tion, tried unsuccessfully to buy up Courtaulds in 1962. As well as comparatively routine expansions in nylon and other textile fibres, Courtaulds has also declared its interest in the bulk manufacture of carbon fibres. According to Sir Frank Kearton's declaration to the annual meeting a week ago, carbon fibre production should amount to 25 tons a year by the middle of 1970 and probably to 100 tons a year by early 1971. This is not merely a decision destined to win friends in Parliament and in the British Government—the Select Committee on Science and Technology has been calling for such a plant—but also another smack in the eye for ICI, possibly the most natural producer of carbon fibres.

PHARMACEUTICALS

New Ventures for Beecham

THE Beecham Group, widely known as the manufacturer of what is described as the "world's leading haircream", seems to be preparing to spread its wings in pharmaceuticals outside the comparatively narrow field in which it has so far been engaged. This, at least, is the implication of a passage in the speech by Sir Ronald Edwards, the new chairman, who said at the annual shareholders' meeting last week that the group is "steadily increasing research in a number of other fields including nutritional, dental and viral disease, immunology and parasitology". For the past few years, the company's pharmaceutical division has been reaping the rewards of the semi-synthetic penicillins developed in the fifties. According to the annual report, £70 million worth of variants of the penicillin marketed as 'Penbritin' were produced throughout the world last year. The British plant manufacturing the semi-synthetic penicillins is said to have produced £11 million in exports alone in the same period. But, with all the examples of failure in pharmaceuticals which abound, the group is plainly on the look-out for the succession of new products on which continued survival must depend.

Where will be the next move? No doubt the company will be anxious not to move too quickly into the development and manufacture of vaccines—Glaxo and Burroughs Wellcome are well established and the British market is worth only £5 million a year, in any case. There may be more to be said for trying to make something of the way in which the antibiotic rifampicin seems to be effective against some viral and rickettsial infections, and certainly the time should eventually come when molecular biology has some therapeutic consequences. Another possibility is the production of immunosuppressive sera such as ALS, for transplants have come to stay. The Beecham Group will no doubt also wish to look hard at such openings as there may be in the manufacture of special components of diet, if only because it has the marketing organization for selling such things. The company itself is plainly anxious to keep its plans to itself for as long as possible, but it seems likely that the new ventures will be substantial. The cost of research in the new financial year is estimated to amount to £5 million. The group employs 300 qualified people on research and is extending its laboratory at Brockham Park in Surrey, and Sir Ronald Edwards says that it has bought a new laboratory at Harlow in Essex so as to increase the pace of growth.

EDUCATIONAL TECHNOLOGY

Learning by Computer

THE investment of £2 million over the next five years in computer based learning is recommended by the National Council for Educational Technology in a report published this week. This "Programme for Action" is the outcome of eighteen months' work by the council, and is based mainly on a study by a team of seven appointed in September last year. Its main suggestions, intended to bring a measure of coordination to trends that are likely to occur in the near future, cover three general areas—specific applications of teaching by computer to selected topics that are particularly suitable for this technique; studies of the feasibility of using computers in fields of high priority, such as the education of slow learners; and the development of means of communication between the student and the computer.

Using computers is seen as a natural extension of current techniques of programmed learning and audio-visual aids. Many institutions in the United States are already making progress in this direction, and members of the study team have investigated their results at first hand—a report on what they found of direct relevance has been published separately. Such advances seem to be essential, constituting one way to avoid a clash between a continuing expansion of education at all levels and impending economic obstacles to a proportionate increase in the number of teachers. The report speaks rather vaguely of the finance coming "from diverse sources in the public and private sectors", but points out that sums of the order of £2 million will probably be spent anyway, so that the immediate task is one of central control.

The best sectors of education for the first phase of development are those in which there is a high degree of structural coherence in the subject matter. Further criteria of selection, somewhat more expedient, include a shortage of teaching staff and a substantial contribution to national economic needs. On this basis, the report's suggestions are technological and mathematical topics, parts of the medical curriculum such as diagnostic procedures, and the training of electronics technicians and computer staff. Quite what is to be done here is left as a matter for future evaluation. Feasibility studies refer euphemistically to "the needs of those children who are described as being at the lower level of ability", and also to the exploration of potential uses in refresher courses for teachers, as well as in management training. Whether any of these lines will actually be pursued presumably depends on the report's reception among ministers.

Computer technology is already adequate for most of these needs, with one exception: the link between the computer and the student who is learning from it. The council recommends that £500,000 be allocated to improving communications here. Computer-controlled teletypewriters have usually joined the machine to the external world, but this system will be far too cumbersome for routine use by students. Nobody yet knows what new developments will provide and, although there are optimistic references to future possibilities of written or even spoken input, it is clear that the problems of the "student terminal" are the main hindrance to immediate computerization.

