absorption is hardly affected, and the advantage conferred by the greater number of neutrons per fission can be exploited.

Arguments like these have convinced the UKAEA that it is more sensible to retain plutonium within the system, although small amounts are exported if the price is right. This year an agreement was signed for the export of plutonium to Belgium at an undisclosed price, but the amount involved was small in comparison with Britain's annual production. The much maligned Magnox reactors are prolific producers of plutonium, and the annual production of plutonium in Britain will soon be approaching 2·5 tons a year, just about enough to start a 1,000 MWe fast reactor. Dr Hans Kronberger, chief scientist at the Risley establishment of the AEA, told a conference in Washington recently that Britain would have enough plutonium to construct 15,000 MWe of fast reactors between 1975 and 1985, and that only a severe setback in the fast reactor programme would convince him of the need to re-cycle plutonium through thermal reactors. The chances are that if fast reactor development continues to go well, even the need to construct thermal reactors as plutonium producers will decline. It may even be cheaper in the long run to build a fast reactor, and run it on enriched uranium for the first few years of its life until it had generated sufficient plutonium for that to be used as fuel. Fast reactors operated in this way are excellent producers of plutonium, although their energy cost is increased by about 0·15 pence per unit. Looking at the system as a whole, it might still be cheaper to do this than to build thermal reactors like AGRs and HTRs, which are poor plutonium producers. (The SGHWR is slightly better, and the Canadian CANDU better still.)

The price of plutonium is such a doubtful quantity that Mr C. E. Iliffe and Mr P. J. Searby of the AEA have devised a model of the nuclear section of the British fuel economy which assumes that the system consumes only the plutonium which is generated within it. Under these conditions, the effect of the generating cost of the entire system of any price assigned to plutonium cancels out in transactions between reactors within the system fed on uranium or plutonium. The model also allows a price for plutonium to be calculated, however, by substitution in the model of reactors of the same capacity, but fuelled by uranium. The difference in total cost of the system would then put a value on the plutonium which had thus been made available for sale. This method is used for calculating prices for the small amounts of plutonium which have been exported.

None of these arguments seems to have carried much weight in the United States, however, where the utilities still seem set on re-cycling plutonium through thermal reactors. To them, the fast reactor still seems a remote possibility, and scarcely worth waiting for in the hope of earning more for the plutonium they hold. But Dr Kronberger did make an intriguing suggestion to those determined to re-cycle plutonium. Magnox plutonium contains little of the undesirable isotope Pu240, and it is therefore ideal for thermal reactors, in which Pu240 acts as an absorbent. The plutonium produced in American reactors is much less suitable for re-cycling, but it is fine for fast reactors. Dr Kronberger therefore suggested the idea of a plutonium exchange between countries; he said that 0·734 kg of Magnox plutonium would give the same value as 1 kg of PWR plutonium when re-cycled. The PWR plutonium, on the other hand, would have to have only 0·176 kg of Magnox plutonium added to it to make it as good as 100 per cent Magnox plutonium in a fast reactor. By exchanging the two, he suggested there would be a net gain of about 5 per cent.

EDUCATION

Student Wastage

THE wastage rates among undergraduates at British universities show no sign of decreasing. According to the University Grants Committee's *Enquiry into Student Progress 1968*, published in August (*Nature*, **219**, 549; 1968), 13·3 per cent of the 35,386 undergraduates who might have been expected to graduate at the end of the academic year 1965–66 did in fact leave the universities without obtaining a degree. The other striking fact which emerged from the UGC's survey was that the failure rate was remarkably constant. In 1955, 14 per cent of university students did not get a degree and in 1966 the figure was virtually the same. The figures in the Department of Education and Science's latest volume of *Statistics of Education 1967, volume 5* (HMSO, 13*s* 6*d*), published on December 10, indicate that the rate has not declined and may even be increasing. Seventeen per cent of the 20,180 men and 13 per cent of the 8,498 women students in universities in England and Wales who held full value grants in 1967, either from the Government or from local education authorities, failed to complete their degree courses. Assuming that the failure rate in Scottish universities is comparable with that in the rest of Britain and that full grant holders are not more prone to failure than undergraduates who hold lesser awards or are without awards, the average 1967 failure rate among students of both sexes reached about 15 per cent. The failure rate among students at all establishments of further education other than the universities is even more alarming. In England and Wales in 1967, no fewer than 34 per cent of the men and 28 per cent of the women failed to complete their courses.

The total public spending on education and related services—which includes such things as school meals, transport of pupils and maintenance grants—reached £1,571 million in 1966–67, an increase of 10 per cent over the previous year and 69 per cent more than five years earlier. For the first time the amount spent on education proper has been distinguished from all the associated spending. The universities received £198·6 million, the schools £852·4 million and maintenance grants cost £73·2 million. £33 million went to university students. The number of students holding grants has increased faster than the total spending on education, and in December 1967 there were 230,500 students with grants of one sort or another.

The distribution of the number of grant holders per thousand in the 18–19 age group within the UK is illuminating. In England, 61·3 per thousand of this age group held full or lesser awards at the universities and 49·5 per thousand held grants at colleges of education; in Greater London, new awards taken up at the universities amounted to 73 per thousand of the age group whereas only 40 per thousand took up grants

for teacher training colleges. In the West Midlands, however, the figures were only 48·4 and 47·2 per cent. Wales compares very favourably with England; 71 per thousand of the age group took up new awards at the universities and 63 per thousand at the colleges of education.

