The support given by Research Councils for in-house and university research : the report of a working party of the Board.

Advisory Board for the Research Councils

The support given by Research Councils for in-house and university research

The report of a working party of the Board

THE ADVISORY BOARD FOR THE RESEARCH COUNCILS was established by the Secretary of State for Education and Science in 1972 with the following terms of reference:—

(a) To advise the Secretary of State on his responsibilities for civil science with particular reference to the Research Council system, its articulation with the universities and departments, the support of postgraduate students and the proper balance between international and national scientific activity;

(b) To advise the Secretary of State on the allocation of the Science Budget amongst the Research Councils and other bodies, taking into account funds paid to them by customer departments and the purposes to which such funds are devoted;

(c) To promote close liaison between Councils and the users of their research.

Advisory Board for the Research Councils

The support given by Research Councils for in-house and university research

JULY 1983

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INTRODUCTION

1. We were appointed by the Advisory Board for the Research Councils (ABRC) in July 1982 with the following terms of reference:—

> "To enquire into the distribution of Research Council resources in support of research in their own establishments and in universities and elsewhere; and to make recommendations".

Our membership was as follows:

Chairman

Mr J R S Morris FEng FIChemE, Chairman of Brown and Root (UK) Ltd*

Members

Sir Leslie Fowden FRS, Director , Rothamsted Experimental Station, Harpenden, Herts

Professor J G Morris FIBiol, Professor of Microbiology, University College of Wales, Aberystwyth

Mr B W Oakley CBE, Secretary, Science and Engineering Research Council

Professor Sir David Phillips FRS FInstP, Professor of Molecular Biophysics, University of Oxford†

Professor Sir Peter Swinnerton-Dyer Bt FRS, Professor of Mathematics, University of Cambridge and Master of St Catharine's College*

Secretariat

Mr R G Powell (Agricultural Research Council)

Mr K C Humphrey

Mrs J Baker

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*Member of the ABRC

† Sir David Phillips was appointed Chairman of the ABRC with effect from 22 January 1983 but continued in membership of the Working Party.

2. The SUSR report* was published in June 1982. The report was, as its title indicated, essentially concerned with the funding of university research and on this broad subject the Joint Working Party recommended inter alia (8.5) that universities should give a higher priority to their funding of research at the expense of their other activities. In saying this the report went on to record (8.15) the Joint Working Party's recognition that there might be a case for Research Councils also to give higher priority to university research support and continued: "We are not satisfied that the balance of Research Council expenditure between such support and the work of their own institutes is in all cases right. When sudden economies are forced on a Research Council, university support may be the only or chief area where it is possible to make cuts with the necessary speed. We are concerned therefore that university support may be particularly vulnerable to economies, but we believe it essential that it be maintained. We recommend therefore that a study is made under the auspices of the ABRC of the balance between the support (suitably and uniformly defined) provided by the Research Councils for university research and their own in-house work".

3. The present Working Party owes its existence to this recommendation but the SUSR report has throughout been of general relevance to our study and we shall make further references to it later in our own report. We think it right as a preface to our report to stress the circumstances in which the earlier Working Party was set up and the continuing relevance of the introductory remarks in the SUSR report which noted (paragraph 2 of that report) that the Joint Working Party had been appointed following a period in which wide concern was being expressed about the health of the dual support system for research in universities, given the strains which were already appearing in its operation during the period of economic restraint in the 1970s.

4. While we have from the outset readily acknowledged our direct descent from the SUSR study and our indebtedness to our predecessors on the Working Party which carried it out, we have been equally clear that our remit has contained a somewhat different emphasis. They were concerned with the health of university research, our own study has been aimed at an overall view of the balance between the support given by the Research Councils to research in the universities and local authority institutions on the one hand and in their own institutes on the other. This has led us

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* Report of a Joint Working Party on the support of University Scientific Research. HMSO Cmnd 8567.

inevitably to consider in some detail the research support provided by the UGC and its deployment by the universities. We have sought always to keep in mind considerations of value for money in the interests of the UK economy.

5. In formulating our approach to the task we attached considerable weight to the need for a rapid study. We decided that the nature of our remit and the need for urgency called for submission of a report in time to influence the Board's Forward Look exercise in the early summer of 1983.

6. In making recommendations about the policies of the Research Councils, we are aware that we may appear to be intruding into the management of research by the individual Councils. This is not the intention. The responsibility for management of research lies with the Councils but we have thought it important to comment on the different policies adopted by the Councils in the pursuit of their aims, particularly as these affect the support for research in universities.

7. We found that some helpful information already existed in the archives of the ABRC, in the published annual reports and handbooks of the Research Councils and in the appendices of the SUSR report. We decided however to supplement this by asking Research Councils for factual information about their own establishments and to invite them to describe their funding policies. A limited programme of visits to Research Council establishments and to universities was undertaken and other relevant bodies were invited to submit evidence to us. The institutions visited are listed at Appendix A. We should like to express our gratitude to the Reserch Council and university staff who invariably received us in a friendly, helpful and hospitable way.

8. Bodies which submitted written evidence to us are listed at Appendix B and to them also go our thanks for their ready cooperation.

9. Our report was received in May1983 by ABRC who agreed that it should be published as a discussion document.

10. We gratefully acknowledge the support provided for our study by the Secretariat and we should in particular like, on behalf of the Board, to thank the Agricultural Research Council for making available Mr Powell as a member of the team.

THE EXISTING FUNDING OF RESEARCH

1. In this country research in the natural sciences, engineering and the social sciences is carried out by a variety of institutions among them universities and polytechnics, Research Council and Government establishments, industrial research units, commercial organisations, and private or charitable bodies. In our study we have been concerned solely with Research Council establishments and institutions of higher education; we have made no direct examination of the other types of research centre though we are of course fully aware of the significant amount of research carried out in them. It is simply that we have not seen research in industry and commerce, Government research establishments or private bodies as coming within our terms of reference.

2. In order to avoid repetition of the detail concerning the funding of research in higher education we would refer readers to the SUSR report and in particular to Section 6 (The funding agencies and their policies), and to Appendices J-Q of that document. We think however that readers may find it helpful as a context to our study to have the following brief summary for which we have freely drawn upon the SUSR report and to which we have added some comments of our own.

The UGC

3. The UGC allocates Exchequer grants for teaching and research to individual universities within an overall sum determined by the Government. In the past this sum emerged from discussions related to an agreed target for student numbers but, in recent years, it has been arrived at in accordance with what the Government considered the nation could afford. Recurrent grant for 1983-84 amounts to £1,192m with an additional sum of £81.9m for equipment and furnitures grant. The modus operandi of the UGC is not, we think, generally well understood in the research community and the Committee's methods of appraisal and allocation do not in our view help universities in determining their approach to the research component of the block grant.

The Universities

4. Once universities have their allocation from the UGC they then decide themselves upon its internal distribution and, as the SUSR report noted, they are in that sense themselves funding bodies for research. The criteria for allocation of block grant vary widely and

may, for example, take account of varying departmental responsibilities, staff/student ratios and of the relative expense of one subject compared with another. They may be substantially formula-based or make provision for exercising discretion and judgement. Allocation mechanisms also vary considerably as we discovered on our visits; some may be operated by a central source within the university, whereas others may take the form of a substantial devolvement to faculties or departments. Against this background the importance for research of the individual university block grant from the UGC is obvious.

The local education authority sector

5. Advanced further education (AFE) in the local authority sector is funded from the Rate Support Grant. AFE is spread unevenly among authorities and its costs are therefore shared ("pooled") across all authorities. The Secretary of State for Education and Science limits the amount of expenditure that may be pooled each year, and determines how that amount should be distributed. Individual local education authorities are not required by law to spend on AFE precisely the amount received from the "pool"; if they do decide to spend more, they must finance it from their own resources.

6. The National Advisory Body for Local Authority Higher Education (NAB), set up in 1982, advises the Secretary of State on provision in the local authority sector and on allocation of resources within it.

The ABRC

7. The Board advises the Secretary of State for Education and Science on his responsibilities for civil science, particularly in the field of the Research Councils, and on the distribution of the Science Budget. The Science Budget is directed towards developing the natural and social sciences and engineering, to maintaining a fundamental capacity for research, and to supporting higher education at the postgraduate level. The Science Budget, the level of which is determined centrally by Government, is distributed between the recipient bodies (the five Research Councils, the British Museum (Natural History) and the Royal Society) with the advice of the ABRC: 97% of the total Science Budget going on annual grants to the Research Councils

8. The Government have reaffirmed their intention broadly to

maintain the value of the Science Budget so as to safeguard this component of the nation's support for basic scientific research at a time when provision generally for higher education, along with most public expenditure, was planned to decrease. The SSRC has had to make adjustment in the face of reductions in its funding and the ARC also has not been able to maintain the volume of its research activity latterly but, on the whole, it would seem that the bodies funded from the Science Budget have so managed their affairs as generally to maintain the level of their total research activity, and to free resources for new opportunities, despite evidence to suggest that the Government cash factors have not always been sufficient fully to compensate the Research Councils for increases in costs.

The Research Councils

9. As the core of our study the funding policies of the Councils are examined in a separate section.

The Computer Board

10. It is, we think, relevant to include this Board because its capital expenditure on computer purchase and rental for universities in 1981-82 amounted to some £13.2m with recurrent expenditure by the Board of £14.4m in that year. The computing power thus provided is part of the basic infrastructure of university research, complementary to the well-found laboratories which the UGC grant is intended to provide as a contribution to the dual support system.

Government departments

11. Government departments commit large sums of money to research and development. SUSR estimated that in real terms the total research and development budgets of departments grew from £796m in 1971-72 to £1,346m in 1978-79 (of which £1,070m represented expenditure on defence R and D) but noted that relatively little of this money was used to support or commission research in universities. Of the funds that go to universities and polytechnics, most are in the form of research contracts. Research grants amounted to £1.6m in 1978-79, support for studentships and fellowships was £0.4m in the same year and research contracts amounted to £12.0m.

12. SUSR noted as a cause for concern the surprisingly small contribution made by Government departments towards university re-

search activities, suggested that departments might not fully appreciate the extent to which the research they needed could be carried out within the universities and concluded that there would be advantage in increased contacts between university researchers and Government laboratories, for example in the shared use of specialised facilities. Although this aspect of the nation's total research effort did not come directly within our remit we share the views expressed by our predecessors and are disposed to support a suggestion put to us by one of the universities that there could be merit in a separate study of the balance of support given by Government departments to their own research and development units and to other bodies which we would take necessarily to include university and non-university higher education institutions and establishments run by Research Councils.

Charitable trusts and foundations

13. Charitable bodies supporting research divide broadly into two groups, those with a purely medical remit and those with a wider field of interest. They show a considerable diversity and consistent information about their research funding effort is not easily presented. SUSR concluded that in general the relationship of charitable bodies with universities was similar to that of Research Councils and that, generally speaking, university research was well served by the charities since, not only did the funds provide a significant contribution to overall resources, but they were especially effective because they could provide in a flexible way relatively small amounts of funding where these were most needed.

Industry

14. SUSR noted the importance and complexity of the relationship between universities and industry and outlined a number of the issues and factors involved. We endorse the comments made and would simply add that, in parallel with our own study, there has been a study by ACARD with the co-operation of the ABRC, set up at the instigation of the Prime Minister, on the links between industry, the Research Councils and higher education institutions in the field of research and its application. Our Chairman, as a member of the ACARD Working Group, has enabled us to maintain contact.

