Fermilab Receives a New Director: Upsilon Discoverer Gets the Job

After months of waiting, it has finally been announced that the next director of Fermilab, the country's highest-energy accelerator laboratory, will be Leon M. Lederman. The well-known particle physicist from Columbia University has long been associated with the laboratory and was working there in 1977 when he discovered the upsilon—a particle that is widely interpreted as evidence for a fifth quark in matter.

Rumors of Lederman's appointment had been circulating since late July, when he was actually selected by the board of the 53-member university consortium that manages Fermilab, University Research Associates. But bureaucratic problems arose with the Department of Energy, which funds the laboratory (*Science*, 13 October), delaying the formal announcement until last week. Lederman's selection was given official status on 24 October in a joint announcement by John Deutch of the Energy Department and Norman Ramsey, chairman of the University Research board. During the next year, Lederman will spend part of his time at Fermilab while finishing research commitments elsewhere, and he will begin as full-time director in June 1979.

The new director may not make sharp or immediate changes in the direction of the laboratory, but he is nevertheless expected to bring a new style of leadership to Fermilab. Lederman is replacing Robert R. Wilson, who resigned last February in protest over inadequate support and formally stepped down in July. "Lederman and Wilson see high energy physics in similar regards," says a close associate of the new director, so it is likely that Lederman will continue to give high priority to the laboratory's energy doubler project, whose level of funding was the issue that brought about Wilson's departure. Lederman, 56, is an energetic and fast-moving physicist who has also been described as a man who is "conscious of the ease with which a rigid pattern can develop" in a laboratory, who "sees a need for new things," and who "will bring a different weight of understanding to what the problems of research are." Known for his charm and wit, he is expected to be a very effective ambassador for the laboratory.

Lederman is also known as a tough competitor who is willing to make decisions, and who runs his own research group with a firm hand. Since 1968 he has also been the director of Columbia's small accelerator center, Nevis Laboratories, outside New York City. Working at Nevis has given him some administrative experience, but the yearly budget there is only about 5 percent the budget at Fermilab.

There are two elements essential to the success of particle physics, and just as surely as Wilson represents one, Lederman represents the other. Wilson was known among his colleagues as a master builder of accelerators, who trained at the Berkeley Laboratory of E. O. Lawrence and was one of the few American scientists to have an accelerator named after him. Lederman, on the other hand, has spent his scientific career building the large experiments necessary to detect the particles produced by new accelerators. His career began when the field itself began, just after World War II, and has touched on most of the important areas of high energy physics in the ensuing 25 years, including findings that distinguish the so-called weak nuclear force from the strong nuclear force, and almost including the pivotal J/psi particle, as he notes in his "unauthorized autobiography" (see box).

The J/psi particle, discovered in November 1974, proved to be evidence for a fourth quark and dramatically changed the tenor of elementary particle physics. Before it was found, the idea that particles with strong nuclear forces were composed of different arrangements of quarks was considered speculative, although plausible. Afterwards, the idea

From Pions to Upsilons

Soon after Lederman's upsilon discovery, the following "unauthorized autobiography" was published in the Fermilab newsletter, *The Village Crier*.

Leon Lederman is one of the oldest barely active particle physicists seen at Fermilab. He began his career back in 1946 when delivering a telegram to someone in the Pupin Physics building of Columbia University; he got lost in the labyrinth of tunnels and emerged four years later with a Ph.D. He began his research at the Nevis cyclotron and helped invent the first pion beam. He started counting pions in 1951 and when he reached 4722938, two of his graduate students hung themselves, and one was committed.

In 1953 he carried out a brilliantly conceived pion scattering experiment that missed the N resonance. His period of greatest creativity came in 1956 when he heard a lecture by Gell-Mann on the possible existence of neutral K mesons. He made two decisions: First, he hyphenated his name. Then he determined to find the neutral K meson. Working at top speed Lede-rman and his group constructed an accelerator at Brookhaven and put the cloud chamber in the beam. In 1956 they found the neutral K meson.*

Flushed with success Lede-rman decided to have an END OF RUN PARTY. Unfortunately, due to a typist's confusion, it came out END OF PARITY RUN and led to the widespread, but mistaken, notion that parity had been violated. Oh well. Lede-rman was promoted and sent to CERN. There he started the famous g-2 experiment and managed to confuse it so badly it took 26 physicists nineteen years to finish.

In 1961 he worked under M. Schwartz and J. Steinberger on neutrinos. He was in charge of finding neutral currents. Schwartz was in charge of finding Lede-rman. In 1968 he invented the di-muon experiment and missed the J/Psi particle. In 1969 Lede-rman invented the high speed digital computer but his ideas were stolen by IBM. Since that time he has resolutely refused to use computers.

In 1974 he gave the main Fermilab dedication address. Fortunately, his words were obscured by [the Chicago] wind. His group then looked for direct leptons and missed the J/Psi. The great success of the upsilon experiment owes much to the fact that Lede-rman was very busy on his memoirs during most of the crucial phases of the experiment.

