Italian Science and the "Rubbia Effect"

A research system built around strong personalities has its strengths and weaknesses

Rome. In Italy, they call it the "Rubbia effect." When the National Institute for Nuclear Physics (INFN) approached Parliament last year for approval of its ambitious 5-year program costing almost $500 million, the response was equivocal, and the organization received funding for the first year alone, at a level substantially lower than its request.

This year, however, when INFN went back to the Parliament with its budget proposals for the remaining 4 years, it was able to point proudly to the Nobel Prize that had just been awarded to Italian physicist Carlo Rubbia for the discovery, along with Simon van der Meer, of the W and Z particles. It came away with considerably more money than it had asked for—including enough to cover the shortfall in 1984.

The incident illustrates both the strengths and the weaknesses of Italian science. The country's prominent position in high energy physics is largely the result of a tradition built up by a succession of charismatic characters, starting with Enrico Fermi in the 1930's; and in all areas of science, personal charisma still plays an important part in funding decisions.

On the positive side, the emphasis on creativity as much as on intellect has helped build bridges between the worlds of physics and engineering that have contributed directly to many of Italy's technological achievements, from motor cars to advanced computers. Several prominent Italian industrialists are physicists by training, while Rubbia himself is known as an experimentalist and machine-builder rather than a theoretician. In a recent newspaper interview he said that if he had not been a scientist he would have been an engineer—his father had wanted him to be a lawyer—and that "instead of particles I would have dealt with computers."

The system, however, also has drawbacks. One is the fact that, because Italian science depends so heavily on individuals with strong personalities—and often political connections—who can create and maintain support for research groups in a frequently unsympathetic environment, areas that do not have such champions tend to suffer, even if they reflect important social needs. "For example, one would expect Italy, with all its earthquakes, to give some priority to research in seismology; yet although we have had some theoretical seismologists in the past, this has not happened," says Carlo Bernardini, professor of physics at the University of Rome. "This is the main weakness of research in Italy; the strong sectors have a good life, but the weak ones do not."

The result, according to many research workers, is that Italian science—

Luigi Granelli

Wants to double share of GNP spent on R&D.

as, indeed, its economy in general—displays what has been described as a "zebra" quality, with areas of outstanding success alternating with others in which international recognition has been minimal.

The situation is reflected by statistics of research performance. Even though the Italian economy is the seventh largest in the Western world and the fourth in Europe, the proportion of its gross national product spent on research and development (1.3 percent last year) is about half that of its main competitors. Closing this gap is one of the main preoccupations of the current Minister for Scientific Research and Technology, Luigi Granelli. "I would like to see this figure double to 2.5 percent by 1990," he said in a recent interview.

According to Granelli, a major obstacle facing Italy in attempting to boost its research base is not lack of money, but the difficulty of increasing the number of scientists who would be able to spend it effectively, often because those who could do so have been attracted to work elsewhere.

The same problem preoccupies Luigi Rossi-Bernardi, the newly appointed president of Italy's main government agency for supporting science, the Consiglio Nazionale delle Ricerche (CNR).

Rossi-Bernardi makes liberal use of a sheaf of statistical tables produced from data on Italian authors listed in the Science Citation Index to support his claim that the country is well up with its main competitors in terms of research productivity—for example, the average number of research papers produced by each quoted scientist, or per dollar spent on R&D.

Since a decision 4 years ago shifted financial responsibility for university research to the Ministry of Education, CNR has focused increasingly on what is called "finalized programs"—strategic research areas that now include fields such as new materials, image processing, space technology, and molecular biology. Rossi-Bernardi's strategy for his agency is to build on the strengths of Italian science, where these exist, rather than to scatter its funds widely among a range of scientific institutes with little reference to their scientific output, a practice which, he claims, has happened too often in the past.

Central to this strategy is a plan revealed by Rossi-Bernardi last month to concentrate the work carried out in CNR's 200 institutes, each of which currently enjoys a high degree of scientific autonomy, into ten identified research areas. In addition, each separate institute is being asked in future to provide detailed annual reports of its achievements, including some form of external assessment of its scientific output; some of the most unproductive are likely to be closed.

The proposals have already generated some strong protests from many CNR-supported scientists, who see in them the danger of much greater state control being exerted over their work. In universities, claim critics, the main problems are inadequate equipment, excessive red tape, a lack of career openings for young scientists, and the low pay (and status) of

research assistants, rather than overall productivity.

Rossi-Bernardi, however, defends the idea of focusing the CNR's research support on centers of excellence that can provide "a critical mass of good people"—even if this means diverting resources to help Italian scientists now working in the United States and elsewhere "to return to Italy for short periods to help us formulate quality control on our programs."

