

which seemed to indicate a safety value of 80  $\mu\text{g}$  lead per 100 g of blood. (An average concentration for city dwellers is about 20  $\mu\text{g}$  lead per 100 g blood.) Danielson disputes this safety value and also criticizes experiments in which Kehoe claimed to show that the lead pollution of city air is harmless.

Danielson recommends that more research should be undertaken on the accumulation of lead in the biosphere, and that the amount of lead allowed in petrol should be reduced to nothing, the phasing out taking place over five years so as to allow for the introduction of engines with low compression ratios. Essentially this is the policy which Sweden seems likely to adopt, and other countries may follow suit though for different reasons.

#### MEDICINE

### Neutrons to treat Tumours

THE first neutron generators designed to treat cancer will soon be installed at the Christie Hospital in Manchester and in the Glasgow Institute of Radiotherapy at the Belvidere Hospital. Neutron therapy may have advantages over conventional radiation therapy in treating tumours, but the difficulty in developing the technique has been to find a powerful enough source of fast neutrons. The new generating tubes may provide an effective source for routine neutron irradiation.

A prototype of the machine has been in operation in Manchester since last summer, and doctors at the Christie Hospital hope that it will be used to treat patients within the next month or so. Two commercial versions of the machine, made by Elliott Automation, will be installed in Glasgow and Manchester within the next few months. Dr J. M. A. Lenihan from the Glasgow Institute estimates that he and his staff will begin treating patients during 1971.

The neutron generating tubes, the most powerful of their kind in the world, were developed at the Services Electronics Research Laboratory, Baldock. A beam of fast, 14 MeV, neutrons is generated in a sealed tube by the deuterium-tritium reaction, and by an ingenious selection of the target material the design team has succeeded in pushing the output of the tube up to  $10^{12}$  neutrons per second. This is high enough to be able to use the beam for therapy without unduly long treatment times, although even higher outputs would be preferable. The designers hope that they will be able to get close to the theoretical maximum of three times this figure by improving the target design.

Neutrons are already being used for cancer therapy at Hammersmith Hospital where doctors in the Medical Research Council's cyclotron unit are using neutrons generated in the cyclotron to treat patients with particularly advanced tumours. Some encouraging results have been obtained, but it is still too early to say whether the sensitivity of poorly oxygenated tumour cells to neutron radiation offers a distinct clinical advantage over X-ray or  $\gamma$ -ray treatment. The Hammersmith doctors are now planning a carefully controlled clinical investigation of the technique on a larger group of specially selected patients.

One difficulty in using a cyclotron to generate the neutrons is that the equipment is too expensive for most radiotherapy departments. But as Professor J. F. Fowler, at Hammersmith Hospital, pointed out,

part of the cost of a cyclotron, which can be up to £0.3 million, can be borne by the other uses to which it can be put. The advantage of the new neutron therapy machine is that the generating tube is movable and also cheaper than a cyclotron—the whole installation costs about £150,000 and the replaceable tubes, which have an operating life of some 200 hours, cost only £3,000.

#### ARCHAEOLOGY

### Real Maths

ARCHAEOLOGISTS and mathematicians will have a fresh chance next autumn to discover how much they can help one another. The Royal Society has arranged with the Academy of the Socialist Republic of Romania to hold a conference in Bucharest on the role of mathematics in the archaeological and historical sciences, opening on September 16. Professor D. G. Kendall, director of the Statistical Laboratory at the University of Cambridge, is convinced that the conference will be "something of a novelty", not least in that it will put forward a hard sell for "real mathematics and not just arithmetic".

Fortifying archaeology with the powers of statistics in particular has a respectable history during the past decade or so, but some archaeologists seem to have retained a suspicion of mathematics. Some have a methodological bone to pick with the "statniks", to use the terminology of *Jacquetta Hawkes (Antiquity, 42, 255; 1968)*. More often, however, the problem is that some archaeologists feel out of their depth in a sea of statistics, and the view of the conference's scientific secretary, Dr F. R. Hodson, is that the Bucharest conference will help them find their feet.

The kind of "real mathematics" that can be brought to bear on archaeological problems is illustrated by Kendall's method of seriation which can be used, for example, to reconstruct the chronology of a group of tombs from stylistic variations in the pottery they contain. The Bucharest conference should pinpoint other mathematical tools for which there is an archaeological demand—cluster analysis perhaps—as well as exploring other potential applications in fields such as historical demography. Full details of the conference can be obtained from Dr F. R. Hodson at the Institute of Archaeology, 31-34 Gordon Square, London WC1.

#### ROYAL SOCIETY

### Admissions to Carlton House Terrace

THE Royal Society announced last week the batch of 32 people elected annually to join its select body. This year the 700 fellows of the society proposed some 350 candidates, the roll of which was decimated by the twelve specialist committees that mull over the candidates' claim to scientific excellence and somehow juggle their respective quotas to fill the thirty-two places. The survivors of this year's initiation rites, with one of their chief fields of interest, are as follows: C. C. Addison (University of Nottingham)—inorganic chemistry; F. F. Bonsall (University of Edinburgh)—Banach algebras; C. C. Butler (Rothamsted Experimental Station)—honey bees; R. Casey (Geological Survey, London)—Mesozoic stratigraphy and palaeontology; C. A. Clarke (University of Liverpool)—haemolytic disease in newborn infants.