Long-term plans will depend directly on the outcome

of the initial phase, and the feasibility studies will determine the direction of what happens in eight or ten years' time. Eventually a much wider range of subjects should be susceptible to automation. The report also suggests links with the Open University (see below).

OPEN UNIVERSITY

Off at Last

PROSPECTIVE student activists at the Open University may not have been too happy when the inauguration ceremony on July 23 began to the sound of a Coronation March, but all were no doubt glad to hear the project finally making some noise at the presentation of the Royal Charter and the installation of Lord Crowther as chancellor. Neither Lord Crowther nor Mr Harold Wilson, who also addressed the gathering, revealed any startling new developments of the university's plans, although it was hinted that broadcasting may eventually constitute only a small part of its output. There is also much enthusiasm for helping underdeveloped countries by providing recorded material, and Mr Wilson spoke of potential invisible exports as a result of education over the air.

The scientific courses are now being worked out in greater detail. Both staff and students will need laboratory facilities, and there has been doubt about how far the Open University will be able to match up to conventional universities in providing them. It now seems that the first year intake for the "Foundations of Science" course will be reasonably well looked after when they begin work in 1971. Assuming a total of 20,000 students for the course and a two-week summer practical session repeated five times, the university needs about eight centres to accommodate 500 students at a time and is negotiating for suitable premises. It has turned out to be impossible to make arrangements for week-end courses by 1971, mainly because of the difficulty of knowing the distribution of students through the country far enough in advance, although the eternal struggle for finance has made it necessary to be selective among possible lines of development. At higher levels, there will obviously have to be more practical work than can be crammed into an annual fortnight. Here there is less urgency, and by the time the first foundation courses have been completed, home experimental kits (for distribution by post) may also have been developed. A research building at Milton Keynes will be ready to accommodate all staff activities from the beginning of the 1973 academic year. Until then, those who are working in other universities may have to commute between the laboratories there and the Open University. The alternatives are either to hire space in an established university or to build a small temporary laboratory on site—this would require up to £40,000.

Research students will be taken on at Milton Keynes from 1973, some of them possibly transferring from elsewhere in mid-course, which may be the explanation of a slightly surprising remark in Lord Crowther's inaugural address to the effect that the university's first degrees will probably be awarded to postgraduates. In normal circumstances, an undergraduate will take at least five years to get his degree, so that anyone starting in 1973, just a year short of his PhD, looks like qualifying first.

Questions of content have yet to be settled. Certainly the aim is to avoid the fragmentation of subjects typical of many traditional undergraduate science courses: according to Professor M. J. Pentz, director of studies in science, there will be just a single integrated course. What provides the main challenge to the staff is that the course is intended as a foundation course for students in all disciplines, so that it must offer breadth to non-scientists as well as depth to future specialists. Consequently, "Is it useful?" and "Is it good?" are questions that the course will raise just as much as simply "What is it?" Techniques of teaching this material will be as advanced as possible—for instance, programmed texts in conjunction with correspondence courses will save much time otherwise wasted in postal delays—but the problem here is educating the staff themselves, who will probably be put through a crash course by educational technologists before the first session.

BRIDGE DESIGN

Picking Computer Brains

FEW bridges are built nowadays without the use of a computer at some stage in the progress from conception to construction. Many of the programs used in this work, however, have no application beyond the specialized scheme for which they are designed, so that a little rationalization might save much labour, and in this context a series of programs sponsored by the Ministry of Transport for the design and analysis of bridges is likely to find a general welcome. The idea is to make available widely tested and successful programs (on terms so far unspecified) to engineers throughout Britain, by placing contracts with consultants who will develop the required techniques into a format readily accessible to suitably skilled people. As a result of a research contract with the Construction Industry Research and Information Association, the first of these is now complete.

This "Finite Element Package for Reinforced Concrete Slab Bridge Decks" originated in a program for the elastic bending of thin plates and beams devised by Professor O. C. Zienkiewicz of the University of Wales, Swansea, some time ago. To this were added an input program, simplifying the preparation of data, and an output program speeding up assessment of the detailed design. Basically it is a way of checking and elaborating an outline design—it offers no easy substitute for a creative engineer, but does give him considerable help in evaluating his ideas. This deals only with the bridge deck: future additions to the series will be concerned with other problems such as column spacing. The program will, however, allow the analysis of any shape of slab with any support system, and the finite element method itself is apparently something in which Britain has a lead over the rest of the world.

The testing was carried out by R. Travers Morgan and Partners in connexion with the approach flyovers to the Clifton road bridge at Nottingham, and was exhaustive enough for the program to be considered one of the best validated of its kind. The firm of consultants subsequently prepared a manual for users which also has strong claims to superiority both in scope and in approach. Nobody knows precisely how such programs will be taken up but some results should be seen within six months.