Basic Science: British Policy Aiming at Quality Plus Utility

London. Though politicians keep closing in with budget shears and demands for practical results, academic research in the United States retains a good deal of maneuvering room and, perhaps even more important, many doors to try in its quest for money.

That is not the case here, where, in contrast to the continental spread of U.S. academic science, the British operate on a doll-house scale. In the United Kingdom of Great Britain and Northern Ireland, there are, altogether, 44 universities—fewer, by some measures, than in California alone. In the absence of any significant private endowments, local funds for research, or large-scale private philanthropy, most of the funds for U.K. universities come from the national government. And the bulk of the funds is dispensed by two agencies: the University Grants Committee, a quasi-governmental though highly independent body which is the mainstay for general academic costs, and the Science Research Council (SRC), a 3-year-old reorganizational offspring which, though part of the cabinet-level Department of Education and Science, is more or less equivalent to the United States' administratively independent National Science Foundation. Outside the biomedical field, SRC is the principal source of money for academic research, and virtually the sole source of support for half a dozen centers of high-energy physics, astronomy, and computing. In the fiscal year that ended 31 March, it spent about $92 million, which buys a lot of research in a country where $8000 a year is an upper-level salary for scientists.

Last month (October) SRC issued its annual report,* and, in this setting of near-monolithic financing, it is illuminating to examine some of the science policy patterns that are proposed there for a nation gripped by economic difficulties and the belief that science can play a key part in ending those difficulties. (As Prime Minister Harold Wilson is caustically reminded now and then by his throngs of critics, he is yet to fulfill his campaign pledge of a "white-hot technological revolution" to remake Britain's economy. He is still trying to fulfill it; hence policy on science and technology seems to rate more high-level political attention here than it does in the United States.)

The patterns that seem to emerge from the SRC document all converge in the direction of squeezing basic research so as to emphasize scientific quality while at the same time pushing more scientific talent and effort into work that is related to utilitarian purposes. As the report states, "The Council knows that more scientists could profitably be engaged in fundamental research but the number available is limited and it is essential to the country's prosperity that a greater proportion, especially of the most able, should be applying their skills to tackling the country's industrial problems." Whether the universities can be influenced to turn their students in that direction is open to question. One elder statesman of science, lamenting what he describes as the immunity of the universities to outside influence, pointed out in a conversation that the SRC is only the latest to take up the science and industry theme. Similar talk, he said, can be traced back to the 19th century, when German industrial competition was hurting Britain. "It has been true ever since," he said, "that you cannot get the universities interested in producing better tin cans."

Whatever the case, not only does SRC sound as though it means business but many of the Council's 17 members —13 of whom, including the chairman, are Fellows of the Royal Society—occupy positions of considerable influence in academic science. And it appears that, taking the long view, they are unanimously convinced that the scientific community can help the economy, and, furthermore, convinced that it would be all to the good for science's growing financial appetite if Britain were to snap out of its economic distress. One may also speculate that, politically, it does not look bad for science to be doing its bit for the economy, even if it is a small bit and if, as some contend, technological malaise is a product, and not a cause, of Britain's economic condition.

The result, as reflected in the SRC report, is a blueprint that would arouse NSF supporters to proclaim that night had descended upon science. Here, however, it has evoked scarcely any dissent within the scientific community, perhaps because that community has long been pummeled with the message that things are so awry in the allocation of scientific and technical resources that correction is mandatory.

Stating that most SRC funds will still go to basic science, the report explains that this apportionment will be accompanied by "increasing emphasis on high quality" and "increasing encouragement to applied research." As for university research positions, which have come to be regarded as overpopulated refuges from industry and teaching, the report states that "the Council will regulate the funds it provides through its research grants for the appointment of academic and professional staff to ensure that such staff increases only proportionately with the university science population as a whole, even though the output of graduates and postgraduates is initially increasing more rapidly."

As for the quest for applications of pure research, the report notes that, though this is the principal responsibility of two other government departments—the Ministry of Technology and the National Research Development Corporation—SRC intends to devote "a small but significant part of its intramural resources" to such purposes. Noting that it now provides financial support for about half of those who go on to postgraduate training, the Council states that, on the basis of present projections of university output, it will be able to continue to do so without increasing the number of SRC studentships. But, at the same time, "even more emphasis will be placed on training relevant to industrial needs."

