volved. Under existing law, FWPCA could bring an enforcement action against Ship Channel polluters only at the request of the governor of Texas or if pollutants contaminating shellfish in the bay could be traced back to specific outfalls on the channel.

Last year the Texas Legislature authorized the establishment of a Gulf Coast Waste Disposal Authority, hoping thereby to overcome much of the present diffusion of responsibility for protection of the bay environment. Now being organized, the Authority will face a critical political test when it appeals to voters of the bay area for permission to levy taxes and issue bonds. If, however, it survives this test, the Authority will have a chance to carry out an ambitious program of regional water quality management comparable even to the work of the *Genossenschaften*, the regional water resources associations of the Ruhr. Under its legislative mandate, the Authority could build not only waste collection and treatment facilities but facilities of any other kind needed for cleaning up the bay, such as possibly an aeration system for the Ship Channel.

Further, the Authority is expected eventually to become self-supporting by levying effluent charges on the industries and municipalities from which it receives wastes. The Authority probably will base its charges on the quality of these wastes, thus giving its clients an economic incentive to improve their effluent quality by pretreatment or industrial process changes. Polluters do not have to join the regional system, but if effluent and water quality standards are vigorously enforced by the Water Quality Board and by the Authority itself, some polluters will have no practical alternative but to join.

Still needed is a comprehensive resource management program for the Galveston Bay system, one which could complement the activities of the Waste Disposal Authority by developing water and land-use plans to protect the bay from such things as harmful water diversions and the filling in of marshes for housing or industrial sites. The Nixon administration has asked Congress to authorize a modest program of grants-in-aid to encourage states to establish such management programs for their estuarine zones.

Even if Congress acts favorably on this possibly inadequate proposal, which is all carrot and no stick, Texas and other states will be free to decide whether to have their estuaries managed systematically or left to the kind of random and conflicting forces of use and development responsible for their present condition. However, the Texas Legislature last year ordered an inventory of the state's estuarine resources and a moratorium on the sale or leasing of submerged lands until 30 June 1973, unless the inventory is completed sooner. Also, the Galveston Bay Study and the establishment of the Waste Disposal Authority could be steps in the direction of a comprehensive program of estuarine management.

In sum, Galveston Bay is providing a classic case history of an estuary that can be rescued from its troubles only by determined and imaginative effort. Other major estuaries, such as San Francisco Bay and Chesapeake Bay, are troubled by problems of their own but none has problems more difficult and complex than those of the Galveston Bay system, especially on the Ship Channel. The problems of the Ship Channel alone are enough to put the state and federal water pollution control programs to a significant test. But while optimism is not yet in order for those who would save Galveston Bay, neither is despair. The solution to the bay's problems seems to lie in large scale research, ambitious programs of pollution control and water- and land-use management, plus tough enforcement and a close watch on the outfalls.

—LUTHER J. CARTER

West Germany: Educational Reform Is the Major Domestic Issue

Bonn. The antipollution folk movement now sweeping the United States has its counterpart in West Germany. In that country, however, it is educational reform and expansion that, after long neglect, have suddenly arrived to fill the press and meeting halls, and also to become an object of uppermost government concern. "No experiments" was the slogan that kept Konrad Adenauer in office from 1953 to 1963, and that, until the recent change of government, tended to color the thinking of his successors. But Germany today rings with public introspection over its domestic problems and with demands for experiment and innovation, particularly in the field of education, widely designated the nation's number one problem. *Der Spiegel*, Germany's *Time*-like weekly, recently devoted sections of 17 issues to descriptions and analyses of the nation's educational deficiencies, setting out a gloomy picture of overcrowding, antiquated teaching techniques and curricula, and authoritarian rule of the schools. When the first change of ruling party in 20 years brought Willy Brandt to the chancellorship of the Federal Republic last fall, he declared that "education and training, science and research are at the top of the reforms to be carried out." Later it appeared that the latter two had been found to be in reasonably good shape ("They seem to run themselves pretty nicely," is the view of a staff member at the U.S. Embassy in Bonn); this leaves education and training at the top of the top for reform. One of Brandt's first reorganization moves was to make it clear to his constitutionally decentralized country that the federal government would henceforth seek to play a major role in the educational affairs of the 11 states. This intent was indicated by appending an educational role to the fast-growing Ministry of Science, with the resulting organization christened the Ministry of Education and Science. The budgetary division between the two functions is yet to be detailed, but it has been announced that, while overall federal expenditures will be held to an 8 percent increase, funds for the new Ministry will rise by 40 percent. As is usually the case in such matters, the bookkeeping is tricky, especially since the federal role in education is starting from a small base, but there is no doubt about the priority.