The Royal Society

15. The Royal Society, in common with the Research Councils, receives the major part (some 60%) of its total annual income from the Government through the DES Science Budget. The Society de-

votes its income to the furtherance of scientific research in a variety of ways and makes a significant, selective contribution – although in monetary terms the amount of this is not large.

THE SUPPORT POLICIES OF THE RESEARCH COUNCILS

16. The ways in which the five Research Councils support scientific research have been summarised on previous occasions in published material, notably in the Third Report of the ABRC (Cmnd 7467) and in the SUSR report. We nonetheless have included in our own report a brief description of those policies and later in this section have summarised the policy statements made to us by the Councils. From these the following broad categories of research support may be identified:

a. "In-house" research establishments either maintined or supported by a Council and permanently staffed for the conduct of research.

b. Establishments entirely funded by a Council to provide specialised facilities, on a national basis because of their high cost, for the use of both university researchers and the Council's own staff.

c. Research Units, located within university departments but staffed and financed by a Council.

d. Research Grants. These are awarded to specific members of a university research department. In certain cases the grant may be of 5 or 10 years duration and be intended to support a Research Group working on a clearly defined topic which is of interest to the funding Council. The staff supported in this way are university employees. Research Grants may also be made to research workers at polytechnics on the same basis as those at universities.

e. Postgraduate studentships, mostly in universities, and fellowships for postdoctoral work. A studentship normally comprises both the payment of fees and the payment of a maintenance grant to the award holder.

f. Subscriptions paid by a Council to an international research organisation which may provide facilities on a co-operative basis accessible to UK researchers many of them from universities. Examples include the European Organisation for Nuclear Research (CERN) in the field of SERC and the European Molecular Biology Conference and Laboratory to both of which UK subscriptions are paid by MRC.

17. The distribution of each Council's research support between these six categories varies widely. To a great extent the differences in distribution are related to their tasks, their histories and indeed their inheritances. Thus SERC bears the responsibility for the provision of several costly facilities under heading (b) and plays the major role in the funding of awards under (e). ARC in contrast makes very few awards under (e) as it relinquished this responsibility in 1967 jointly to SERC and the Ministry of Agriculture, Fisheries and Food. ARC's major expenditure lies in category (a) in order to fulfil one of its Charter obligations to "establish or develop institutions or departments of institutions for the advancement of research in agriculture or the production and processing of food". In a similar way the distribution of the other Councils' expenditure between these six categories is influenced by the balance of their responsibilities.

18. Council support for university research can be considered under two main headings, 'direct' and 'indirect'. Of the types of support set out at a-f above, 'direct' support may be said to include research grants for specific projects and student awards of various kinds. The 'indirect' contribution is far less easily defined but, it is nevertheless very substantial. In addition to the major research facilities provided by Councils for use by university researchers, some Council establishments allow access to their facilities by university staff although as we discuss later in our report, it has been extremely difficult to quantify the extent of this in most cases.

19. From the information published in the Appropriation Accounts for 1981-82 we have compiled the following table showing expenditure by each Council in that year on research grants and postgraduate awards and also current expenditure on their own research establishments and on other establishments.

Table A. Categorised Council Expenditure 1981-1982 £m (rounded)

	a	b	c	d	e	f	Totals
ARC*	6.4	67.9	11.6	3.7	0.5	—	90.1
MRC	6.0	53.9	7.8	31.6	5.7	1.5	106.5
NERC*	4.7	60.5	10.9	5.1	4.7	—	85.9
SERC	8.2	56.3	21.5	64.4	33.4	40.8	224.6
SSRC	2.4	1.1	—	8.2	9.2	—	20.9
	27.7	239.7	51.8	113.0	53.5	42.3	528.0
			291.5		166.5		

Table B. The above expressed as percentages of the total expenditure by Councils

	a	b	c	d	e	f
ARC*	7.1	75.4	12.9	4.1	0.5	—
MRC	5.6	50.6	7.3	29.7	5.4	1.4
NERC*	5.5	70.4	12.7	5.9	5.5	—
SERC	3.6	25.1	9.5	28.7	14.9	18.2
SSRC	11.5	5.3	—	39.2	44.0	—
	5.2		55.2		31.5	8.1

Key to columns:

a. Administrative and central expenses.
b. Gross current expenditure on research establishments and units.
c. Capital expenditure on research establishments, units and headquarters.
d. Expenditure on research grants and contracts to universities and other bodies.
e. Expenditure on postgraduate awards and fellowships.
f. International subscriptions.

* For these Councils the totals of expenditure (and also the calculated percentages in Table B) include a large amount of income for research commissioned in their institutes.

20. The SUSR report had contained (Appendices L and M) tables which sought to show direct and indirect expenditure by Councils on university support. In order to arrive at an indication of the spread of support our predecessors had attempted to apportion expenditure by Councils between 'in-house' activities and 'indirect' support of university research but it was represented to us in our own study that such an attempt, however laudable in theory, was fraught with such difficulties of definition as to be in practice seriously misleading. The problem, it was put to us, was that no generally acceptable definition existed of what exactly was meant by university support, and that in the absence of such a definition, any figures provided by Councils had inevitably to be treated with considerable reserve because different Councils would include different things under the same heads and because much of the work of the Councils was of a collaborative kind with strong associations with or influence upon academic institutions but which did not lend itself to quantification in money terms. We saw much force in these arguments and we concluded that it would not be right for us to offer tabulated information which purported to attribute cash figures to the 'direct' and 'indirect' support policies of the individual Councils.

21. We have however been impressed by the large amounts spent by Research Councils in universities. Table A indicates a total of £291.5m spent on in-house activities compared with £166.5m spent on university research support (which increases to £208.8m if international subscriptions are included and would increase further if a figure for indirect support through uncosted access to facilities were added). This last figure will be further enhanced if the costs of Research Council Units embedded in the universities are included. This expenditure is subsumed in columns b and c. The substantial nature of university support by Research Councils must therefore not be overlooked. It is our opinion that it is not possible to lay down a specific ratio of expenditure between the two routes of research support. Rather more emphasis should be placed on the appropriateness of the location of the work and its associated expenditure. It has been to this aspect that the Working Party has addressed most of its time.

ARC

22. This Council has 8 institutes of its own; it supports a further 14 institutes by grants in aid and funds 5 units and 8 research groups in universities.

23. The objects for which the Council is established under its Charter are:—

1. the organisation and development of agricultural and food research;
2. the establishment or development of institutions or departments of institutions for investigation and research relating to the advancement of agriculture or the production and processing of food;
3. the making of grants for such investigation and research.

24. The Council is not specifically required to support the universities and, under the terms of its Charter, is free to decide which institutes it supports or which grants it makes in order to carry out its functions as effectively as possible. That the Council's agriculltural research is largely carried out in institutes is partly historical and is also related to the nature of the work which often requires large scale specialised facilities or long-term experimentation or both.

25. The Council's funding derives principally from two sources – grant-in-aid from the Science Budget and 'commission funds' from the Ministry of Agriculture, Fisheries and Food. Very broadly the 'commission funds' support applied work at the Council's establishments and the grant-in-aid from the Science Budget supports fundamental or strategic research at the Council's establishments and the direct funding by the Council of university research.

26. The Council has emphasised that certain expenditure apparently of 'in-house' research contains a considerable element of university support and that the balance between in-house and university funding is always under review, but is subject to a number of constraints. Much of the Council's research programme requires resources of land and animals which may not be available within the universities, and sometimes a degree of research direction is called for which was not so readily achievable within a university environment and timetable.

MRC

27. The MRC has 2 large research establishments, the National Institute for Medical Research and the Clinical Research Centre and 62 other establishments or units of which 38 are closely associated with universities and contribute to research there. The Council also provides block grants to certain other institutes. MRC provision for

university and polytechnic direct support is made centrally by the Council rather than through the individual research establishments.

28. In addition to research grants and postgraduate awards the Council also supports as members of their 'External scientific staff' (ESS), a number of research workers working individually or as members of small teams (but not part of any MRC institute or unit). The majority of these research workers are directly attached to, and closely integrated within, university departments; most of them undertake certain teaching and related duties and make a considerable contribution to the activities of their host institution. The provision made by the Council for ESS in 1981/82 was of the order of £5m.

29. Considerable freedom is given to scientists in MRC Institutes and Units to generate and develop their own programmes of research. Redirection of the work in MRC establishments may follow from regular peer reviews or following the retirement of a Director; in addition, the Council may request new work to be undertake in response to its own perception of scientific needs or following requests from government departments. In its support for research in universities the Council for the most part responds to the wishes of university workers by providing grants as long as the work is scientifically acceptable and funds are available – either a project grant (maximum 3 years) or a programme grant which can provide support for at least 5 years and is extendable for a second, or even third, 5-year period. Recently the Council have sought to encourage proposals for project grants rather than the longer-term programme but their hope is that, in a period of greater financial stability, it will be possible to accept more programme proposals. In recent years research proposals which appear to justify longer-term support have been directed away from the research unit idea to the programme grant scheme. While in particular circumstances as, for example, where there is a national need, or the work involved requires facilities which are out of scale with those which might be expected to be provided in a university setting, the Council can still decide to establish a research unit. It is the Council's policy to set up new units within universities, although financial constraints make this form of support, attractive though it is to the universities, increasingly difficult to apply.

NERC

30. The NERC has 10 component institutes and supports 5 other associations and units. In addition the Council maintains a fleet of six research vessels which are also used by universities. Over £30m

(1981–82) – over 35% of NERC's income – is for research commissioned in its institutes.

31. In addition to direct support in 1981–82 of over £9m in research grants and postgraduate awards and fellowships the Council has estimated its contribution by way of indirect support in that year as about £5.28m through ship-time (including charters), equipment loans, services, research contracts, centrally-funded projects, and assistance to vacation/sandwich students.

32. The Council stressed that much of the outcome of research at institutes was essential to university teaching and research programmes even though this was nor the sole objective; and offered by way of example the geological maps produced by the Institute of Geological Sciences, which formed a crucial teaching tool for universities as well as providing a basis for most geological research undertaken in the UK. The Council emphasised that although it was not realistic to cost this form of contribution to universities the total actual Council support for universities greatly exceeded the figure of direct support in the form of grants and students awards.

SERC

33. This Council supports four major research complexes, the Daresbury and the Rutherford Appleton Laboratories and the Royal Observatories at Edinburgh and Herstmonceux. It participates in a number of European and international scientific ventures.

34. SERC explained that their primary purpose was to sustain standards of research and postgraduate education in higher education. The Council supported research in universities and polytechnics and similar institutions directly by the provision of research grants and postgraduate training awards and indirectly by provision of central research facilities and through membership of international scientific organisations. The direct support of universities and polytechnics by research grants and postgraduate training awards was administered by the Central Office; the central research facilities are for the most part provided through the four establishments of the Council. When the Council was created in 1965 its establishments came together from diverse origins. Since their inception the purpose of the Daresbury and Rutherford Laboratories had been to provide central facilities for the university community. In the case of the two observatories, Edinburgh and Greenwich (Herstmonceux) their role originally had been to undertake

astronomical research and to provide certain national services but, under the aegis of the Council, their functions had been brought into line with the general academic service objectives of the Council although their specialised research and national services functions remained.