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tween the United States and foreign countries, international organizations or commissions of which the United States and one or more foreign countries are members."

Just what that will mean in practice is far from clear. The new legislation leaves most of the details up to the State Department by delaying implementation for 1 year, and requiring the Secretary of State to spell out by 20 January 1979 budgetary and personnel requirements to carry out the objectives of the legislation. Rather than relying totally on State Department personnel to implement its goals, the new law calls for the department to go out and consult with individuals, industries, universities, and other research institutions.

To some, the demand for technological literacy in the State Department has been put off for too long. Critics contend, for instance, that U.S. foreign policy on nuclear matters, especially as related to proliferation issues in the early 1970's, was inadequate at best. The State Department appeared to recognize the issue too late to deal with it effectively. And U.S. tardiness in getting preparations under way for the U.S. Conference on Science and Technology for Development, scheduled for next summer, is pointed to as another example of U.S. failure to deal with a set of potentially explosive issues.

But the situation may be about to change. The new legislation grew out of a massive study, *Scence, Technology and American Diplomacy* (three volumes, 2107 pages, 7 years in preparation by the Congressional Research Service), that was initiated by Rep. Zablocki and completed last year. For many, it became the "bible" on science, technology, and foreign policy. But in reviewing the study for the June 1978 issue of the *Bulletin of the Atomic Scientists*, W. Murray Todd, executive director of the Commission on International Relations of the National Academy of Sciences, took issue with the scope of the proposed international science policy. "The implicit assumption," he said, "that such a policy is needed can be questioned on the grounds that a policy would perforce have to be so broad and consequently so vague as to be no policy." Backers of the legislation, however, say that its impact is inevitable and that it is now just a matter of time before the State Department begins its crash course in science and technology.

—William J. Broad

achieved widespread acceptance, and the question arose of whether there were still more quarks. Lederman took up the search while heading a large experimental group at Fermilab and, after a false start, found a particle three times as heavy as the J/psi and similar to it in many respects. The finding was not only evidence of a fifth quark, but also a hint at a sixth.

The new director's connections with Fermilab go back to the period even before the new accelerator proposal had a home. He was on the site selection committee, which toured the country evaluating proposed locations (46 states were eager to have the facility), he gave the dedication speech for the laboratory, and he led one of the first experiments to be conducted on the new accelerator. As spokesman for the "users" of the laboratory, he lobbied hard to get a comfortable meeting spot for the physicists who traveled there from all over the country to do their experiments, and when one was built, many suggested that it should be called "Leon's Place."

Lederman has been known at Fermilab both for his quickness of wit and for his delight in chiding Wilson over the idiosyncrasies of life at the laboratory.

In his speech given at the dedication of the laboratory, he praised Wilson as a man "whose charisma and artistry and impudence and unflagging optimism have alternately driven us up the wall but also occasionally to some heights of pleasure." A volume of correspondence between the two over Lederman's first proposal is notable for the repartee in Old English and Old French, and early this year Lederman presented Wilson with a memento of the upsilon experiment—a chrome-plated piece of burned out magnet. Lederman said that the piece (which caused a fire and delayed the experiment) should be memorialized because successes in experiments are duly recorded, but failures, which can be even more spectacular, are not properly honored.

Now that he has been named head of the $80 million per year enterprise that is Fermilab, Lederman will soon find himself in the same position that Wilson occupied for 11 years. "I never thought of myself as a laboratory director" or necessarily wanted to direct a large laboratory, Lederman told *Science*. "I never wanted to do anything except present great results and tell funny jokes," he said. But Fermilab, after operating for 5 years at accelerator energies of up to 500 billion electron volts, having committed to an ambitious project to double that energy within the next 3 years, and

Leon M. Lederman

facing stiff competition from a new European accelerator of the same type in the same energy range, appears to be at an institutional watershed. Important questions have been raised about the balance of funding between accelerator development and experimental work. Lederman, rather than being on the outside, is now on the inside and beginning to grapple with questions about the laboratory's future.

"We have a great laboratory to build upon," he says, and he has high praise for the accomplishments of Wilson, whom he calls "a great physicist and truly one of the visionaries of modern science." During the months since he was selected, he has been spending 1 to 2 days a week at Fermilab and has been reviewing the funding of all aspects of the laboratory.

"I've been concentrating much of my time on the doubler project and the various options for it—what they can and cannot do," Lederman told *Science*. But at the same time, research on the present accelerator faces problems—limited funding and uncertain reliability. "Our budget is falling in real terms," he says, and first priority must be given to the present research program. "We are studying how much more money is needed to make this machine reliable and responsive to the physics community," he says. For lack of funds now, major parts of the lab are shutting down on a rotating basis (the meson area closure referred to as the "mesopause.")

Final Word on Disputed Mastectomies

Last year a great deal of fuss and publicity was generated by reports that as many as 66 women had undergone needless mastectomies as a result of a mammography screening program sponsored by the National Cancer Institute (NCI) and the American Cancer Society to detect early breast cancers.