Rubbia, who teaches at Harvard University and carries out most of his research at the European Laboratory for Particle Physics (CERN), but visits Italy regularly, serves as a useful role model. "The Nobel Prize was a very important demonstration that we have to build up centers of excellence to attract people like him," says Rossi-Bernardi.

At the same time, both Rubbia's success and the heavy emphasis placed on high energy physics within the research budget also demonstrates another key fact of Italian science, namely, that international collaboration—both on research projects and on the construction of major research facilities—is more important and more enthusiastically supported than in any other large country in Europe. The reasons for this are not merely financial. The creation of CERN, for example, in which Italian physicists such as Eduardo Amaldi played a key role, found political support in both Europe and the United States in the postwar years partly because of its value as a symbol of a united, Westward-looking continent.

Indeed some politically active scientists, such as physicist Marcello Cini,

Slowdown Urged in High Energy Physics

Western nations should agree to slow down the speed at which high energy physics is developing in order to free up more resources for other fields of science, according to a top-level British scientific committee set up to consider whether the United Kingdom should withdraw from the Geneva-based European Laboratory for Particle Physics (CERN).

Given the overall financial pressures on the science budget, the current level of expenditure on particle physics in Britain "cannot be justified and should be reduced as soon as possible," says the committee in a report to the Minister of Education and Science, Sir Keith Joseph, which was published in London on 18 June.

As far as the international picture is concerned, it adds, the present growth of particle physics is also too high and should be reduced not only at CERN but world-wide—presumably including the United States.

The committee was chaired by the molecular biologist Sir John Kendrew, a former director of the European Molecular Biology Laboratory. It recommends against complete withdrawal from CERN—at least not before 1989, the date when CERN's latest accelerator, the 27-kilometer circumference Large Electron Positron (LEP) collider, should be completed (*Science*, 24 May, p. 968).

However, the committee adds that membership after this date should only be continued if it can be achieved "at a significantly lower cost." And it suggests that Britain should immediately give notice to the other 11 member states of the organization that it wants to negotiate reducing its contribution (currently about $40 million a year) by a series of steps, starting with a 5 percent reduction in 1988–89 and leading to a 25 percent reduction by 1991–92.

Since all CERN subscriptions are calculated on a pro rata basis, this would imply that other member states should lower their subscriptions by a similar proportion. Furthermore, suggests the committee, funding of domestic activities in particle physics in Britain should be reduced even more drastically, to 75 percent of its current level of $6.25 million a year by 1990–91.

The committee was established last year in response to widespread criticism of the distortive effect of the CERN contribution on the other areas of British science, particularly since the contribution is paid in Swiss francs, which have been rising sharply in recent years against the pound (*Science*, 20 April 1984, p. 266).

Hoping to head off anticipated criticism from other CERN member states that a significant reduction in contributions would inflict a highly damaging, perhaps even fatal, blow to the organization, the committee sets out various proposals for achieving a 25 percent cut in the laboratory's budget. The main money saver would be a decision to delay the planned upgrading of LEP from a 50 × 50 GeV to a 100 × 100 GeV electron/positron collider. The committee admits that reductions in CERN's budget of the order of magnitude it is proposing "cannot be achieved easily" but suggests that they are "feasible" and represent the "minimum" that is required.

The committee's proposals about how CERN might absorb the cuts have already been fiercely contested by several British physicists, such as Christopher Llewellyn Smith of the University of Oxford, who argues that a 25 percent cut in Britain's contribution after 1991–92 would result in a situation for CERN that would be managerially impossible. Llewellyn Smith, who acted as a scientific adviser to the committee and was the only particle physicist directly involved in its deliberations, suggests that it would have been more honest of the Kendrew committee to have recommended a straight withdrawal.

It is generally accepted in Europe, however, that such a suggestion would have carried a high political cost, particularly as politicians in other member states might have used it as an excuse to follow Britain's lead and recommend that their country withdraw from CERN as well.

In contrast, although even the proposals for a stretched-out program in the 1990's will inevitably raise strong protests from other countries, at a less public level it may be possible to build a consensus around some form of the British proposals, even if it is not the full 25 percent budget reduction.

Almost every other European member country—including France, West Germany, and even Italy, which currently spends about twice as much as Britain on the field (see article page 1508)—is already under pressure from other scientific fields to reduce its funding for particle physics. Rival projects for limited research funding include plans for the new European Synchrotron Radiation Facility, the recently expanded research program of the European Space Agency, and the various projects being proposed by France for the European Research Co-ordination Agency (EUREKA). —**DAVID DICKSON**

argue that the enthusiasm of Italy's politicians for participation in projects such as CERN or the atomic energy agency Euratom was motivated partly by a desire to prevent the country from moving too far toward the Left.