35. The Council explained that, whilst by far the greater part of their direct funding of university research took the form of research grants, there were also payments made to universities arising from what were variously called 'research agreements', 'laboratory agreements' or 'extra-departmental contracts'. These were all arrangements entered into between the Council's research establishments and individual university departments. In 1981/82 there were 120 of these to a total value of nearly £1m.

SSRC

36. The SSRC supports 5 research units of its own located in universities and has established 6 Designated Research Centres at universities and other academic institutions. Of the Research Units three (Aston, Warwick and Oxford Universities) are concerned with matters of topical concern (ethnic relations, industrial relations and socio-legal studies) while a fourth (at Cambridge University) deals with the history of population and social structure and is in the forefront in the use of modern techniques, in particular computing, for the analysis of historical data. A fifth Research Unit, the Social and Applied Psychology Unit at Sheffield University, is administered jointly with the Medical Research Council, and carries out research into psychological well-being and effectiveness with particular reference to work and employment. The six Designated Research Centres are intended to promote the support by the Council of key growth areas in social science research.

THE VIEWS OF THE UNIVERSITIES

37. Certain broad themes occurred in the majority of the evidence we received from universities and in the views put to us in discussion on our visits. We summarise below the main contentions put to us and, later in this section, make some comments upon them. In general, academic institutions acknowledged the assistance they received from the Councils which they mostly found helpful to deal with. The central facilities made available for big science were warmly appreciated. The efforts made by the Councils in a very difficult financial climate, to sustain and, to some extent, to develop further their support for university work were widely welcomed.

38. Most of the views put to us however emphasised that the heavy cutbacks in funding from the UGC had seriously jeopardised the dual support system and had eroded the academic research base. The economies having to be made by universities and the consequent deterioration in staff/student ratios were said to be having an adverse effect on research effort.

39. The general view which came over strongly was that the universities were reasonably entitled to look to the Science Budget via the Research Councils for resources to offset the detrimental effects of the cuts in UGC funding and to maintain the standard and volume of academic research. Along with this could also be identified a feeling that Council in-house facilities were being protected while direct support for universities was being reduced and it was suggested that research in Council establishments would benefit by being subjected to the same stringent accountability as research proposals from the universities. It was, in this connection, also suggested that much university research was partly judged by Councils on its industrial relevance and that the same criterion should be applied to work in Council establishments.

40. We found evidence of a belief that Councils were too inclined to support projects in "safe" areas of well-known research activity and were prone to favour "big" at the expense of "small" science. It was also held that large, open-ended international commitments (eg. CERN) took too large a slice of Council resources to the detriment of funding for smaller projects in the UK. Some universities considered that Councils tended to prefer funding research in large departments so that smaller science facilities did not get a fair share of resources. A number of universities produced figures which supported the comment that, while the Councils remained the largest

single sponsor group for research, their funding of research grants had declined during the decade since the early 1970s, a decline which had been masked by the offsetting increase in studentships. Some of our correspondents identified a marked decline in the total value (as distinct from the number) of projects supported in 1981-82 as compared with recent earlier years, a decline which was even greater if the figures were adjusted to allow for inflation.

41. It was repeatedly put to us that the balance had shifted in favour of Councils' in-house work. The tendency of Councils at a time of economic difficulty was to protect their own establishments having built up in them a heavy investment in staffing, equipment and buildings which reduced flexibility and operated to the detriment of university research support. The opinion was expressed that in-house research should be restricted to areas of work which through size, expenditure or complexity universities would be unable to handle. In-house facilities should already have sufficient flexibility to absorb savings in hard times but universities contended that there was little evidence that the need for such flexibility was generally accepted in the Councils.

42. Our university contacts readily accepted the need for some directly-funded Research Council institutes where major facilities were required or a concentration of expertise was clearly necessary but many considered that money would be more effectively spent by providing additional resources and manpower to assist outstanding research groups in universities. This approach was thought right because it took advantage of existing expertise and the research "floor". Because it involved fixed-term commitments, it also made for valuable flexibility in the longer term. Some of our correspondents held that new independent Research Council institutes should not be established unless the work in question could not be accommodated within universities and that existing institutes should not be retained unless they showed promise of becoming of genuinely international standing.

43. We found considerable emphasis on the mutual benefits to be derived from the close association of Councils' Units with universities and a general view that such units should be sited on campus. Scientific research was more likely to flourish in the university environment than in small isolated groups while the Units would bring intellectual stimulus and expertise to the universities.

44. The general view which emerged from the evidence was that,

because of the size and nature of Councils' investment in in-house work, no major short-term shift of resources towards universities could be expected but that efforts should be made to encourage such a shift in the longer-term.

45. Other points made to us included the following:

i. It was suggested that a significant amount of work being carried out in Research Council establishments duplicated work in universities and that more efforts should be made to identify and to eliminate such duplication.

ii. The question of staff mobility was seen as being of crucial importance. On the one hand, the Councils, like the universities, needed to be able to attract high quality researchers, a need which required a sufficient level of remuneration and some security of tenure as well as suitable facilities. On the other hand, flexibility was greatly to be encouraged and it was not easy to find the right balance. Specific suggestions put to us in this context included the staffing, in the longer term, of Research Council establishments by researchers seconded from the universities and, in the shorter term, examination of the possibility of staff transfer between Councils, the Scientific and Administrative Civil Services and the universities.

iii. Research Councils should give top priority to project grant schemes, otherwise the prospects for research in the future would be poor. Such support should receive priority even at the expense of programme grant support and support of Councils' own units.

iv. It was more than once put to us that there should be a mechanism by which universities could make an early case for support to be balanced against the competing claims of the Councils' own establishments. In this connection the strong university presence on each of the Research Councils was recognised and the participation by members of univerities in the normal peer review readily acknowledged but it was felt that the latter, although valuable, represented an advisory process in relation to the distribution of sums already allocated by Councils for university support and that what was needed was a more effective university presence at an earlier stage when Councils were, in considering their alloca-

tions, in a position to shift the balance between the claims of their own institutes and those of university researchers in similar fields.

v. Many good research proposals – some of first rate quality – were currently being turned down solely for reasons of financial stringency, sometimes after initial indications of likely approval. There was concern at the restrictions in research student quota awards. Because of the shortage of research students and assistantships the numbers in research groups were alleged often to be undesirably small and fluctuating with the consequent threat to valuable continuity in research. There was a need to maintain research fellowships and other short-term research appointments. Grants were sometimes said to be approved for shorter periods than requested or were only partially met leaving departments to find a greater than expected proportion of the costs.

vi. Research Training Support Grants should be retained and regularly increased in value in line with inflation – the recommendations in this sense in both the SUSR report and the report of the ABRC Working Party on Postgraduate Education (Cmnd 8537) were warmly endorsed.

46. We can see much force in some of the arguments summarised above but this is not to say that we agree with everything put to us by the universities. We have two major comments on the views put to us. First, the universities may not have been sufficiently prepared to acknowledge the differing roles of the two legs of the dual support system. Despite the serious effects, which we in no way wish to deny, of the cutbacks in funding from the UGC it would in our view be wrong to expect the Research Councils drastically to reshape their support programmes so as to provide extra resources for basic research in universities to compensate for the decline in UGC support. Indeed we wish to see reestablished the effective use of both sides of the dual support system.

47. Secondly, we think that some of our correspondents from the universities in referring to what they perceived as an excessive emphasis on the support of some of the Research Councils' "big" science may not have fully appreciated the extent to which the ABRC has since the early 1970s progressively reduced the share of resources made available to "big" science in order to release funds for other areas of research. This policy has been reflected in the

major shift of resources that has taken place within SERC's budget from "big" science mainly to engineering but also to biotechnology. The Board is however conscious of the need for flexibility over resource allocations but concluded that in 1982* further redeployment of resources away from "big" science would be undesirable. This aspect of policy will continue to be reviewed each year.

48. Turning to some of the other principal comments put to us from academic sources: we can accept to some extent certain of the views put ot us and summarised above which are critical of Research Council policies but we think that some of the contentions put betrayed a lack of knowledge of the Councils, their institutes and their approach to research support. Despite the widely held view that Research Councils have cut back on support for university research it is evident from what the Councils have told us that this support has been in large measure maintained. We would only add that these views reinforce our conviction (discussed more fully in the section on collaboration) that universities and Research Council establishments should take active steps to cooperate more closely, especially through the medium of staff exchanges and joint projects.

49. A number of critical comments (not all of which we have included in the summary above) were received from universities about various aspects of the research grant allocation and postgraduate student support schemes of the Research Councils. We did not think it appropriate to go into what could be seen as matters of detail rather than as broad policy considerations. We are sure however that the Research Councils would be very ready to examine complaints or suggestions put to them about the operation of their grant or award schemes and we suggest that Councils and academic institutions should come together more frequently than they may do at present in order to discuss matters of grievance or misunderstanding.

50. To conclude this section we would wish to add our warm support to the recommendation made by earlier Working Parties that the Research Training Support Grants should be retained and increased in value in line with inflation. In this connection we welcome the recent approval by the Government for an increase, the first for some 8 years, in the level of these grants but we urge that this level should not in future be allowed to fall so far behind the indices of prices.

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* The Science Budget: A Forward Look 1982 (DES 1982)

THE DUAL SUPPORT SYSTEM

51. The dual support system for university research has been operating for many years and has been widely endorsed by the academic community. The system has been the subject of various enquiries in the recent past, but it appears that the rationale behind the system and the nature of its operations have not always been fully understood. We have in this section drawn upon the SUSR report adding our own comments in the light of evidence we have received from the university community.

52. The 'duality' of the system is sometimes taken to refer to there being two sources of funds, the UGC and the Research Councils. This is not so since a sizeable part of university funds derives from student fees and of the total external research income only about half comes from the Research Councils. The balance is obtained from a wide variety of other sources of support including industry, charitable bodies, Government departments and private benefactors. Another equally misleading assumption is that the duality refers to a separation between the direct costs of research, which were met by Research Councils and others, and the indirect or overhead costs which come from general university funds; a false assumption because general university funds are intended to provide in full for a basic level of research, as well as to sustain the research infrastructure on which the effective use of additional Research Council funds depends.

53. The essence of the dual support system lies in the character of fundamental research which, in order to flourish, requires both an assured general level of non-specific basic support and the availability of additional funds in the form of external specific grants and contracts for specialised or more advanced work. The advantages of this system are seen as being both general and particular, general in that the academic community in the widest sense is able to derive benefit, particular in that speculative research initiated by persons of proven track record and not subject to peer review is often the seedcorn for the future. Additional benefits may be seen to include the provision of a mechanism for concentrating resources, providing central facilities and generally encouraging cooperation and collaboration. The system is held to provide effectively for direct encouragement of efforts in particular fields which are seen as being of national importance.

54. Our firm opinion formed on the basis both of our individual

experience in those institutions with which we are closely associated and our collective experience gained during our visits is that the strains and deficiencies within the academic research community have become more pronounced over the past 2 years. Despite the Science Budget operating broadly on a basis of level funding, the parallel funds from the UGC have been subject to cutbacks of such magnitude that the dual support system is now under considerable strain.

55. It is evident that many constraints are at the moment reducing the effectiveness with which universities engage in research. These have largely arisen from the financial economies imposed by the Government upon the universities which have affected particularly the provision of running expenses, equipment and technical support for research and advanced teaching.