Since astronomy has long been one of the internationally renowned jewels of British science—and possibly also because two of the most combative apostles of that discipline, Fred Hoyle and Sir Bernard Lovell, sit on the Council—SRC tends to deal kindly with astronomy and, with no effort whatever, to conjure up technological significances. Thus, it states that "in supporting university research, the Council will intensify and extend its policy of selectivity with priority for astronomy

* *Science Research Council, Report of the Council for the Year 1967–68* (Her Majesty's Stationery Office, London, 1968).

and for work in other fields which show scientific or technological promise"—and then goes on to cite "other fields" that are characterized mainly by technological promise: "applied mathematics, computing science, plasma physics, neutron beam techniques, enzyme chemistry, industrial biology, control systems and polymer and material sciences." It also notes plans to upgrade the 250-foot Jodrell Bank telescope and to begin work this year on a big telescope at Cambridge, though there will be a 2-year delay in starting construction of a 400-foot telescope at Jodrell Bank.

The only sour note in the report is reserved for the government's refusal for Britain to take part in construction of the 300-Gev accelerator planned by the European Organization for Nuclear Research (CERN) (*Science*, 23 August). And that note merits attention not because it is especially sour but because its very presence represents something that is relatively new, and still quite rare, in British science affairs: public disagreement between the government and its high-level science advisers. SRC chairman Brian H. Flowers, professor of physics at the University of Manchester, denounced the decision last spring, after officially presenting it to the CERN governing council. And now, in the SRC report, the subject is taken up again: "The Government's decision . . . is a severe blow to British high-energy physics; it has removed the center-piece of the Council's long-term plans for this most important field of fundamental research, and imperils the long-term survival of the subject in Europe. The Council will therefore continue to press for a reversal of the decision."

Why is Britain spending a substantial amount of money on basic research? Since leaders of American science are occasionally called upon to compose rationales for inquiring legislators, it may be worth a look at the SRC version, in which, conditions being what they are, considerable stress is placed on the utility of science. "The Council exists," states the SRC report, "primarily to enable good scientists and technologists in the universities and SRC establishments to do significant research. The Council confirmed [in a policy review] that this essential function aims to create cultural, scientific and technological assets through the training of highly skilled manpower and through the support of research which leads to the discovery of new knowledge and techniques. The assets so created are of value in their own right; they eventually permeate society as a whole; but they can only be generally seen to benefit the community after they have been applied to immediate aims by other organizations in industry, commerce and the public services. The Council will therefore continue to support both postgraduate training and research proposals of high quality over the broadest front. However, within each area of activity resources will be concentrated on schemes which seem most likely to yield significant scientific advance or the basis for economic or social benefit or both."

The SRC took note of the "swing from science"—the catch phrase for the drop-off in school-age science enrollments, and this was the subject of an all-day conference held here by the Royal Society on 24 October. In attendance were some 250 educators, scientists, and government officials, and among the speakers was F. S. Dainton, vice chancellor of the University of Nottingham, who pinpointed the "swing" in a major study made several years ago. The meeting produced no revelations but, rather, brought an assortment of views on the "swing."

As for causes, various speakers, including the headmasters of several schools that are experiencing the swing, cited poor teaching as the factor that most often chills early interest in scientific study. With students under pressure to compile records that will qualify them for university admission, the relative difficulty of the sciences, together with a dearth of qualified teachers, sends the students looking elsewhere. Several headmasters reported that it was far easier to recruit well-qualified teachers in the arts and humanities than in the sciences. Many agreed that a lot of school-level science teaching was dull and sterile, and that students really could not be blamed for turning their backs on it. Could the swing be attributed in part to a feeling that the physical sciences today create more problems than they solve? That charge is often made, but Dainton said he would not put too much stock in it; "too slick an explanation," he said. The causes, he and his colleagues agreed, are many, but most significant among them seems to be a lack of good teaching. The situation is one that feeds on itself: poor teaching leads to lower science enrollments, which produces fewer scientists, which results in fewer science teachers. It is the existence of this cycle, along with industry's presumed need for more scientists, that underlies the SRC's design to push more people out of university laboratories and into Britain's schools and factories.

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The Draft: Graduate Schools and Students Are Still Worried

The sharp drop in graduate school enrollments feared by educators early this year did not materialize in many universities when classes opened in September. A decline had been anticipated because of the new Selective Service provisions under which students who started graduate degree programs after 1 July 1967 are no longer eligible for 2-S (student) deferments. Because the decline wasn't nearly as precipitous as had been expected, there was even an air of optimism among some university officials.

Any euphoria which may have prevailed, however, is evaporating as first- and second-year graduate students are beginning to receive their induction notices. For the students and the universities, it now looks as if things will get worse before they get better.

One reason why more graduate students haven't yet been taken is that draft calls have been relatively low in recent months; many of the monthly calls have averaged about 12,000 men. Even if the Vietnam peace talks are successful, the armed forces will still need a large number of replacements for those who will be leaving the services next year. It is anticipated that monthly draft calls will average about 25,000 men in the early part of next year and may further increase to 35,000 to