As a symbol of respective national

concerns, the German decision to amalgamate education and science provides an illuminating contrast to the French approach. When the Pompidou government came to office last year, one of its first steps was to graft the weak Ministry of Industry onto the strong Ministry of Science, creating a Ministry of Industrial and Scientific Development (*Science*, 26 September 1969) with a mandate to promote greater industrial productivity from the government's research expenditures. Germany, however, is not worried about its industry; it is worried about its schools and universities. The grounds for worry have long been proclaimed by German educational reformers, many of whom, like their antipollution American counterparts, suddenly find themselves eagerly employed or consulted by government after years of being virtually ignored. But among the educational reformers it is not unusual to encounter the view that it was not reasoned tracts or statistics that brought political respectability and power to the reform movement; rather, it was the nearly nationwide uprising of German university students—involving perhaps the most sustained violence to sweep any educational enterprise in the world, with the exception of Japan—that produced the current enthusiasm for reform.

Out of the Wilderness

These uprisings, in response to an archaic system that makes West Point look like a showcase of academic democracy, seem to be played out for the moment, but, after a long time in the wilderness, the reformers repeatedly talk about how little time they feel there is to get at the problems. Thus, one of Germany's most renowned evangelists for educational reform, Hildegard Hamm-Brücher, recently installed (to her own great astonishment) as Secretary of State for Education in the new Ministry, remarked in an interview, "I fought for reform for 15 years and didn't succeed. But now, because of recent events, we have a new atmosphere. The question is whether we will get the money we need fast enough to do the things that should have been done long, long ago. Germany is rich, but the states are strong, and in the past there has not been enough public money or understanding to provide properly for education."

Against the background of Germany's long-sustained industrial boom, it is easy to conclude that a strong educational base must inevitably exist. Perhaps it does, but in a form that does not show up well in international comparisons. Whatever the case, Germany is now taking painful notice of the fact that, despite educational expansion in recent years, the country still trails its industrialized neighbors in the percentage of university-age persons enrolled in school. Even with the best of statistical services, these numbers can be deceptive, and, Germans lament that their statistics on education are poor. But it is commonly stated that, in Germany, only about 8 percent of the university age group is enrolled in long-term studies beyond the secondary school level, as compared with approximately 14 percent in Great Britain and France and about 50 percent in the United States.

Another finding, according to Dr. Hamm-Brücher, is that Germany devotes only about 11 percent of her public spending to education, as compared with France's 17 percent—and no one contends that French education is well financed. Still another comparison cited by officials of the Ministry concerns the proportion of the gross national product devoted to education and related scientific activities, with Germany trailing most of the field. Whatever the precise figures may have been, it has all along been apparent that the German educational system functioned in a fashion that made it relatively unusual for offspring of the working class to get a higher education; it is estimated that they comprise only about 5 percent of university enrollments. Now, however, there is a strong feeling that something should be done about it.

Though plausible remedies are in ample supply, the difficulties involved in applying them generate a good deal of pessimism. Germany's constitutional setting of strong states in a federal system, plus the universally innate conservatism of the educational trade, easily evokes memories of the torturous educational struggles that enveloped the Kennedy Administration. And the similarities extend to the types of people the Brandt government has brought to high positions, as well as to the strategies they are contemplating at this early stage of their tenure. The constitution that was adopted after World War II provides for an extensive fragmentation of power as a barrier to the return of a strong central authority. In education, the fragmentation was accomplished by giving the states virtually complete responsibility for their schools and universities—so complete, in fact, that, until the arrival of the Brandt government, Germany may well have been the only nation, large or small, without a central government agency responsible for educational affairs. Since necessity is a powerful force (and since science, in Germany as elsewhere, usually exists in a politically protected enclave), the means were often found to channel federal funds into university activities related to research. In certain fields of big science and technology, such as space research, atomic energy, data processing, and oceanography, this was administratively simple, since fragmentation made no sense and the federal government clearly held the authority. In lesser, but still costly, fields however, the means were found, one way or another, to provide federal assistance, regardless of constitutional niceties. But a common lament at the federal level was that, with the states still retaining final authority for education and with the universities themselves often sovereign within the states, there was little possibility of relating higher education to any assessment of national needs. Furthermore, the money could not be used as a lever to break up the rigid hierarchies that dominated many institutions. Nor was it possible to achieve any rational distribution of expensive research facilities. As one German official indignantly declared, "there are probably more accelerators and generators per square kilometer in Germany than in any other country, simply because almost any institute that wanted one could get it, regardless of the need or how close by another similar facility might be."

