Research in Greece

In this second article on Greek science, E M Pantelouris, assesses the effort put into non-university research.

MORE active Greek researchers work abroad than inside Greece. The recent death of one notable Greek scientist, K. Kotzias, who pioneered the treatment of Parkinson's disease with L-Dopa in the United States, only serves to emphasise this fact. And it was another Greek, George Papanicolaou, also working in the States before Kotzias' time, who first established the science of exfoliative diagnostic cytology.

Scientific papers, however, do come out of Greece. A computerised data search of the *Science Citation Index*—which may well cover 90% of the world's original research work—picked some 2,000 papers published in 1974-77 which are attributed to research centres in Greece (see table). Although there must be limitations to drawing conclusions from data about the quantity of published items, some general points can be made. In this article, such data will be taken as starting points for a general look at non-university research.

Non-university research

Pride of place in non-university research belongs to 'Demokritos', a research centre for fundamental science in Athens. The number of publications attributable to its 40 biological researchers equals the number attributable to equivalent researchers in Athens University; and its 140 researchers in physics and chemistry produce more publications than their university colleagues.

Scientists at Demokritos are, of course, free from teaching commitments; but so are scientists at other less effective institutes. The factors contributing to Demokritos' success seem to be the lack of the narrow compartmentalisation of the university, the relative independence of scientists in planning their research and competing for project grants, the higher qualifications possessed by practically all scientific staff, and good facilities.

In addition to fundamental research, the centre tackles some practical tasks. These include the production of 130,000 μCi of short-lived radio-isotopes (another 35,000 are imported) for hospital use (the centre was in fact founded around the reactor and still carries the name 'nuclear research centre'); dealing with methods for searching for uranium deposits; main-

taining a human tissue bank for transplants; and doing fundamental work on photosynthesis with the use, for biological control, of sterilised males of the insect pest of the olive, *Dacus oleae*. Demokritos would probably be a good place for postgraduate students to work.

The papers from 'other centres' come from a variety of establishments, including the National Research Foundation (with 30 publications) industrial laboratories and so on. For convenience, publications from the small, young universities of Yannina and Patras are included in this category.

Medical research

The medical faculty of the University of Athens has recently produced, with some pride, a list of 5,859 publications by its members in 1970-75. The press, however, soon pointed out that of these, the bulk are locally published articles, case discussions and so on. Only 757 are refereed papers in international journals; and some of those cover work carried out abroad. The *Science Citation Index* figure of 479 (see table) is limited to the years 1974-77 and does not seem to contradict this figure.

It cannot be disputed, however, that hospital doctors come across ample case material, and have sufficient facilities for doing clinical tests, leading to publishable observations; the stimulus, and in fact competition, for publishing such observations is undoubtedly strong. But few papers deal with biomedical, as distinct from clinical, research. Some medical research teams have become internationally known for a continuing body of work in certain fields, such as the

locally important problems of haemoglobinopathies and of enzyme polymorphisms.

But the prestige of the Athens medical faculty is not founded only on the number of papers it produces, but also on the social impact of the medical profession. Has the profession been able to provide adequate medical cover for the population? Is the standard of medical care much higher in the lucrative private sector than in the public sector? Is the profession avoiding the worst excesses of private practice?

These are legitimate questions when thousands of patients travel every year to seek treatment abroad, especially as they cannot help but compare the ethical attitudes and fees in other countries with those back home. It would also be interesting to find out whether the lucrative character of private medicine in Greece—or more accurately, of a special circuit of private medicine including a high proportion of university professors—will attract to Athens, when Greece enters the European Economic Community many doctors from other member countries.

Agricultural research

Another sector where social impact is important is agricultural research. The achievements of numerous stations and institutes run by the Ministry of Agriculture are not adequately reflected in the table because much of their work ends in filing cabinets, or is translated into circulars; and work lasting ten or more years to establish a new variety of wheat may yield very few papers.

But it may yield a lot of grain. In the 1920s when one and a half million refugees, mainly from Ionia, arrived in Greece destitute, the average wheat yield was 220 kg per acre. The late Papadakis, a dedicated agriculturist, started work at a small station in Thessaly with the aim of breeding new varieties better adapted to the country. It is largely thanks to the breeding work he initiated that, today, Greece

Numbers of papers listed in the Science Citation Index 1974-77 as originating from Greece.

Institution	Medicine	Life sciences	Science and Engineering
University of Athens	479	66	142
'Polytechnion' of Athens			96
University of Thessaloniki	57	66	133
Agricultural Research Stations and Institutes		29	
Demokritos	13	68	228
Other medical centres	297		
National Research Foundation			30
Other science laboratories			194
Other life science laboratories		46	
	846	275	823
Total:	1944		

Dr E. M. Pantelouris visited Greece as a Nature travelling fellow

is self-sufficient in wheat, with an average yield of 1,000 kg per acre, and could, if it were economical, produce some wheat for export. Greece might in fact do that specifically for the hard wheat required by EEC industries.