56. An analysis of statistics provided by the UGC and published in December 1982 (University Statistics Volume 3, 1980 Table 10) has indicated that the level of expenditure on equipment and consumables at the departmental level in universities has been falling when measured as a percentage of the expenditure on salaries during the recent past, a trend which may be seen from Table C below.

TABLE C. Expenditure on equipment and consumables expressed as a percentage of the expenditure on salaries

	70-71	75-76	76-77	77-78	78-79	79-80	80-81
Universities (Historic prices)							
All Departments	22.4	18.6	17.3	18.2	19.0	17.2	16.5
Arts only	7.4	7.4	7.6	7.9	8.2	7.5	7.0
Science only	31.5	24.8	22.7	23.9	25.1	23.3	22.8
Medical only	19.3	20.7	19.1	20.7	21.7	18.0	15.8

Comparable information in respect of the Research Councils is not available in a form that would enable us to make a comparison with the situation in the universities, but it is our opinion that the Research Councils have managed to maintain a reasonable level of expenditure on consumables in relation to the other calls upon their funds.

57. We have considered carefully a number of strategies to alleviate the financial problems of the universities, given that any sub-

stantial increase in Government funding cannot be assumed for the foreseeable future and that the SUSR report has already put forward a number of helpful specific suggestions. Among the possible solutions was the radical change to funding all university research from the Science Budget with an appropriate reduction in the UGC grants. This has undeniable superficial attractions in seeming to offer more protection for, and perhaps more effective use of resources for research, but we have concluded that it would be a retrograde step which would have undesirable consequences including, perhaps most important of all, reduction in the capacity of university staff to engage in speculative research. We are satisfied that the university infrastructure for research should be, and must remain, for the universities themselves to provide out of funds made available by the UGC.

58. We consider, however, that, while the UGC should continue to make the recurrent and equipment grant allocations to the universities, there should be one important modification to the existing system: we would wish to see the research component of the UGC funds allocated to each university earmarked for this purpose with suitable broad guidance from the UGC about both the basis for the allocation and the application of such funds. We make this recommendation in the full knowledge that the SUSR Working Party did not support such a proposal. We believe however that our predecessors placed too great an emphasis on the indivisible character, as they saw it, of the block grant and we consider that the funding situation in the universities demands bold solutions given the continued deterioration in the position. This would, we accept, be a major change in the allocation process and we recommend that the UGC should, in conjunction with the ABRC and the universities, examine the implications of this recommendation. We are reinforced in this conclusion by the recent statement from the Royal Society that the dual support system was collapsing because the reduction in UGC funds combined with the difficulty of reducing academic staff numbers, put on universities an irresistible pressure to reduce severely the funds they provided towards the recurrent cost of research. The Royal Society went on to conclude that no solution would be adequate, short of earmarking for research purposes a share of the UGC grant to each university.

59. We associate with this a further recommendation to which we attach much significance. The SUSR report recommend that universities should establish Research Committees and we strongly endorse that proposal. We know that a number of universities already

have such committees or bodies which perform similar functions but we have no evidence to suggest that significant progress has so far been made on the establishment of new committees of this type.

60. We recommend that it should be a UGC requirement that each university should have a Research Committee (or some equivalent which would satisfy the UGC) in order to receive an allocation of research funds. The Research Committee should include representatives from outside the university, including Research Council nominees and relevant people from industry and commerce. They would be charged not only with allocating funds for research, both generally and for specific projects, but also with ensuring the cost effectiveness of the work, its exploitation if successful, and the transfer of expertise, developments and inventions to other appropriate research groups or centres or to industry.

61. Given that some earmarking of research funds within the UGC allocation is adopted we envisage that, following allocation by the university administration of fixed costs for staff, buildings and services a substantial part of the remainder should be allocated for disbursement by the Research Committee.

62. If proposals along the lines indicated above are implemented we believe that strong university departments will continue to develop, with well-found laboratories and with a vigorous capacity for research. The obverse is that some will not be so well supported and may develop into departments concerned mainly with their teaching activity and supported by individual scholarly activity which requires neither the well-found laboratory nor Research Council support. On our visits we encountered differing opinions as to the acceptability of such a situation. There is evidence however to suggest that the largely teaching-only department to some extent already exists and we see nothing wrong with it and no necessary incompatibility with the concept of the university. We accept that one effect of our suggestions may be that some departments may have to be closed if it becomes obvious that there are too many in existence in a particular discipline for all to remain viable. Such a process of rationalisation, common enough in industry, would we think ultimately be beneficial for the academic community and for the future of research in this country.

THE LOCATION OF RESEARCH COUNCIL ESTABLISHMENTS

63. When we drew up our programme of work we decided that, in order to consider as effectively as possible the fundamental question of the balance of support, the aspects we needed to examine should include location of Research Council establishments. To assist us in this task we prepared maps to show the broad pattern and distribution of Council establishments and of universities and polytechnics throughout Great Britain. We have included these maps at Appendix C to our report. They are, we suggest, largely self-explanatory; here we would simply wish to draw attention to the heavy concentration of institutions in Central Southern and South East England, the large numbers of MRC units (mostly – although with some significant exceptions – in or near universities) and the relatively small number of SERC and SSRC establishments.

64. In their evidence Councils made some reference to their policy on siting of establishments although without offering detailed descriptions of the processes by which one site had been preferred to another. Accordingly, we decided in our programme of visits to lay some emphasis on this question of location and were interested to hear what headquarters and institute staff had to say about it.

65. From our visits and other sources of evidence it was apparent that, in terms of location, Research Council establishments fell into 3 main categories:

i. those which had been by act of Council policy located within or in close proximity to a university. The SSRC units, most of those of the MRC and a number of establishments of the ARC come into this category.

ii. those more recently established which had not been located in or near a university because other considerations carried greater weight in the choice of location. The SERC Daresbury and Rutherford Appleton Laboratories, a number of the ARC and NERC establishments and 2 of the major MRC establishments come into this category.

iii. those institutes, usually long-established, which happened for historical reasons to be situated some distance from the nearest universities. The Rothamsted Experimental Station (ARC), founded as long ago as 1843 when there were only 4 universities or university colleges in England, affords a striking example.

66. We can readily understand and accept the reasons which led Councils to set up their establishments where they did. We think however that it would be very undesirable for the existing siting of establishments to be regarded as immutable in deciding future overall policy.

67. There will of course continue to be a place for the existing large institute, which is not necessarily close to a university campus. We are however firmly of the belief that, in order to bring the Research Council and academic communities closer together, any new institutes or units – particularly those of small size or engaged in subject areas outside 'big' science – should, unless there are overriding reasons otherwise, always be established on or near a university campus and in close association with the relevant university departments. Special measures would, we accept, need to be taken in the managements of such campus-based institutes to ensure that the university community at large is given fair treatment in their access to the institute's work and facilities.

68. There seems to us to be a number of problems associated with those institutes which have large central facilities (which one may for convenience call "service institutes"). First, the design and construction of such facilities, whether for "big" or "little" science, involve a large and expert staff of scientists and engineers. Their plans and the implementation of them ought desirably to be monitored but, as the people directly involved in the planning may themselves be the major national experts in the relevant aspects of science, this may present difficulties.

69. Secondly, there is in our view a continuing problem over staff deployment once the facility is completed and in operation. The design and construction teams remain but they are not themselves the natural users of the facility and are unlikely to be satisfied with a role as operators or supervisors. Our collective experience is that these experts are likely to press for continuous development, perhaps interfering with the use of a good facility in the hope of making it better, and to start designing the next generation machine. Much of this developmental work can of course be very desirable but the design staff and the equipment represent a substantial investment which is, in our experience, likely to lead to proposals within the establishment that new capital projects should be developed. Such projects may or may not be in the best interests of the scientific community. Often the resident experts can anticipate future requirements better than the current users but some kind of over-view of their work would seem desirable.

70. Thirdly, we think it relevant to ask to what extent service institutes should have their own in-house research programmes. Our opinion is that that there should at such institutes be some in-house users of high quality to interact with the operators and with outside users but we recognise – and feel obliged to offer warning about – the natural tendency for the facilities to build up their internal programmes and for the parent Research Council to place work in them for managerial reasons.

71. Our conclusion is that there needs to be some form of regular external assessment not only of the quality of central facilities but also of the efficacy of the services provided (and the demand for them), the science that results and the operational roles of the design, construction and permanent in-house research staff of the institute. It seems to us that what is needed is a system of monitoring, perhaps on a four or five year cycle, by experts who are not, or in the main not, drawn from the particular field and who should desirably include some overseas experts. We suggest that it should be for the parent Council to set up suitable groups for the purpose.

72. Quite apart from the issues discussed in the immediately preceding paragraphs there is of course the important consideration that, in institutes established specifically for the university research community, equality of treatment between users must be assured. In general we have been impressed by the collaborative and flexible approach of the large establishment set up to provide facilities for academic researchers from universities and polytechnics nationwide. We consider however that each establishment of this kind should appoint a Users' Committee to assist in the formulation of co-operative arrangements and to monitor progress. In this connection it has been put to us that, in cases where an establishment is seen as part of a particular university with, as normal, the latter covering part of the costs, it sometimes happens that the university tends to assume a proprietary right in the facilities and outside researchers may not feel that they are entitled to use the equipment and services as freely as they might in a separate establishment. The case for siting such an institute on a university campus may well be very strong, but we suggest that Councils should make special efforts to ensure that the proposal will be assured of the full and effective support of that section of the academic community in the subject as a whole. This may require the establishment of management and time allocation panels for the facilities that may be serviced by the host establishment, but not dominated by it.

73. In considering the location of Research Councils' establishments and the main thrust of Councils' support policies we have paid close attention to the readiness or otherwise of Councils to maintain a flexible approach on the permanence of their establishments and to reshape the pattern of their establishments to meet changing or developing needs. We have been generally much reassured by the staff of the Councils and have brought back from our visits a favourable impression of the high quality and motivation of the Institutes and Units which we have seen. We have been encouraged by the strong and effective leadership demonstrated by the Directors and their colleagues in the management of their work.

74. We are however not entirely satisfied that the Research Councils as a whole have up to now been prepared to take a sufficiently hard look at the number and pattern of their institutes in relation to current and likely future needs or to reappraise the appropriateness of current activities in relation to work which could equally well be carried out in either the Research Council or academic sector. Accordingly we recommend a systematic review of these matters by each Council who in turn would keep the ABRC informed of the results. In this connection we appreciate the way, for example, NERC's concentration of IGS has been presented to ABRC, but feel that the giving of such information should be normal rather than exceptional. The attitude of the ABRC should act as an encouragement to accelerate their progress in reducing the number of locations and institutes and to intensify their efforts to integrate more closely research institutes and academic institutes in the interests of more effective collaboration.

75. We would expect such a restructuring to lead , in due course, to the release of funds which in some cases are likely to be sizeable and we think it most important that the Councils should be permitted to retain the proceeds from the sale of plant, buildings and land and to apply them to new developments in the restructuring process. At present we understand that the conventions of Government grant-in-aid policy require surrender to the Exchequer – unless specific Treasury approval to their retention is obtained – of the proceeds from disposal of land and buildings originally purchased wholly or in part from grant-in-aid and we urge that the DES with the support of the ABRC should make every effort to negotiate with the Treasury for maximum flexibility in this respect.

THE EXTENT OF COLLABORATION BETWEEN RESEARCH COUNCIL ESTABLISHMENTS AND UNIVERSITIES

76. We were concerned to examine all ways in which existing obstacles to collaboration between academic institutions and Research Council institutes could be removed or at least reduced in order to ensure a significant increase in the level of cooperation.