Limited Openings

Though the educational aspirations of the new Ministry are great, the constitutional openings available to it are, on the face of it, narrow. Principal among these is a constitutional change of last spring (not to be formally implemented for several years) permitting the federal government to provide 50 percent of the costs of university construction and to take part, with the states, in the planning of university expansion. This opening is of limited potential, it might seem, especially in view of the fact that, under special federal-state agreements, the federal government had already been putting money into university expansion. But, as veterans of the American educational wars will surmise, it is altogether different when the financial basis has constitutional underpinnings and is accompanied by the seem-

ingly minor right to take part in planning—a matter that, in Germany's case, is yet to be spelled out in detail. The newly appointed Minister for Education and Science, Hans Lüssink, a civil engineer and former chancellor of the Karlsruhe Technical University, has proclaimed that he wishes to promote education rather than legal controversy. In line with this, Lüssink, who has also served as president of the West German Conference of University Chancellors and as president of the German Science Council, has already taken a number of steps that suggest a well-sharpened sense for orchestrating power without falling into constitutional entanglements. Thus, after a meeting Lüssink held last November with the education ministers of the 11 states, it was announced that the federal and state governments had decided to look into "the establishment of a data bank as a basis for educational planning; the foundation of an institute for curriculum research . . .; questions of vocational education, particularly in connection with the establishment of a federal institute for research into vocational courses; questions concerning the promotion of refresher courses and in connection with this further social questions relating to students at university level, such as student health insurance, students' hostels, housing for students, etc."

Another of Lüssink's early moves was to equip his sprawling, mushrooming Ministry with a central planning staff, which reports to the number two man in the Ministry, a 41-year-old newly elected member of Parliament, Klaus von Dohnanyi, a Yale law graduate who from 1956 to 1960 was chief of planning for the Ford Motor Company in Germany. From 1960 until his election last year, Dohnanyi was the managing partner in Germany's largest market research and management consulting firm. Dohnanyi is the Ministry's Parliamentary State Secretary, normally an important position, and especially so in this case since Minister Lüssink is not a member of Parliament and is regarded as being without political affiliation.

With university enrollments that rose from 140,000 in 1954 to 320,000 last year, and with further rapid growth on the way, the Ministry has initiated a crash building program directed by a planning council drawn from the states and the federal government. The most packed and blighted places are being given priority, in what is apparently a desperation move to make the most of the relative calm that has now settled on German campuses. In the meantime, the Ministry is conducting extensive consultations and discussions throughout the country on long-range reform in the schools and universities, and controversy and debate go on in the press and in public meetings. To a visitor, "healthy" is the word that comes to mind in viewing Germany's efforts to deal with its educational problems. But many persons living among those efforts, while grateful that they are at last being attempted, are not very cheerful about the prospects. An American whose work involves keeping a close watch on German education said, "They'll need an enormous amount of money to fix things up, and I doubt that they're going to want to pay that bill." To return to the American pollution analogy, the similarities are apparent.

—D. S. GREENBERG

Bertrand Russell (1872–1970): The Constant Critic

Bertrand Russell lived so long and, in the last half century of his life, was so prominent a dissenter on political and social issues that now the controversy seems to outweigh his contributions. But what is likely to count at least as much in the long run is that he belonged to that remarkable generation of Europeans whose experimental and theoretical work at the beginning of the 20th century transformed science and deeply influenced society. For just as in their work Planck, Bohr, and Einstein broke the bounds of Newtonian physics, Russell forged on beyond Aristotelian logic and Euclidian geometry.

He had gone to Cambridge as a student in 1890 and for two decades engaged primarily in work on the frontiers of technical philosophy. It is fair to say that he and his friend and fellow philosopher G. E. Moore led the revolt that freed British philosophy from the absolutes of Hegelian idealism which had dominated the universities and influenced British thought in the later years of the 19th century. But Russell's main interest was in the foundations of mathematics, and he gained lasting recognition with his book *The Principles of Mathematics*, which he completed in 1900. Then, in collaboration with Alfred North Whitehead, he worked for 10 years on the monumental three-volume *Principia Mathematica*, in which Russell's central thesis that mathematics is derived from logic is elaborated in symbolic language which he and Whitehead developed.

The *Principia*, a highly difficult work still accessible only to specialists, became a foundation stone of symbolic logic. But Russell's ideas were also highly influential in the development of a strain of analytical philosophy that was apposite to the "scientific revolution" of the 20th century and became dominant on the Continent and in the United States as well as in Britain. As it evolved it was called by various names, including logical positivism, logical empiricism, and linguistic analysis. To put it in oversimplified terms, its practitioners sought to reexamine traditional philosophic problems and to distinguish questions which can be answered by logic and mathematics from those which require empirical means for their solution, and also from those which yield to neither method. They were interested in clarifying the difference between language that expresses emotion and that which conveys information, and this interest in clarification extended to the language and the structure of science.

Russell was in his late thirties when he finished his work on the *Principia*. Because of a combination of intense effort and personal unhappiness at the time, he says in his *Autobiography*, "my intellect never quite recovered from the strain. I have been ever since definitely less capable of dealing with abstractions than I was before. This is part, though by no means the whole, of the reason for the change in the nature of my work."

His absorption in philosophy during his Cambridge years did not prevent the development of his political and