems are working out curriculum alterations of their own.

To handle the new kind of science teaching requires especially trained science teachers who function in a way similar to the specialized music and art teachers who have been traditional in elementary schools, says Dr. Shamos.

There are between 90,000 and 100,000 elementary schools in the United States, and they have about a million teachers. Retraining all these teachers so that they could handle the new science curricula would not only be a formidable task, but an unfair imposition. Also, in the opinion of Dr. Leo Schubert of American University, this year's convention program chairman, getting such a project started would require overcoming attitudes of indifference, fear and even outright hostility to science on the part of many teachers.

It is better, both agree, to start fresh with especially trained new teachers. Prof. Shamos would like to see one special science teacher in each of the U.S. schools. At present there are very few. School boards have begun to hire them in significant numbers only in the last two or three years, says Prof. Schubert. ◇

HEALTH BUREAUCRACY

Shifts affect hospital builders, not researchers

Two out of three shoes have dropped in the long-considered reorganization of the health side of the U.S. Department of Health, Education and Welfare. The first came last month when Dr. Philip R. Lee, assistant secretary for health and scientific affairs, moved from a staff position into a line position as director of all the department's health activities (SN: 3/23 p. 284).

Now, as step two, the Public Health Service has been split into two administrations, one to retain the name of the present National Insitutes of Health, the other to be called the Health Services and Mental Health Administration.

It is believed that relatively low-level reshuffling of the reorganization plan is all that is holding up the third step —the consolidation of the Food and Drug Administration and various environmental health control programs into a Consumer Protection Administration.

The dismembering of the Public Health Service is likely to have a great effect on the administration of Federally financed biomedical research, but the shock waves are not expected to reach the lab bench. It will, however, facilitate medical school construction.

The subdivision of PHS announced by Secretary Designate Wilbur J. Cohen goes a long way toward finally realizing the dreams of NIH Director James A. Shannon. Shannon has pushed for an NIH independent of the Public Health Service and Surgeon General William H. Stewart, on the grounds that Stewart and PHS think in terms of service while NIH is bent on research. Further, NIH administrators have had to work through an organizational layer between them and the surgeon general; many of them feel this layer has been insensitive to NIH needs.

The reorganization plan was ordered to reduce the degree of autonomy in the balkanized HEW health services, not increase it through the creation of yet another practically independent agency. Under the plan, therefore, NIH has had to be content with a separate-but-equal role, still under Stewart.

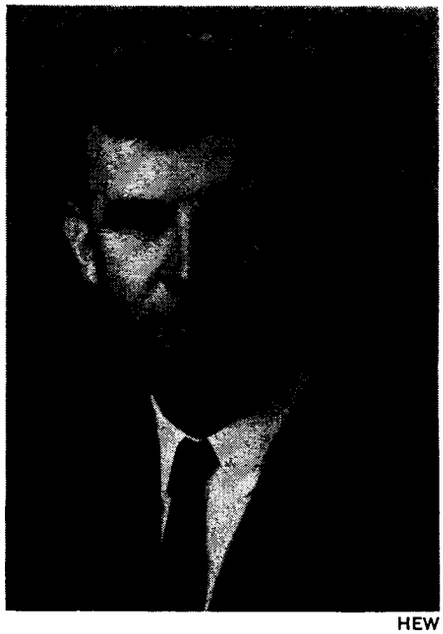
According to Cohen's announcement, Stewart retains his title of surgeon general and becomes "principal deputy" to Dr. Lee. The retention of the title is an anachronism designed to satisfy the requirements of many statutes to the effect that certain functions can be performed only by authority of the surgeon general.

Shannon, as director of the new NIH, will report directly to Stewart, as will Dr. Robert Q. Marston, acting director of the health services administration, and Dr. James L. Goddard, almost certain to be named head of the consumer protection administration.

The more powerful role for Stewart seems to be the result of pressure from his considerable number of supporters in the public health field.

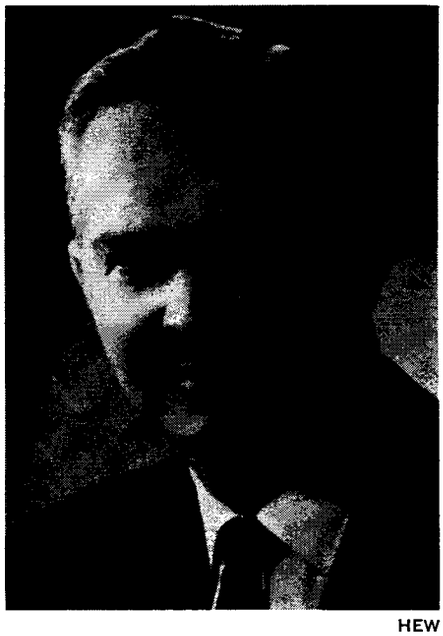
The shakeup is not likely to affect either intramural researchers or researchers working under NIH grants, except as it is expected to reduce confusion in the administration of their funds. There are not likely to be new attitudes felt toward basic as opposed to applied research, at least while Shannon is director (he retires in September, unless he and Congress can be persuaded to extend his tenure).

From the NIH standpoint the main impact will be felt in the administration of medical school support funds. The medical schools have been pushing the reorganization, and are happy with the current version. Previously an institution wishing to build a medical school had to go to one agency for library funds, another for money to build the educational plant, and another for money to install research facilities. This procedure had to be followed even though all the money was going into one building; one agency might turn an application down while another ap-



HEW

Lee unifies HEW health programs.



HEW

Marston is acting head of services.