77. Councils were invited to tell us about any staff affiliations their establishments had with universities, indicating the forms which these took and bringing out less formal contacts such as occasional lectures, meetings, seminars, external examining and, where possible, quantifying and costing the work described.

78. We are grateful to Councils for doing their best to meet this request; they found difficulty in providing us with reliable estimates expressed in man hours, student numbers or cash resources as a measure of the extent of the affiliation with academic institutions. From the material supplied, we were, however, able to form a general impression of the extent of collaboration which we argumented by information obtained on our visits.

79. In so far as generalisations can be made the broad picture seems to be:—

a. Many establishments have links with more than one university, although the character and strength of the links vary considerably.

b. Where senior staff have a formal affiliation with a university the academic commitment this implies amounts to about 5-10% of their time.

c. Some Research Council staff give occasional or even regular lectures in academic institutions.

d. Some Research Council staff undertake a small amount of examining work for academic institutions, a typical amount of such work falling in the range 20-40 hours per annum for each member of staff concerned.

e. Similarly, there is some participation by institute staff in university administration, the extent varying widely.

f. There can be involvement with either undergraduate or postgraduate teaching or both ranging in scope from access to facilities or data to having at the institute CASE students, sandwich course or other research students.

80. We also asked Councils to supply information on the nature of services supplied to universities at Council establishments, including estimates of the numbers of visiting academic staff and other visitors and of the proportion of the costs of the establishment attributable to this service. Again Councils did their best to provide us with the information but often had difficulty in offering reliable estimates and were able to provide little information on the costs of such work, largely because it was not possible at most institutes to make a meaningful estimate of what part of the establishment's overall budget could be attributed to provision of facilities for outside researchers and other visitors. All that can usefully be said is that the replies indicated that in a typical year almost all establishments, including even those which did not include among their major functions a responsibility for providing facilities for academic researchers, received some visitors either for formal research or for brief exploratory visits. The numbers, as could only be expected, varied very widely with the larger establishments and/or those performing work with a known reputation receiving the largest numbers of visitors.

81. In our programme of visits we gave establishments the opportunity to elaborate on their collaborative policies. We did not gain much additional factual information in this way but we found it to be helpful to hear how institute staff viewed the links with universities. The point most frequently made to us was that a community of interest existed – or ought to exist– between Research Council institutes and universities but there was a need to strengthen contacts: in particular there was a need for a mechanism to enable staff to move freely from university to institute and vice-versa. We were told that study leave by university staff was only rarely spent at Research Council establishments which by contrast often received visiting workers from North America and the Antipodes. The various reasons for this included the obvious attractions of overseas centres especially in North America, the problems of providing cover for teaching commitments at the parent university and domestic accommodation costs at the host establishment. There may be something in each of these, especially the first, but we think that, even in a time of economic difficulty, more should be done to overcome organisational or financial obstacles. Rather more difficult to deal with was the somewhat grey and ill-focussed image which many university researchers have of the world of the Research Council establishments. It was put to us that many university staff were reluctant to spend periods at Research Council establishments because they thought it likely that they would find the con-

straint of institute research uncongenial. This remark was not made to us with reference either to "big" science establishments such as Daresbury which are largely geared to meeting the specific needs of university researchers, or to Council units set up within a university setting but was put with special reference to the large number of Council establishments that were not in a university and whose major functions did not include specific provision of research facilities for visiting academic researchers.

82. On the related aspect of institute staff contact with academic institutions there was a general view, although with some dissenting voices, that many – perhaps most – Research Council staff should desirably perform some function each year within the university setting, lecturing being most frequently mentioned, with some reference also to examining, administration and supervision of research students. It was however emphasised to us that a full research work load at the establishment, especially where fieldwork away from the institute was involved, did not easily permit the undertaking of a sizeable teaching load. We can see the force of this but we think that the Research Councils, their establishments and the universities and polytechnics should look more closely at the possibilities of promoting greater staff contacts as part of a wider process of strengthening collaborative links.

83. Although we found that many institutes co-operated well with appropriate universities we also became aware in the course of the study of a lack of real cooperation between some Research Council institutes and some universities. We would not wish to overstate the matter but we have detected evidence of suspicion and jealousy which have led to isolationist and inward-looking attitudes. The problem is a two way one but we would like to see the Research Councils take the initiative by encouragingg a re-appraisal of attitudes and relationships towards the universities. Specifically, we would like to see tham positively encouraging their institute staff to give lectures, supervise research, take in doctoral students for extended work periods in their laboratories and to assist generally in the work of the universities when and where it is appropriate, as a means of creating the necessary personal bridgeheads between institutes and universities. We would like to see more staff exchanges, study leave and joint study programmes; in short we would wish to see the development of a closer community of interest between the two streams of research.

84. What we have in mind is that Research Councils should seek in every sphere of their activities to create what for want of a better

word we would call 'clubs' or communities of research workers engaged in similar fields of work to ensure that progress is accelerated and that the flow of information, which is so dependent on personal contact, is facilitated. Some of the larger establishments such as Daresbury which provide special facilities already display a very effective grasp of the research community approach and we would like to see their example applied more widely.

THE CATEGORISATION OF RESEARCH

85. The Rothschild Report divided research into fundamental and applied, primarily in order to assess how it should be supported. For this purpose applied research was research for which there was a clearly identifiable customer, who would derive sufficient financial benefit from the results of the research that he could be expected to pay for it. All other research was fundamental research, which if done by a Research Council would be paid for from the Science Budget. In practice the consequences of this were only implemented for ARC, MRC and NERC; and the financing of MRC has since reverted to the pre-Rothschild position. In a later report, Lord Rothschild has said that it would be inappropriate to apply this categorisation to SSRC-sponsored research.

86. For our somewhat different purposes, we divided research into three categories (fundamental, strategic or applied) according to the following definitions:

a. Fundamental research is undertaken to add to the general pool of human knowledge, without any particular expectation that the results of it will in themselves be exploitable.

b. Strategic research is undertaken in the expectation that its results will be exploitable, but without an application in view so clear-cut that there is an identifiable customer who can be expected to pay for the research.

c. Applied research is research for which there is a clearly identifiable customer, who can expect to derive from it financial benefit which is greater than the cost of the research and who can therefore be expected to pay for it.

87. In effect, we divided Rothschild's 'fundamental' category into 'fundamental' and 'strategic', while preserving his 'applied' category. Of course, the distinctions between these categories are not sharp, and from time to time fundamental research produces immediately exploitable results – a good example of this is the work on monoclonal antibodies.

88. We sought to establish the distribution of the work of an institution between these categories and further to determine if it could be said that the university or the Council environment was the more effective venue for a given category of research.

89. A broad generalisation regarding the distribution of the Coun-

cils' work into these three categories is not possible nor is it to be expected since the determination of the work done by each Council is regulated by different criteria and related to their respective charters.

90. The Working Party have no wish to make detailed recommendations regarding the disposition of the research effort by the Councils or by the universities and their purpose in adopting this categorisation was to refine somewhat the Rothschild divisions of research. In very broad terms the universities see fundamental and strategic research as falling squarely into their area of competence with the Research Institutes undertaking strategic and applied work. On the other hand the Research Institute staff maintain that successful applied and strategic work cannot flourish when completely divorced from fundamental work. An effective compromise in our view would be the enhancement of cooperation between higher education and the Research Institutes to produce the necessary cross flow of information and expertise. Our later recommendations are intended to reflect and focus this interaction.

MULTI-DISCIPLINARY RESEARCH

91. There seems little doubt that many areas of research in the past two or three decades have increasingly required a relaxation of the boundaries of narrowly defined traditional scientific disciplines. The narrow definition may be sound at the undergraduate level but may also give a misleading impression of the overall vitality and relevance of these subjects. Thus a great deal of modern chemistry (spectroscopy) and biology (fine structure analysis) are properly to be regarded as parts of physics but are not considered as such by all physicists or taken into account in reviews of that subject.

92. These and similar difficulties, which may stem from a lack of flexibility in higher education, may be compounded by the grant committee structures of the Research Councils and probably also by the division of responsibility for subjects such as biology between SERC, MRC, NERC and ARC (with even some involvement of SSRC). While conscious of the existing arrangements between Councils and their staffs to ensure adequate review and liaison we did receive evidence that this may need further emphasis by Councils in some instances.

93. From the Research Council staffs we met the response was, with few dissenting voices, an emphatic conviction that a multi-disciplinary approach was both intrinsically desirable and was effectively achieved in the Research Council environment. Many of the Council staff were at pains to make it clear that they also had experience of the university world and had seen at firsthand how a rigid departmental structure could militate against effective multi-disciplinary collaboration compared with the easy relationship between disciplines in a Council institute.

94. We were convinced that, at the Council institutes visited, inter-disciplinary research flourished and was deliberately and effectively managed. In particular we noted that Council funded Research Units provided an effective way of achieving a multi-discplinary approach in a defined research area and at the same time benefitting from university expertise. In this context the concept of University Research Institutes might be the vehicle for bringing together appropriate multi-disciplinary groups.

95. The universities constitute a most important research resource and because of the range of disciplines covered they are inherently well suited to provide a basis for inter-disciplinary re-

search. To varying degrees, dependent upon their departmental and faculty structures and the roles and responsibilities of the academic staff, they are successful in fulfilling this requirement. There would appear to be a spectrum of commitment to multi-disciplinary research activity within the universities ranging from that which is effectively managed by variants of a Research Committee to that which is transitory and dependent on the initiative of a few outstanding individuals, often against significant departmental opposition.

96. We think that the development of interdisciplinary discussion and transitory co-operation can be as effectively nurtured in a university environment as in a research institute, but that, at present, the direction and management of an investigation requiring multi-disciplinary effort and long term commitment of resources is more readily effected at an institute. On the other hand, because of the wider range of disciplines usually present, one should expect that with proper management and encouragement the universities should make a major contribution to cross-discipline innovation.

97. The Working Party stresses the need for the stimulation of multi-disciplinary research activity at universities. With some notable exceptions very little positive encouragement for this activity has been discovered. It should be the responsibility of the university research committee to foster multi-disciplinary research activity in response to a perceived requirement in the projects which it might be currently sponsoring.

MONITORING OF SCIENTIFIC RESEARCH

98. We were particularly interested in discovering what methods of monitoring research progress were employed and what criteria were adopted for judging the relative merits of research projects.

99. Broadly the Councils use similar Visiting Group procedures and adopt the peer review method of merit assessment. However, there are some differences of detail arising from the disparate nature of the research and its control across the five Councils. We are pleased that some Councils regularly include scientists from overseas in their Visiting Groups, thus ensuring a validation of their standards of work in an international context.

100. Exceptionally among the Councils SERC have not adopted the Visiting Group procedure; the in-house research carried out at their establishments is subject to the same assessment by peer review Research Committee which is applied to the university based scientists who wish to use the facilities.

101. The main criteria applied by Research Councils in deciding whether to initiate new lines of research are "timeliness", "innovation" and "scientific promise or merit". The extent to which prospective research would fill gaps in the research coverage or complement existing lines is also considered. In deciding whether to open a new In-house research establishment, Councils have regard to the existing university provision. In some cases research cannot appropriately be carried out within an existing university department (eg. because a special location or facilities are required or a multi-disciplinary team is needed). The criteria in respect of applied research also include the usefulness of the work, its significance to industry and the national interest, and likely economic benefits.