Whatever the historical roots, Italy is now an important partner in a variety of technological projects in which other countries have taken the lead, ranging from the French fast breeder nuclear reactor Superphenix, to which Italy is contributing one-third of the costs to Spacelab.

Frequently, as with the case of the superconducting magnets that are being built for CERN's new Large Electron Positron collider, participation in such international projects has been more than justified by the substantial engineering contracts won by Italian companies in fields of high technology for which there is no domestic demand.

The same spin-off effect operates within science itself. Research minister Granelli argues that the emphasis on international projects "is a great help to us," since they can be used "as a push" to justify supporting complementary research at a national level.

Thus although Italy is not likely to be chosen as the site for the new European Synchrotron Radiation Facility (*Science*, 27 July 1984, p. 391), plans are already being discussed for a smaller, national facility (possibly operating at a different wavelength) which, it is argued in Rome, would put Italy in a position to reap the full benefit from its expected participation in the European facility.

In the past, again, it has been high energy physics that has benefited most from the spin off effect. Although a large proportion of the INFN's budget is spent directly on CERN, there is also money in the 4-year program approved by the Parliament for several domestic facilities—including an underground laboratory for studying proton and neutrino decay processes, the so-called "Gran Sasso project."

Not surprisingly, the generous funding provided to high energy physics has generated some resentment in other, less-well-endowed fields and demands for redressing the balance. "It is gradually becoming clearer that you must have a large reservoir of basic research in all fields to be able to compete in the international marketplace," says condensed matter physicist Carlo Rizzuto of the University of Genoa.

Nicolo Cabbibo, the president of INFN, provides three answers to the complaint that support for nuclear physics is distorting the overall shape of Italy's research effort. First, although this support is high by Italian standards, it is in line with that provided by other Western nations. Second, the investment in high energy physics has brought ample rewards in terms of both scientific productivity and national prestige. "Our success is probably due to the fact that we seem to be quite effective in making good use of the money we are given, for example in the number of scientific papers that we produce," says Cabbibo. And third, other fields of science should not be trying to take money away from physics, but to emulate its success. "I do not think that anyone is getting less money because we are getting too much," he says.

Detractors of this argument claim that the current strength and prestige of high energy physics in Italy is also partly the result of patronage received from both the United States and the rest of Western Europe, whose price in terms of lost political independence is seldom acknowledged.

Supporters, in contrast, claim it merely indicates that the bootstrap mentality that led physicists such as Amaldi to conduct advanced experiments in the immediate postwar years on improvised apparatus built from army-surplus equipment—and subsequently played a large part in the petrochemicals-induced "economic miracle" of the 1950's and 1960's—remains alive and well as Italy prepares to meet the challenges of the physics-driven technologies of the 1990's.—**David Dickson**

A Guarded Endorsement for Shock Therapy

NIH panel finds it effective for short-term treatment of severe depression; calls for more training and monitoring

A panel assembled by the National Institutes of Health has given cautious endorsement to electroconvulsive therapy (ECT) as a treatment of last resort for some types of severe depression. The procedure, which the panel notes is "the most controversial treatment in psychiatry," has long been the focus of an intense medical and political debate. Attempts to regulate ECT have occurred in more than half the states, and the procedure was outlawed in Berkeley, California in 1982 (a decision that was later overturned in court).

The panel's conclusions, which were developed at a 3-day consensus conference earlier this month, are based on evidence that the risks of serious side effects are relatively low. In essence, the panel, which was chaired by Robert M. Rose of the University of Texas Medical Branch and consisted of 12 health professionals, a lawyer, and a consumer advocate, said that ECT is effective in treating severe depression that has not responded to drug therapy. It emphasized, however, that patients should be informed as fully as possible of the potential risks.

The treatment was developed following the serendipitous observation that epileptic seizures appeared to have an ameliorative effect on psychosis and depression. Introduced in the United States in 1940, ECT has a checkered past, having been applied indiscriminately to a range of mental disorders and misused for the purpose of making patients more tractable. In the early days, the convulsions often caused bone fracture, but the 1950's saw the gradual adoption of "modified" ECT, which includes the use of muscle relaxants and oxygen to prevent the death of brain cells when normal breathing is interrupted.

The use (and abuse) of ECT has fallen dramatically since the early 1960's, primarily because of the advent of psychotropic drugs. In 1980 the National Institute of Mental Health (NIMH) reported 33,384 cases, but treatment has been on the rise in the past few years, with estimates of the annual number of patients treated ranging up to 100,000—most of them in private general hospitals (which handle the bulk of mental patients outside state hospitals). Outpatient ECT is also increasing.

Experts at the conference felt that research on long-term treatment out-