A working group last year turned up the possible misdiagnoses while assembling data on 506 cases of difficult-to-diagnose "minimal cancers." The concluding report of the group, which was finally made public in October, contains the closest thing to the definitive word on the "66 cases."

According to the report, two of the cases were included through clerical error, so the number at issue was actually 64. The group was able to obtain additional pathological evidence on 36 of these. The pathology subgroup, headed by Robert M. McDivitt of the University of Utah Medical School, confirmed the diagnosis of cancer in 16 of the 36. That left 48 women for whom a cancer diagnosis could not be confirmed. Of the 48, 11 women who were originally thought to have cancer did not undergo mastectomies, although two of them had local excisions. The number of women who may have had unnecessary mastectomies is then reduced to 37.

Just how many women were told they had cancer when they did not have it was a question that apparently caused furious discord within the working group between pathologists and clinicians. McDivitt says cautiously that "we will never know whether we reviewed" all the pertinent material, but the pathology group apparently believed that a misdiagnosis of cancer was made in 48 cases.

The clinical subgroup, however, headed by Charles Smart, also of the University of Utah, is convinced that there were needless mastectomies in no more than six cases. Smart points out that of the 37 women who had mastectomies, 16 had their biopsies reviewed by outside consultants before the operation, and the consultants concurred in the diagnosis of cancer in all but one case. In postoperation reviews by project pathologists, the diagnosis was confirmed in 23 cases and disputed in 11 (data were not available for the remaining three). Given that six of the women, three of whom had already had mastectomies, desired mastectomies even in the face of equivocal evidence, there were very few mistakes, if any, according to Smart.

The question seems to boil down (again according to Smart) to: Who do you believe—the pathologists on the scene who had all the necessary evidence on which to base a diagnosis, or the working group which came along later and was not always able to obtain the slides on which the original diagnoses were based? Others see Smart's position as an instance of cancer clinicians defending their errors at all costs.

The adverse publicity over the mammography program and the questionable operations resulting from it has stirred up a great deal of anger and resentment among radiologists, pathologists, surgeons, and officials at the American Cancer Society. The mammography program, which has undergone major modifications since its inception in 1974, has been cited as an example of a new technology launched wholesale on the public before adequate evaluation of its safety and implications. The publicity has also highlighted the difficulties of making diagnoses in the case of very small lesions.

John Bailar, editor of the *Journal of the National Cancer Institute* and one of the first to raise doubts about the mammography program, thinks the events have taught everyone a valuable lesson. Bailar, formerly head of NCI's cancer control division, believes there is more unnecessary surgery going on than that indicated by the examination of the 66 cases. At least now, he says, "there's not a pathologist in the country who isn't aware of the difficulty in diagnosing these very early lesions."

According to the NCI, the women who were the subjects of "discrepant diagnoses" have been notified through their physicians. Bailar thinks some malpractice suits will very likely result. Smart sees no basis for any suits. "This is the most defensible group of cases I have seen," he says.

The complete report of the working group, which was headed by Oliver H. Beahrs of the Mayo Clinic, is to be published in the *Journal of the National Cancer Institute* next March.—C.H.

Second priority, Lederman says, is for "at least a minimal doubler," which might not quite reach 1000 GeV but would give "really good physics no one else can do." He has already established an outside review of the doubler project to look at the existing "game plan," and hopes to move it from an R & D footing to the status of a comprehensive accelerator plan (by fixing the design parameters) early next year. After getting enough manpower and funding into that effort, Lederman says, third priority is to consider doubler improvements that would make possible colliding beam experiments.

Given his strong background in experimental work, those who know him have no doubts about how Lederman will handle the research program. In the area of accelerator development, "he can bring in good advisers and can learn about accelerators," says a well-known colleague. "I think he will be a good director."

If there are grounds for uncertainty about Lederman's performance, they have to do with his lack of experience in administering an organization that is anywhere near the size of the 1500-employee physics laboratory. "Leon is a very good leader of a small group working in direct contact with everyone," says a physicist who has worked with him at Brookhaven National Laboratory. "In a small group he gets great rapport." Whether he will easily delegate enough authority to administer a large organization effectively is an open question, according to the physicist.

Some observers think that a number of changes need to be made in the administrative ranks at Fermilab and question whether Lederman will have the heart for such a thankless task. On this point, says one observer, "it is very tough to predict how he will make out."

The process of acclimating the new director to the laboratory and vice versa could conceivably be aggravated by the trials of weekly commuting. Even though Lederman officially spends 1 or 2 days a week there, he says that he in fact works 40 hours per week at the laboratory "out of my normal 80-hour week." Furthermore, he says that the 1 or 2 days allow for as much detail about the laboratory as he can assimilate at once; then he has the rest of the week at Nevis (which is at a beautiful site in upper Westchester County overlooking the Hudson River, on what used to be the old DuPont estate) to think seriously about the options for what is still the world's highest-energy accelerator.

—WILLIAM D. METZ

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