102. The criteria for the assessment of success are the quality of the research undertaken as judged by peer review and expressed in published papers and, particularly in the case of applied research, the extent of progress towards the objectives deemed at the outset to be worthwhile and attainable. In the case of commissioned research, the criterion is the satisfaction of the customer.

103. Research is terminated when it is judged no longer to show adequate scientific promise or originality, the programme is deemed to have been completed, the techniques used appear im-

practical, or if the work seems unlikely to meet the objectives set within a given scale of resources or time. Units or lines of research may be closed down in order to allow redeployment of resources, particularly manpower, to more important programmes. Research Units are generally closed down on the retirement of the Director unless there is significant justification for continuing the work in terms of scientific merit or timeliness, and provided a first rate replacement Director can be found.

104. The outcome of scientific research being by its nature uncertain it is only possible to judge in retrospect whether a particular piece of research has been cost effective. Both initially and during the progress of work Research Councils therefore rely on peer review – a panel of experts make their predictions about the likely outcome relying on their own experience and on the track record of the researchers involved.

105. The prime responsibility for the scientific programme, and hence the monitoring of research, rests with the Director or Head of Institute or Unit concerned, who in turn is responsible to the Council. Peer Review systems are used by the Councils to monitor their In-house research and ensure that value for money is being achieved. Council establishments and major research programmes are systematically reviewed (usually every 3-6 years) taking account of reports from Directors of Institutes/Units and progress reports on major programmes, and usually involving Visiting Groups comprising specialists in the area of research being reviewed. The advice of expert referees is also sought; Working Parties and Committees are set up to look at complementary programmes within a particular field, perhaps involving 2 or more units. In addition, support services are subject to regular audit and management services inspection. Following these reviews, programmes are redefined and allocations reassessed, existing lines of research may be phased out and new ones initiated.

106. At the universities there appears to be a considerable range of formality regarding the control over the initiation, monitoring and termination of research projects. To a great extent the constraints are those of the forces of academic approval coupled with the ability of the worker, group-leader or department head to attract funding from the Research Councils, Industry or the university purse.

107. The University Grants Committee would expect to gain a

good general impression of the scope and vigour of scientific research in a university by various means (for example, from visits, from annual reports and from information supplied about research contracts and grants). However it does not monitor research in detail. The conduct of research, they contend, as of teaching, is the responsibility and concern of the universities themselves.

108. It is rarely possible to quantify success in fundamental research – research designed to add to the common fund of human knowledge – in the manner that might be appropriate to strategic or applied criteria. But some indications of success are the approval of the research worker's scientific peers, the acceptance of articles for publication and the winning of funds for further research. The opening up or closing down of a line of research would normally be settled between the research worker and his head of department, who would apply their professional judgement. However the larger the expenditure and the greater the number of people involved the more intensive and far-reaching would be the discussion. Responsibility for monitoring the research and seeking value for money lies essentially with the head of department and the research worker. As a result of the present shortage of funds this responsibility is having to be exercised even more carefully than in the past.

109. The Research Councils themselves consider that their established procedures making use of Visiting Groups are adequate to ensure that research funds are spent in the most effective way. They argue that, whilst ideally the frequency of review might be increased, such a course would require an increase in staff involvement which would not be justified. This increase in effort would be disproportionate to any benefit and they would not support such a diversion of resources (although in the case of NERC they have embarked on an increase in frequency, which we applaud.) Nevertheless, they are keen to consider possibilities for improving their evaluation of research support, and are willing to undertake research into new methods of assessment. ARC, for example, plans to modify its existing system of monitoring research by establishing a new information system whereby Institutes' programmes will be considered within broad subject areas, and by conducting an annual review of strategy. The Working Party, however, wish to see a common approach to the use of the Visiting Group procedure by the five Research Councils, which would ensure that work is reviewed on at least a four year cycle. In addition we recommend that the reports made to Councils by Visiting Groups should receive a wider circulation than is at present the case. This wider circulation

should include the ABRC, and be in a summary form, which would respect the confidential nature of certain parts of the reports.

110. The Working Party noted during its visits to establishments and in writen submissions that the Peer Review system continues to be acknowledged as the best available procedure for the assessment of merit within an area of basic science. Whilst this system is undoubtedly satisfactory for the appraisal of fundamental research where it is the intrinsic merit which is being judged, rather different criteria must be applied when evaluating commissioned research. For example, in ARC close monitoring by the government department (customer) supplements the Visiting Group review and occurs on a 4 yearly cycle in a formal manner.

111. In general the Working Party was satisfied with the best of the procedures used at both the universities and the Research Councils for the monitoring of research. Our recommendations are intended to ensure that independent and relatively frequent monitoring will take place across the *whole* area which we have reviewed and that common approaches are adopted throughout the academic community on the one hand and the Research Council Institutes on the other. In our view university research activities should be monitored by University Research Committees and Council In-house research by Visiting Groups. At the same time we would endorse moves by the Councils and the universities to improve their monitoring procedures by establishing information systems and periodic assessment of research priorities. At the level of individual research projects particularly those in the fundamental and strategic areas we can identify no better principle of assessment than that of peer review.

STAFF MANAGEMENT

112. It is clear that the quality of the research output of an establishment is principally a reflection of the calibre of the personnel involved and their management. We therefore sought to discover what management practices contributed to the maintenance of a flourishing research team and what career pattern for scientists would provide them with the proper degree of motivation throughout their careers.

113. The staffing requirements at a well-found research establishment will clearly vary over a considerable range. There will be an optimum balance of staff acting in innovative, developmental and supportive roles, depending on the balance of fundamental, strategic and applied work being carried out. An important function of the management team is to maintain this optimum balance during the lifetime of the establishment and, at the same time, to provide a satisfactory and stimulating career structure for the personnel.

114. The present climate of financial constraint has brought into sharp focus a number of factors which have a direct bearing on these management problems. The ones which have been noted by the Working Party include:—

a. The need to comply with current employment legislation.

b. The restricted mobility of staff for family reasons coupled with the high cost of housing and removal to a new location.

c. The limited flexibility of staff expertise.

d. The diminution of innovative ability in some mature staff.

e. The limited real savings afforded by the present arrangements for premature retirement.

f. Imbalances in staff structure caused by past recruiting policies.

g. The inflexibility sometimes induced in research programmes by the existing investment in major equipment or facilities.

h. The current reduced availability of alternative employment.

115. Each of these factors, and there may be others, can reduce the vigour of an establishment and seriously inhibit the research output. These factors operate equally in the Council and university areas and of course likewise in industry and commerce. The objective of management must be to encourage the maintenance of a dynamic research approach.

116. The general principles of good personnel management must be applied to preserve this dynamism and the Working Party have noted a number of problem areas which merit attention. First, there should be a greater degree of mobility of scientists and engineers within their professions. Variety of experience and a well stocked and resourceful mind are important factors in maintaining a vigorous research output in individuals. It is likely that a scientist who pursues a single line of research for a long period will suffer some loss of creativity and originality. More opportunities for temporary transfer to other work or other establishments would provide some stimulus and re-invigoration of the motivation of such a scientist. The Working Party would support any proposals which would facilitate this and which could incidentally involve much wider staff exchanges between the Research Council Institutes and universities. This mobility should include the transfer of scientists from research in universities or in Council institutes into industry or commerce which would facilitate an influx of new blood into the research areas.

117. In its 1982 published report "The Science Budget – a forward look" the ABRC examined the need for a flow of new entrants (new blood) into the academic profession and made a number of recommendations. The Secretary of State for Education and Science subsequently announced that the Government was providing funds to enable the universities to recruit some 230 additional lecturers in 1983-84 and said that, subject to the annual review of public expenditure, he expected to provide grant in 1984-85 and 1985-86 to allow further recruitment on a similar scale.

118. In its report the ABRC also briefly touched on the different but parallel question of recruitment of staff to Research Council employment noting that certain Council establishments suffered from much the same problem as the universities in that a rapid build-up followed by low recruitment in recent years had led to a lack of new blood. The Board noted in this connection that in some cases this has been exacerbated by past restrictions in Departmental customer support, leading to the prospect of little natural recruitment for

some years to come. The Board emphasised that its advice to Ministers was directed to the staffing problem in the universities but it indicated that it would like us to examine the similar problems in the Research Councils as part of our present study.

119. In the course of our visits we received evidence on the staffing picture in a range of Council establishments and were able to touch on the wider aspects when the Heads of the Research Councils and officials in the Cabinet Office and MPO appeared before us to give oral evidence. It is apparent that some of the Council institutes are facing problems similar to those of the universities as a result of their age structures and internal development. The Working Party would feel it appropriate if individual Councils informed ABRC from time to time of their situation and policies in the face of their concern about the age structure of their staff.

120. Mobility can also involve transfers to posts within the same institute or organisation. In our view much greater use should be made of transfers by research managers and equally there should be a more ready acceptance of the moves by the staff involved. This has a particular bearing on the management of that small proportion of scientists who may suffer loss of research creativity in their more mature years. While it was widely recognised both in the Council and university area that this could arise, it was acknowledged that there was usually no concomitant loss of other scientific skills by these people and that a prudent management should make proper use of them by suitable transfers to technical support, advisory and administrative duties. The Working Party noted however that opportunities for these internal transfers were limited at many establishments. Alternatively this problem may be reduced by mid-career retraining for work in an allied field or by the creation of matrix management structures within an establishment to bring together the more mature scientist and the younger innovator. The skills and experience of the one can then be made to complement the creativity of the other.

121. Structural imbalance in the staffing of both university and Council establishments can be modified by the ongoing policies regarding recruitment, length of the employment contract, promotion criteria and age of retirement. Against the background of changing research priorities and continuing financial constraints the task of maintaining the right balance of staff is a problem commanding the attention of all levels of research management in both the universities and Council establishments.

122. The use of a proportion of short-term appointments (and the Councils are already using these to some extent) has obvious attractions in the context of research management and for the initial assessment of aspiring research workers. We noted however that the staff associations' views is that the use of the normal probationary period should provide the flexibility required and at the same time offer to the staff the job security which they seek.

123. A careful and consistent application of a promotion policy which ensures that early or accelerated promotion is awarded to the outstanding scientists and also allows of a good career prospect to the average performer is of course essential for the maintenance of a flourishing cadre of research scientists.

124. The Working Party approved strongly of the Management and Personnel Office's Individual Merit Promotion scheme which was introduced into the Civil Service some 12 years ago. It is clearly a highly regarded award by the scientists we met among the Councils' staffs and is an appropriate way of stimulating and rewarding the highest achievements in research by the Research Councils.

125. We note that the retirement age at universities is 65-67 and at Council establishments predominantly 60 (although the MRC have a retirement age of 65 for clinical and scientific staff). Whilst there are many examples of scientists undertaking innovative research beyond the age of 60 we believe that careful consideration should be given to a general lowering of the age of retirement to 60 with provision for the retention of the outstanding research worker, perhaps on a year to year basis, until 65. In the short term it may be necessary to make use of selective premature retirement schemes, implemented at management's discretion with a modest financial inducement to the scientist concerned and minimal penalty (in terms of continuing financial commitment) to the establishment to facilitate the rationalisation of an unbalanced age structure.

