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Three years after Allende

Alwyn Eades, recently in Chile, assesses the state of the physical sciences there

Chile is a large, sparsely populated country. Three million of its ten million inhabitants live in Santiago, the capital city, where virtually all economic activity except mining and agriculture is concentrated.

A former Spanish colony, Chile gained her independence at the beginning of the nineteenth century. Subsequently she maintained a remarkable record (indeed a record unique in Latin America and scarcely matched anywhere) for unbroken democracy and liberal government. She was, for example, among the first countries to abolish slavery, and her social services were very well developed for such a poor country. From the 1930s consistent policies by successive governments succeeded in achieving a substantial degree of industrialisation, though mostly with production on a rather small scale and using imported technology.

The country's stability was broken in September 1973 when a military junta overthrew the leftist government of Dr Salvador Allende, who was killed. In the years since the coup the junta has followed a policy of repression and infringement of human rights, and an economic policy which has caused both a large reduction in production with many companies both large and small going bankrupt, and very high unemployment.

Alwyn Eades, who wrote the accompanying article, is at the University of Bristol and worked in Chile from 1967 to 1973. He recently returned there for the first time in three years to attend a scientific congress and work with his former colleagues. He spent two weeks in the Department of Physics of the Engineering School and visited four other institutions. Together the five laboratories represent a very large proportion of the nation's research effort in physics, materials science and related areas. "It is very easy to be misleading about Chile", he says, "and very easy to be misled".

DURING the past three years, research in physics in Chile has suffered set-backs from which it will recover only with difficulty. University physics departments have been especially hard hit; they have no protection from the severe budget reductions and loss of staff brought about by the political upheavals. In materials science the position is less bleak and people are hanging on, if only by the skin of their teeth. This is because the centres of applied science have partial independence. The Institute of Materials Testing and Research of the University of Chile, for example, is in a stronger position than the physics departments because it is able to pay (and has to pay) the whole of its research budget from contract work. Only staff salaries are paid by the University.

This reversal is in marked contrast with the previous steady growth of research. Twenty years ago there was little or no research in physics in Chile. Then in the mid-1950s a small number of physicists, trained abroad mainly in England, began to set up research programmes. This effort was initially slow and precarious, but by the late 1960s they had met with such success that the two most important physics departments in the country (both in the University of Chile, one in the Engineering School, the other in the Faculty of Sciences) each had about 40 academic staff including graduate students, nearly all of whom were involved in research.

At this point it began to seem for the first time that there were enough research physicists in Chile to form a stable nucleus for future development, and that some kind of critical mass had been achieved. Evidence for this lay in the establishment of a doctoral programme; until that time Chilean students were obliged to go abroad to get a higher degree. In the early 1970s people felt such confidence in this stability that there was a lot of talk of developing a science policy for Chile in a way which was unthinkable previously. For the first time, Chilean physicists began to feel secure that no longer could an arbitrary administrative decision or the departure of one man have a disastrous effect on the nation's research effort. It was therefore bitterly ironic that the military coup of September 11, 1973 should, almost incidentally to its many brutal acts, set physics research back nearly two decades.

It is worth pointing out here that the election of Allende did not directly affect science in Chile very significantly. The presidency of Salvador Allende represented much more of a continuation and natural extension of previous government policy in Chile than is usually recognised outside the country. In any case, the principal effects on science research were, initially, considerable governmental encouragement to make research relate to problems relevant to Chile and, later, a reduction in the budget available in hard currency. The latter was a result of economic problems rather than an attempt to restrict science.

The fate of the two physics departments mentioned above since the coup has been quite different. The Department of Physics in the Faculty of Sciences lost most of its staff within a very short time of the coup. Many left voluntarily to seek employment in other countries. Some were imprisoned and/or expelled. In the three years since the coup there has been a bare handful of staff and there has been no research. I was told, for example, that the two main experimental areas, the cyclotron and a low temperature facility for solid state research, have remained closed down. In the past few months, however, new staff members have been contracted and attempts made to restart research. It is surprising to find that those involved seem confident that stable conditions suitable for research may now prevail.