From that Cereal Improvement Station of Thessaly has developed the Cereal Breeding Institute of today at Thessaloniki; and the country has also become self-sufficient in barley for animal feed, and in rice. Corn is a problem, mainly because in the Greek climate it requires irrigation, and the country has very little irrigated land. All the work on cereals is carried out by about 20 members of staff at the institute, with the help of other people at peripheral testing centres. This is cost-effective research.

The same can be said about other research stations dealing either with single crops (such as cotton, in which again self-sufficiency was achieved years ago) or with livestock. The Yanitsa Livestock Improvement Station has had successes of great potential with crosses of the local Chios strain of sheep with Friesland sheep.

There are also some larger, interdisciplinary, institutes. The Benaki Phytopathological Institute near Athens deals mainly with entomology. Although founded in 1929 as an independent establishment, it is now largely supported by the Ministry of Agriculture. It deals with problems such as the notorious *Phylloxera*, which is reappearing in the vineyards of Crete, and the biological control of citrus-fruit scale insects.

The two forest institutes, at Athens and Thessaloniki, are also multidisciplinary. Forests in Greece are largely state owned, and are run by a system where the forestry service supervises all operations in co-operation with local villagers on contract. The institutes therefore have a variety of concerns, ranging from timber technology, mechanisation, and the introduction of new economic plantations, such as poplar and eucalyptus, to the protection of forests from fires, which caused enormous damage last summer. The forest institutes could perhaps concentrate more on forest and soil preservation in the least productive and uneconomic areas.

The work of these stations and centres suggests that small research groups, geographic isolation, and restricted facilities are not necessarily disadvantages so far as applied research of this type is concerned. Success hinges more on leadership and dedication. Applied research may well benefit more generally from the work of small task-oriented groups. Fundamental research on the other hand would be

Karamanlis: implementing a new science policy

better served in larger, multidisciplinary centres.

A New Research Policy

The Greek government is taking measures to stimulate 'relevant' research.

Greek agriculture suffers because of the small acreage per farmer, and can only be uplifted by technological progress and, in the last resort, by conversion to irrigation. Industry has, for some years now, exceeded agriculture in importance. To make both viable within the EEC, and to raise the per capita income, which now hovers around the level of Ireland, the government believe that indigenous activity in the fields of applied R&D is essential.

In general terms, the following policy has been formulated. On-going research will continue to be supported at present levels. New funds, however, will be made available specifically for research related to a few key requirements of the country's development plan. These funds will not be dispensed as support grants for institutions as such, but in the form of grants for specific research projects, submitted by individual or grouped workers. Foreign scientists are not excluded.

A law institutionalising the policy was passed last year and the Prime Minister, Mr Karamanlis, is by all accounts pressing for a speedy implementation. A cabinet committee is in control, and a special civil service department has been set up at the Ministry of Coordination, headed by Dr Argyropoulos, an electronics expert returned from the United States. A census of laboratories has been carried out, but due to lack of cooperation, it is as yet incomplete.

The new policy combines two pragmatic approaches: that of letting work now in progress continue; and of setting up target-oriented research.

One of the potential virtues of the combination is that it might forestall the reappearance of the old pattern in the guise of the new.

Success will now depend on how the policy is implemented. Firstly, an advisory council will be appointed by the government. Its appointment will be crucial because it must be efficient and imaginative, and must inspire complete confidence in the research community. The second crucial task is the definition of a handful of research sectors where efforts will be concentrated. If the definition is too narrow and specific it may inhibit creative processes. If too wide, it may be operationally meaningless, and provide no guidance.

For example, one problem Greece has to face is that of soil erosion. Limestone covers one third of the country, mostly in the form of mountains where the extremely fragile ecosystem has been degraded by destruction of forest and by erosion to the state of sparse maquis vegetation and small pockets of soil between exposed rock. What is not already lost must be preserved and every effort made to recoup as much as possible. This will involve preventing the winter rain from causing destructive floods and damaging agriculture and even dwellings.

Defined in this way, the problem appears to be one of traditional torrent regulation so that the seasonal rain is helped to flow safely away. But the water is a precious asset, and the key to making economically viable the Greek farmer's small acreage must be to conserve the winter rainwater for use in the summer. The problem may now be redefined as one of storing the winter rain in each catchment area. Perhaps it could be channeled to underground cisterns, or at least retained in soil 'sponges' created at the outlet of every torrent and gully. Perhaps chemical films should be used to reduce evaporation from reservoirs and special tubing systems (there is one under study by a Greek plastics firm) might permit the speedy and economic irrigation of crops and trees. Perhaps there might even be physico-chemical methods for producing a thin layer of soil on the limestone surface; and perhaps arid-zone plants should be seeded there to retain and improve the soil so that a future generation might reafforest it.

The definition of priority areas must be comprehensive enough to evoke all approaches which, when combined might lead to a solution—a definition of targets and problems, not just of projects and programmes, yet not vague and platitudinous. The successful implementation of the new policy is bound to be a difficult undertaking. □