HEALTH ADMINISTRATION

Better Hospital Services

from our Social Medicine Correspondent

BOLD recommendations for curbing the uncoordinated growth of scientific services within hospitals are spelt out in a report to the Health Ministers published last week (*Hospital Scientific and Technical Services*, HMSO, 7*s*). The report is based on the findings of a committee of eight which was appointed last year under the chairmanship of Sir Solly Zuckerman to consider the future organization and development of these services in National Health Service hospitals.

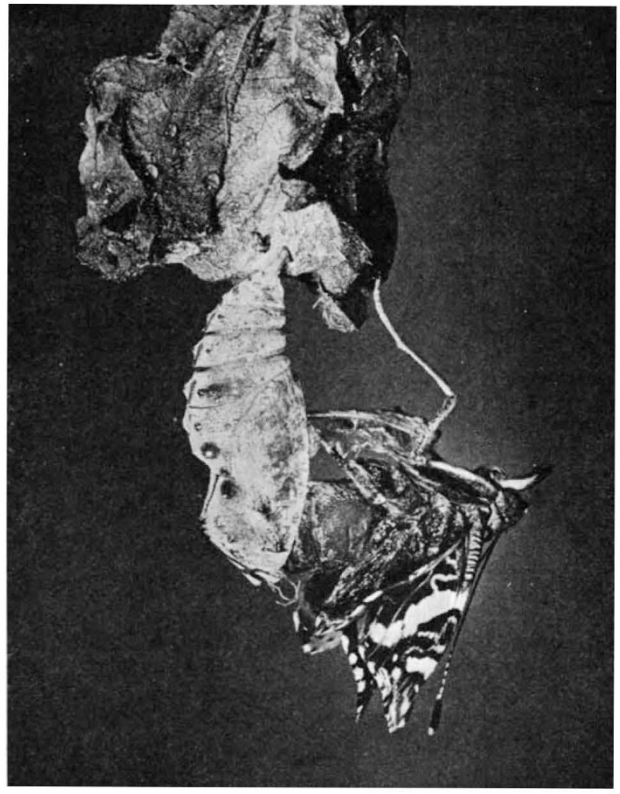
The principal proposal is that a Hospital Scientific Service should be set up in England and Wales, and Scotland, headed by National Hospital Scientific Councils which would advise on the organization and development of the service. Membership of the councils should include independent scientists, clinicians, medical administrators and medical and non-medical members of the scientific service. At a lower level, it is proposed that Regional Hospital Boards should be responsible for planning the scientific services of the region, each board having a Regional Advisory Committee as well as a scientist, medical or non-medical. It is also suggested that district hospital authorities should be responsible for the day-to-day management of hospital scientific services and that there should be a "division of scientific services" including such services as clinical biochemistry, computer science and statistics, haematology and blood transfusion.

The committee also recommends a new career structure similar to that in the Scientific Civil Service and the Medical Research Council. Although medical staff would usually remain, as at present, in the hospital medical staff structure, other scientific and technical staff would fall into the four main classes: scientific officer, technical officer, technical assistant and technical aide. The committee hopes that this career structure would broaden the basis of promotion, but it has nothing to say about rates of pay.

The committee's report is essentially a broad outline of the proposed hospital scientific service rather than a detailed plan. Nevertheless, it will undoubtedly give rise to much controversy, particularly among some sectors of the medical profession who may disapprove of the prospect of a versatile technician assisting in many disciplines rather than specializing in any particular one. Another foreseeable issue is the large-scale employment of non-medical scientists in haematology, diagnostic X-ray departments and other specialties where they are not normally found. It has, however, become obvious that some drastic measures need to be taken if the shortage of hospital technicians is to be overcome and their dissatisfaction with the present service (which has probably done much to precipitate the committee's investigations) quelled. Equally important, it has become necessary to convince talented graduate non-medical scientists that as employees in the hospital service they will not merely be the handmaidens of the medics.

PHOTOGRAPHY

Red Admiral Emergent



A Red Admiral struggling out of its chrysalis—a rare photograph taken by Mrs Jane Craik of Tavistock who has won the title of Wildlife Cameraman of 1968 in the competition organized jointly by the journal *Wildlife and the Countryside* and the Council for Nature. The prize for the best colour photograph went to Mr Jim Rowbottom of Fort William for his picture of a wild otter eating a fish on the foreshore in Argyll.

FUEL POLICY

More Fuel to the Flames

FOR some time, energy and fuel policy has looked the area of the national economy most likely to be amenable to numerical analysis and planning. The interest of the Ministry of Power in computer models, and the publication this week of an important mathematical analysis of the British fuel economy, tend to confirm this impression. The analysis comes from the Department of Applied Economics at Cambridge (*The Demand for Fuel 1948–1975; a Sub-model for the British Fuel Economy*; Chapman and Hall, 30*s*) and is principally the work of Kenneth Wigley, with assistance from other members of the department.

The analysis sets out to do two things: first, it makes a survey of the demand for different forms of fuel in Britain since 1948, and attempts to describe the trends in demand in the form of equations; secondly, it uses these equations to project demand forward to