In the other physics department, that of the Engineering School—a right-wing stronghold in a largely left-wing university—the coup had little immediate effect. My own departure two months later was one of the few obvious results. Over the three intervening years, however, the situation has deteriorated very greatly. There have been several waves of sackings for a mixture of political and economic reasons, as a result of which the number of academic staff has dropped from 45 to about 25. Many research groups have completely vanished.

For example, a very impressive semiconductor and microcircuits facility, set up with substantial funds from the Organisation of American States and the Ford Foundation with the support of the Chilean Development Corporation, now lies virtually abandoned. One of these two laboratories is a complete manufacturing facility for microcircuits; the other is a well equipped laboratory for basic research into semiconductors with no one to use it.

This particular state of affairs is still more disconcerting for another reason. Chilean physics has been characterised by too many groups of too few people covering too wide a spectrum of research; moreover, research topics have been chosen because of the training received by staff abroad rather than because of any relevance to Chile. The now-abandoned semiconductor facility was the beginning of an attempt to change this.

The pattern occurs elsewhere. Thus the plasma laboratory, equipped with a well instrumented shock tube and once with six staff members, is now deserted. The only remaining member of the group is completing postgraduate study in London University and is reluctant to return to work alone instead of rejoining an active group with research in progress. Laboratories for Mössbauer spectroscopy and nuclear magnetic resonance also lie idle.

Some groups are not so unfortunate, and in particular X-ray crystallography, biophysics and theoretical physics remain active. The first is particularly important because Oscar Wittke and his team not only do good crystallography but also carry out invaluable service work for industry. This long standing work is unique as an example of collaboration between industry and a physics group in Chile. But even these more fortunate groups are building up problems for the future because of their stagnation and the lack of young people receiving training. They are also handicapped by an arbitrary and inefficient administrative structure and erratic finance. This is not new, of course, but it is an increased handicap when conditions are precarious for other reasons.

Three non-university research laboratories have had mixed fortunes. CIMM is the Centre for Research in Mining and Metallurgy. It is financed by the national Copper Corporation, and since copper mining plays such a dominant role in the Chilean economy, CIMM enjoys a privileged position. In the laboratories the equipment is in use and a large research team is not only providing a service to the mining industry, it is also pursuing a number of exciting original lines of research. I gained the impression that recent events have hardly affected them. One of the very few foreign research workers to enter Chile since the coup, John Burley, an Englishman, is helping to build up the microscopy section.

Two other institutions—INTEC (The Technological Institute) and CESMEC (The Centre for Testing and Quality Control)—have been less fortunate. They were set up by the United Nations Development Programme (UNDP) which provided the basic facilities and equipment and were subsequently financed by the Chilean Development Corporation (CORFO). In the three years since the coup there has been no direct interference in the running of the laboratories, perhaps because of the quasi-international status deriving from their UN association, but the financial support from CORFO has been cut.

In the case of CESMEC it has been withdrawn completely and they have been forced to become entirely self-supporting from the contract work undertaken for industry. This has necessitated substantial reductions of staffing levels and all projects other than the contract work itself have been abandoned. Moreover, they are functioning entirely on capital, in the sense that they are using the equipment provided by UNDP with little possibility of proper maintenance or purchase of spares and none at all of purchasing new equipment.