126. Closely bound up with consideration of staff management is an understanding of the preferences and motivations of the staff. In particular the Working Party attempted to discover reasons for the selection by scientists of a career in either the university or the Research Council environment. In the time available we were not able to make a wide-ranging survey of staff motivation and preferences and thus can report only the views of a small number of people. There was however a reasonable consensus of view and a sharp division into two categories:—

a. Research Council staff had chosen to work in Council institutes because these offered a generously supported research environment in a directed field. They were content to forego the "academic independence" of the university environment for the more managed approach of the research institute. Many were attracted by the possibilities of a multi-disciplinary approach to "practical" problems and saw this as giving a great stimulation to their research efforts. The majority were also content not to be involved in teaching, though they welcomed having to give the occasional lecture or course tuition. All research council scientists, however, valued close consultative contacts with colleagues at a university, hospital and with the wider community of their particular branch of science.

b. University staff had chosen their career because they wished to teach and research in their own area of science. They valued their freedom of choice of research topic though they stressed that they had to compete for limited funds with their peers.

127. The Working Party believe that careful provision must be made for the management and wellbeing of the staff at the universities and at the Research Councils' establishments. Some Councils, we know, have already undertaken or have in prospect – extensive reviews of their staffing policies. We nonetheless offer a general recommendation that the universities and the Councils should conduct a reappraisal of their staffing policies, noting especially the areas we have highlighted.

THE POLYTECHNICS

128. The SUSR Report was concerned solely with current arrangements for the support of university research. Our own terms of reference, however, were drawn in such a way as to offer us scope to extend our enquiry into the non-university sector of higher education and so we invited comments from officers of the recently established National Advisory Body for Local Authority Higher Education (NAB) and from other representative bodies. We also invited the Research Councils to let us have any special comments they might wish to make about research in the polytechnics and the extent of the assistance given to it.

129. In their comments to us the officers of NAB emphasised the research disadvantages under which local authority institutions operated given the absence of an explicit dual funding system in their sector and stressed that what research base existed had very largely developed as a result of local initiative and discretion. The NAB emphasised that, in these circumstances, the research achievements (mainly but not wholly in applied research) of the polytechnics and some other local authority colleges – owed much to the abilities and enthusiasm of their staffs; the agreement of their maintaining authorities that research should be undertaken was also necessary. It was however extremely difficult to support or create centres of excellence in particular areas of research and polytechnics and colleges were excessively dependent on project research and on grants from the Research Councils in support of these projects as a major element of their research activity. The NAB officers informed us that, against this background, they were in process of consulting about the development of a policy designed to ensure that research in suitable selected local authority institutions could be adequately funded and indicated that one of the objectives would be to enable such institutions to develop a research base capable of attracting external finance. The NAB expressed the hope that, as this policy was developed and implemented, the Research Councils would look for potential centres of research excellence in the local authority sector and offer them effective support.

130. In their evidence to us the Committee of Directors of Polytechnics and the National Association of Teachers in Further and Higher Education laid emphasis both on the important role which research had to play in the polytechnics and other major centres of advanced further education and the potentially signi-

ficant part which the non-university institutions could take in the nation's total research effort. The point was also fairly made to us that the arguments relating to the valuable cross-fertilisation between research and teaching which applied to universities also held good for the public sector institutions.

131. The Associations stressed however that research in this part of higher education had been and remained under-resourced both in terms of research grants and of the more basic capital funding necessary to supply the infra-structure for research work. It was acknowledged that in recent years the Research Councils had generally recognised this dual problem and had responded with a number of special pump-priming schemes; and the Associations stated that they recognised that the Research Councils had no particular remit to promote or finance the general development of institutions mainly funded from elsewhere in the national education system.

132. The Research Councils for their part generally acknowledged the contribution which public sector institutions could make to research and the importance of channelling support to these institutions in suitable circumstances. We were in this connection particularly interested to hear about the work of the SERC's Polytechnic Panel set up in 1979 inter alia to review and to advise on the situation in polytechnics in the context of SERC operations and policies, to advise the Council on aspects of postgraduate training in the polytechnics and to provide a source of guidance to polytechnics on SERC procedures. The Panel has recently made a number of recommendations to the parent Council over ways in which support for postgraduate training and research in the polytechnics might be further encouraged and it would not be appropriate for us to comment in detail on these suggestions. We have however found the report of the Panel of considerable help to us in the process of formulating our own conclusions in the present study and have been interested and reassured to discover tha the views of the Panel very largely coincide with our own and are not inconsistent with the evidence received from the public sector associations.

133. The findings of the SERC Panel fully underline the points put to us by others about the difficulties facing polytechnic staff who wished to carry out research, especially in terms of what the Panel saw as the very low – and often sub-critical – levels of provision of basic equipment and technical support within many polytechnics and the lack of a longer-term planning framework within which

research capability could be developed. The Panel's report amply reinforces too the point – understandably stressed by the Associations – that these problems have been greatly exacerbated since the mid 1970s by the financial constraints imposed on local authorities. The question of basic funding is, we believe, crucial to any consideration of the further development of a research capability in the public sector and we can see the force of the view, frequently put to us, that whatever the current inadequacies of the dual support system for the universities, it represented a mechanism for research support lacking in the public sector.

134. We have come to the conclusion that the potential research contribution and the current problems of the public sector institutions raise complex and fundamental issues of funding, management and organisation many of which have wider political or local governmental overtones and we have had, not without reluctance, to decide that we could not attempt to do justice to these in the limited time available to us. We very much welcome however the announcement that the NAB is consulting about a possible policy strategy for the selective development of a research base in the polytechnics and we hope that, in the development of this initiative, there will be close co-operation between the local authorities and the Research Councils. In this connection we have noted with interest the emphasis placed by the NAB and others on the appropriateness to the local authority sector of applied research. Given the need for selectivity and the avoidance of duplication of research effort elsewhere, we consider that it would be very desirable for the polytechnics and other public sector colleges to continue very largely to concentrate on applied rather than fundamental research.

CONCLUSIONS AND RECOMMENDATIONS

135. The significant United Kingdom investment in research depends for its success on knowledgeable people with lively, enquiring and frequently unorthodox minds who are stimulated by good leadership and supported by appropriate facilities. There is no fixed pattern for the organisation, location and funding of this research but our investigation has been largely confined to the Research Councils and university sectors of this country. We have sought a view of the efficacy and appropriateness of the present arrangements rather than a purely financial survey of the flow of money to the two sectors. Our conclusions and recommendations are aimed at improvements which should benefit the overall research community and there from the community at large.

136. The universities, largely funded by the UGC for their teaching and the provision of basic research facilities, are a significant resource of research manpower and facilities. Because of their diversity they are in a good position to pursue research in virtually every field of science and engineering inhibited only by the problem of provision of specialist facilities and the most expensive equipment which falls, rightly in our view, into the province of the Research Councils. The research potential in universities is to some extent under-utilised because of staff time and funding constraints. The Working Party is concerned to ensure that this potential is recognised and used to a greater extent by the Research Councils and by Government Departments than appears to be the case at present.

137. The Research Councils and their Institutes, on the other hand, provide specialist and concentrated research facilities which in some cases would be difficult to establish in a university either for reasons of cost or environmental requirement. The scientific leadership invariably has the task of counteracting the natural tendency of such institutions to become inward looking and insufficiently aware of the available research resources of the universities. Three broad categories of Research Council Institute can be distinguished.

I. Those established to provide a service based on big and expensive equipment which can only be justified in one location at home or abroad eg CERN, Rutherford Appleton Laboratory and Daresbury.

II. Those established to meet a defined national need for a specific area of research eg the soils and arable crops re-

search at Rothamsted, the vegetable commodity research at the National Vegetable Research Station at Wellesbourne, the British Antarctic Survey and the Institute of Hydrology.

III. The general research institutes where much of the fundamental work could be carried out in a university but which were established for a variety of historical reasons eg NIMR, and certain units of IGS.

138. The variety of types of Research Institute must be borne in mind when considering the balance of research between institutes and universities. For types I and II it is, generally speaking, appropriate that separate institutes should exist for these purposes, but at type III institutes there may be grounds for reviewing the distribution of the research as between the institute and a university.

139. The research Units of the ARC, MRC and NERC are in the main effective and powerfully led research teams. These Units are frequently embedded in and almost indistinguishable from a university department. They have our strong support. It is clearly understood by the staff of such Units that the life of the Unit is limited though their careers with the Council are not so limited. This system confers a measure of flexibility to the research programme and demands mobility of the staff. The analogous Council funded Research Groups in universities (variously known as Rolling Grants or Programme Grants) are seen also to be excellent means of providing support, usually for an initial five years, for a finite term. The members of Research Groups are university employees. *We recommend this research support procedure to all Research Councils as a means of providing highly motivated research with built-in limitation of project duration.*

140. The internal monitoring of the institute research programmes is both by peer review and by the Director and his senior staff. Provided both are actively pursued we are satisfied. In addition each institute and unit is subjected to periodic reviews by Visiting Groups on behalf of the Research Council concerned. The period between reviews varies between 3 and 6 years. We felt 6 years was too long and recommend that the cycle should be not longer than 4 years. A great deal of time and trouble is expended on these reviews both in their preparation, and in the visits themselves plus the compilation of reports by the visitors. The value of these reports may be lost to some extent if their circulation is too restricted and *we propose that consideration should be given by Councils to their distribution to a*

wider audience than at present, including ABRC, perhaps in a summary form that will respect the confidential nature of certain parts of the reports.

141. One of our main concerns has been with the effective management of research at the universities and Institutes. It is clear that management of the personnel has a very considerable bearing on the vigour of a research community. The use of short-term contracts of employment in research appointments can lead to greater flexibility of response to a changing research demand, and there is no doubt that a regular flow of new blood into a research team is very important in maintaining the vigour and stimulus so necessary for good research. In our view the short-term appointment provides for greater mobility between Research Councils and universities as well as between fundamental and applied research and the associated service functions. *We recommend the increasing use of short-term contracts of employment for staff at research institutes in order to afford this greater degree of flexibility.*

142. We have observed the success of management efforts to encourage active co-operation between institutes and universities, but believe that these efforts must be intensified in order to overcome suspicion and jealousy between them which leads inevitably to isolation and inward-looking attitudes. We want to see more staff exchanges, study leave, joint programmes and in every way to see the development of a closer community of interest between the two streams of research. Research Councils should take the initiative and make provision for overcoming any administrative problems. We believe that information flow, which is so dependent on personal contact, and progress of research are accelerated when such a "community approach" to an area of research has developed. *We recommend that all Councils further increase and broaden their efforts to bring this research community concept into being.*

143. The Working Party noted that university research workers, some of whom rely heavily on Council grants to support their research, believe that current financial constraints have obliged Councils to support their In-House research preferentially; while the Councils might with justification challenge this contention *we recommend that Research Councils should consider requiring institutes to compete for a proportion of their research support funds on a similar basis to the universities.*

144. We are firmly convinced that there should be a much closer

integration of the Research Institutes' and the universities' research activities. We think it would be right if Councils, in their longer term thinking on the likely future roles of their institutes, made explicit their views about areas of research which could equally be pursued at institutes or universities, and kept ABRC informed of their findings. *We recommend that each Council should undertake a review of its institutes.* Such a review should concentrate in particular on the smaller remotely located establishments to establish that there was effective communication and interaction with their particular scientific community. The review might lead to relocation of isolated establishments on to university campuses or concentration of work into larger and more suitably sited research institutes. *We recommend that any monies freed by the restructuring, including the proceeds from the sale of plant, buildings and sites, should be available to the Research Council for its restructuring programme.*