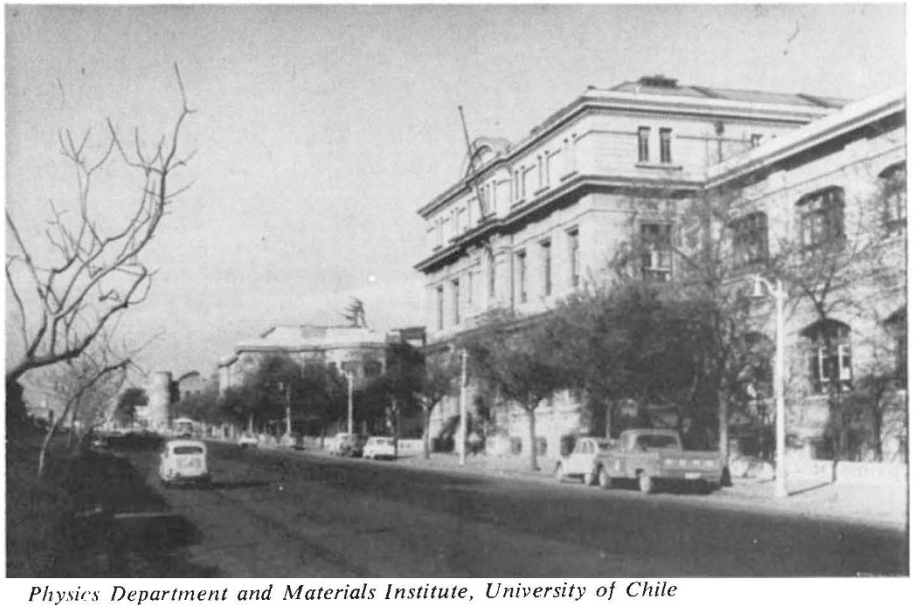
The future of both institutions is very precarious. It is possible for contract research organisations in the developed world—Battelle Labs in the USA, for example, or the Fulmer Research Institute in Britain to be successfully self-supporting—but to expect the same in a semi-industrialised country like Chile is a pipe-dream. Nonetheless, both organisations are doing good work and playing an important role in the industrial development of the country. If government financial support is not restored, both organisations may not survive more than a year or two—another reversal of progress in the country which will bring the return to a time when all expertise has to be bought outside the country; even for certain kinds of routine analysis, specimens will once again have to be sent abroad.

CIMM, CESMEC and INTEC were all founded within a decade, which might be a surprise since they now contribute so much to the mining industry which is the mainstay of the economy. However, it is only recently, a century and a half after political independence, that colonial attitudes have faded sufficiently that Chileans have begun to recognise that their own expertise can be as valuable as that purchased overseas.

Repression remains severe in Chile, but in many ways the country is back to normal and on the whole people are not nervous about discussing the situation in an open way. 'Normal' in this context means that there are no longer heavily armed police at every turn, nor military vehicles conspicuous in the streets; despite the continuation of the curfew there is once more a normal, if curtailed, night-life and the public does not in general, show signs of tension or strain. It would be possible for a tourist to get no hint from what he sees of how things are below the surface.

The recent release of prisoners held without trial under the "State of Siege" legislation, however, does not mark the end of repression. Those people who are taken prisoner now are taken in secret and the authorities do not admit to holding them; this is, of course, worse than before. Although I heard of a number of such cases, I am not aware of any scientist who is held prisoner now.

Unemployment in Chile has been extremely high since the coup. Even on official figures it now stands above 15% and is probably higher. But this figure hides enormous variations. An international official, who knew from first-hand experience in voluntary social work, said that in some working class areas unemployment runs at 90%. On



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the other hand there seems to be very little unemployment among the professional classes. The very extensive sackings and cut-backs in all government departments as well as in private industry have reduced employment, but amongst professionals there seems to have been enough mobility and opportunity for them to move overseas. The ex-Dean of the Engineering School was reported as saying that of 11,000 Chilean engineers, 4,000 are now in Venezuela.

The Chilean Physical Society (SOCHIFI), under its president Claudio Gonzalez, continues to function and hold its scientific meetings in the usual way, although with considerable difficulty because of the loss of members and reduced financial support. One of its present preoccupations is that, since all elections are prohibited in Chile, it is unable (like many other organisations) to replace those committee members who leave the country or retire. It may shortly find itself with no committee at all. □

USA

Overheads: a growing problem

Colin Norman reports from Washington on a growing dispute involving overhead costs associated with government-funded academic research

THE federal government in the United States will spend about $3,000 million this year to support research and development in colleges and universities. According to one widely accepted estimate, however, between $600 and $700 million of those funds will be taken up by overhead costs such as heating and lighting, university libraries, departmental administration and so on.

The size of those costs has long been a source of irritation between researchers and university officials, and between the universities and the federal government, but there are signs that the irritation may develop into a serious dispute when the budgets of some research agencies are considered by Congress later this year. Moreover, the universities have been expressing considerable concern about a review of overhead costs which has been under way in the Executive branch for the past 18 months. Important principles underlying the support of research in the United States are involved, and university officials are now preparing for battle.

It is easy to see why concern about overhead costs is growing. Overheads—which are usually referred to as indirect costs—have been rising faster than the direct costs of doing research in the past few years, which means that indirect costs have been taking up a steadily increasing share of the federal support for academic research. Since, until very recently, total federal funds for basic research have been declining in purchasing power, university scientists are alarmed that the universities are taking an increasingly large bite out of already scarce resources.

And there seems to be a feeling among conservatives on Capitol Hill that the universities may be using federal research grants as a way to obtain revenue to support a variety of questionable activities. A staff aide to one right-wing Congressman argued in an interview last week, for example, that "the taxpayer is getting ripped off because the universities are turning basic research into a porkbarrel" for higher education. Indirect costs, he opined, are "a giant subsidy to the universities".

Such sentiments naturally touch a raw nerve among university administrators who are already grappling with steeply rising costs and diminishing federal support. They generally argue, however, that much of the criticism is based on a misunderstanding of the nature of indirect costs and the manner in which they are calculated. Though a number of extremely complex accounting procedure are involved, the basic concept is relatively simple. Procedures differ from one institution to another, but it generally works as follows.

When a researcher applies for a grant for a particular project, he calculates the direct costs of salaries, equipment, technicians' time, computer use and so on. The university then adds a fixed percentage for overheads, and the application is submitted to the federal government. If the grant is awarded, the university keeps the overheads and passes the funds for direct costs to the researcher.

The indirect costs are supposed to cover items and services which are shared by a number of research projects and which cannot be charged to any individual grant. Each university calculates its own indirect cost rate each year, but it is allowed to include only certain items specified by the federal government in a document known as FMC 73-8. The rate charged by the university is subject to audit to ensure that no unallowed costs are included. The rates differ from university to university, with the private universities generally charging the highest overheads and the large state universities, which receive some state subsidies and where economies of scale apply, charging lower rates. At Stanford, for example, the rate is 58%, which means that for every $100 required for the direct costs of a research project, the university adds $58 to the grant application to cover overheads.

A good deal of confusion has arisen because different universities express their indirect cost rates in different ways, with some expressing it as a percentage of researchers' salaries and others as a percentage of total direct costs, but there is one inescapable fact: however they are expressed, indirect cost rates are increasing sharply. According to a Congressional staff investigation published last year, for example, the average overhead cost rate has increased from about 30% in 1970 to about 35% in 1975. At Stanford, the rate has gone from 47% to 58% in the past six years.

The universities can cite good reasons for the increases. Charles V. Kidd, executive secretary of the Association of American Universities, notes, for example, that a number of recent federal regulations, such as equal pay requirements, privacy legislation, occupational safety and health regulations and so on, have placed considerable cost burdens on the universities, and many items, such as fuel costs, have been rising particularly steeply. According to William F. Massey, Vice-Provost of Stanford, for example, the university's fuel bill alone has climbed from $800,000 to $5.5 million in four years. Moreover, Kidd argues that because of the general financial squeeze on the universities in the past few years, institutions have been more diligent in claiming their legitimate costs from the government, and that has tended to push the cost rates up.

Nevertheless, in response to concerns over rising indirect costs, the Department of Health, Education and Welfare (HEW), which is the largest federal sponsor of academic research, has been reviewing the ground rules governing indirect cost rates. In July 1975, HEW proposed a number of revisions to FMC 73-8 which would have placed severe restrictions on the types of services which the universities could claim as indirect costs. Under the HEW proposal, for example, the universities would no longer have been able to include the costs of libraries in their in-