145. To facilitate further this closer association of the two research communities *we recommend that any new institute or unit should, unless there are overriding reasons otherwise, only be established on or near a university campus and in close association with the appropriate university department.* Special measures will have to be taken in the management of these campus-based institutes to ensure that other universities are given fair treatment in their access to the institute's work and facilities. Some off-campus institutes have been established specifically for the university research community and here too the equality of treatment between universities must be assured. *It is recommended that Users Committees (which are widespread but perhaps not yet universal) should in all cases be encouraged.*

146. We have identified a number of problems associated with service institutes ie institutes with large central facilities intended primarily for use by the academic community nationwide, and we consider that there needs to be some form of regular external assessment of all aspects of such facilities. *We recommend that Research Councils should set up suitable groups of experts to monitor, perhaps on a four or five year cycle, the work of these facilities.*

147. Turning now to the university aspect of our investigations, we have to state unreservedly that the dual support system is currently under severe strain and is not working properly. We have considered drastic alternatives including funding all university research from the Science Budget with appropriate reduction in the UGC funding but believe this would be a retrograde step which

would reduce the capacity of University staff to engage in speculative research. *We therefore recommend the continuation of the present system but with earmarking of the research component. Further the ABRC and the UGC should undertake the examination of the consequences of the implementation of such a policy.*

148. Research of all kinds needs an element of monitoring if not actual management. We are anxious to see the introduction of a respected but light handed degree of management into university research. Resources are being allocated in significant measure to ensure the long term health of our universities as teaching and research establishments and there is a need for an increasing element of review of this investment. The Research Committee should be charged with monitoring the success of its investments in research in the various departments. In addition they would ensure the cost effectiveness of the work and its exploitation. Successful research should be transferred in the form of expertise, developments or inventions to the appropriate research agency or to industry for further development or application. The Research Committee should include representatives from outside the university and in particular from industry and commerce. Liaison should be established with the appropriate Research Council and industrial participation in university research affairs should be encouraged. *We recommend that, on the basis that such funding from UGC were earmarked for research, that a substantial proportion of the funds remaining after the allocation of fixed costs should be disbursed by a Research Committee of the university.* It should be mandatory for a university to have a Research Committee (or similar body which would satisfy the UGC) in order to receive an allocation of research funds.

149. For the Dual Support system to function as intended in its funding of university research it is essential that the Research Councils must not assume the role which is properly that of the UGC. If this were to happen the responsibilities of the two funding agencies would become blurred and a considerable loss of speculative research capability at the universities might result.

150. The traditional departmental structure of the university often inhibits the easy flow of research co-operation across departmental boundaries. Universities differ markedly in the measures they have adopted for the amelioration of this problem. Against the background of an increasing need to establish multi-disciplinary co-operation we suggest that the Research Committee will be a

valuable mechanism for the discussion of and implementation of the necessary liaison.

151. *We recommend that ABRC and UGC examine the multi-disciplinary aspect of university research to ensure that mechanisms exist to provide the necessary assembly of multi-disciplinary effort which might, for example, include the establishment of University Research Institutes.*

152. If the above proposals are implemented we believe that strong university departments will continue to develop supported by well-found laboratories and well supported research. The obverse is that some will not be so well supported and may well develop into departments dominated by their teaching activity and supported only by individual scholarly activity which requires neither the well-founded laboratory nor Research Council support. We see nothing wrong with this situation which to some extent already exists. It may well force decisions on universities to close some departments where it becomes obvious there are too many in existence for a particular discipline for all to remain viable. The impact of the changed economic scene ruling over university research will be to emphasise both excellence and mediocrity from which managed action within the universities should follow.

153. We do not wish to remove the freedom for an individual in a university to pursue his ideas and develop them successfully to the point when they can be specifically supported by a Research Council grant or other funding body. The provision of the basic research facilities and funds for scientists and engineers within departments to pursue their own speculative research remains a function of the UGC leg of the dual support system. But each university, through its Research Committee, will have to choose which of its staff to support in their speculative research and which not to. In parallel we look for an increase in the level of funding of strategic and applied research in order to force the pace of development of ideas and concepts which can be applied in our weakening industrial sector.

154. The overall balance between in-house and university research has been addressed by the Working Party largely in terms of the appropriateness of existing locations and groupings for research. As a result we have made a number of recommendations which will in our view improve the effective management of research in both sectors – the criteria of judgement being good research carried out in the most cost effective manner within

acceptable levels of monitoring and management. *We recommend a modest change in the management of university research in return for a more open and structured basis of funding on the UGC leg of the dual support system; any additional funds released by Research Councils should be deployed to encourage and support university research in the context of greater co-operation and exchange between the universities and institutes.*

155. Although we have made a brief examination of the research in the polytechnics, we have reluctantly decided that we could not do justice to the subject in the time available. We welcome however the announcement by the National Advisory Body for Local Authority Higher Education that they are consulting about a possible strategy for research in the non-university sector and we hope that Research Councils will be prepared to play their full part in subsequent developments. However, we feel strongly that polytechnics should concentrate their research effort in the applied field and not attempt to repeat what exists in universities.

156. Some of our observations and the recommendations leading from them involve significant changes but if these can be viewed as Disraeli said – "change is inevitable and in a progressive country change is constant" – then with co-operation and dedication to achieve worthwhile improvements the national research base will in our view be both improved and more effective.

APPENDIX A

UNIVERSITIES AND RESEARCH COUNCIL ESTABLISHMENTS VISITED BY THE WORKING PARTY

The University of Birmingham
The University of Cambridge
The University of Edinburgh
The University of Surrey
Centre for Socio-Legal Studies, Wolfson College, Oxford (SSRC)
Clinical Research Centre, Harrow (MRC)
The Daresbury Laboratory, Warrington (SERC)
Epidemiology and Medical Care Unit, Northwick Park Hospital, Harrow (MRC)
Human Biochemical Genetics Unit, Mammalian Development Unit } Wolfson House, University College, London (MRC)
Institute of Animal Physiology, Babraham (ARC)
Institute of Geological Sciences (Scotland), Edinburgh (NERC)
Institute of Oceanographic Sciences, Wormley, Surrey (NERC)
Rothamsted Experimental Station, Harpenden (ARC)
Royal Edinburgh Observatory (SERC)

APPENDIX B

INDIVIDUALS AND ORGANISATIONS WHICH SUBMITTED WRITTEN EVIDENCE TO THE WORKING PARTY

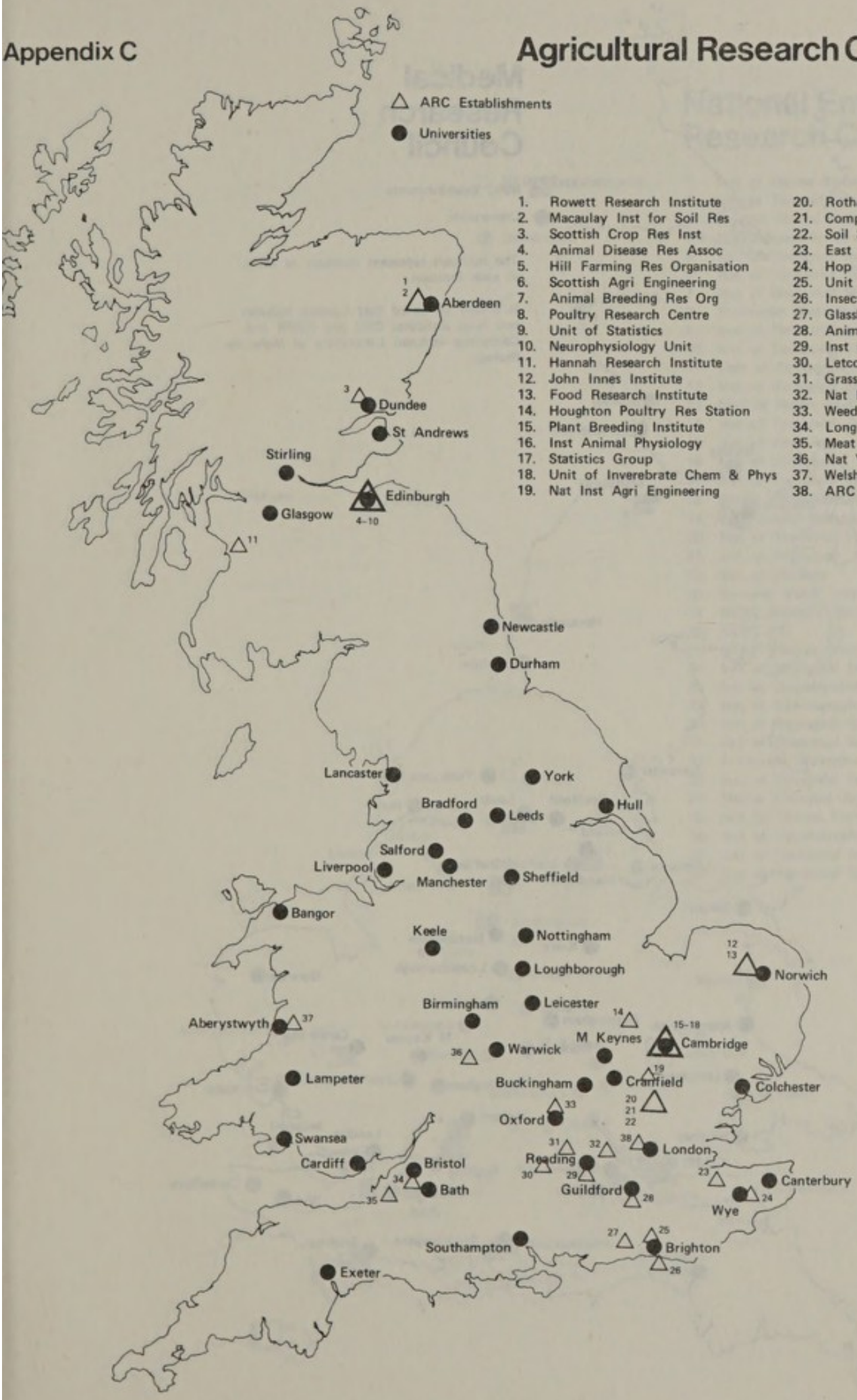
1. Research Councils
   - Agricultural Research Council
   - Medical Research Council
   - Natural Environment Research Council
   - Science and Engineering Research Council
   - Social Science Research Council

2. Universities, colleges and medical schools.
   - Brunel University
   - University of East Anglia
   - University of Essex
   - University of Leeds
   - University of Liverpool
   - The Open University
   - University of Oxford
   - University of Reading
   - University of Strathclyde
   - Imperial College of Science and Technology
   - King's College, London
   - Queen Mary College, London
   - Westfield College, London
   - British Postgraduate Medical Federation, University of London
   - Charing Cross Hospital Medical School
   - Institute of Child Health, University of London
   - The Middlesex Hospital Medical School
   - The School of Pharmacy, London
   - Institute of Archaeology, University of London

3. Other individuals or organisations
   - Association of University Teachers
   - Committee of Directors of Polytechnics
   - Committee of Vice-Chancellors and Principals
   - Institution of Professional Civil Servants
   - National Advisory Body for Local Authority Higher Education
   - National Association of Teachers in Further and Higher Education
   - Dr R Press (Cabinet Office)
   - Mr B Poulter (MPO)

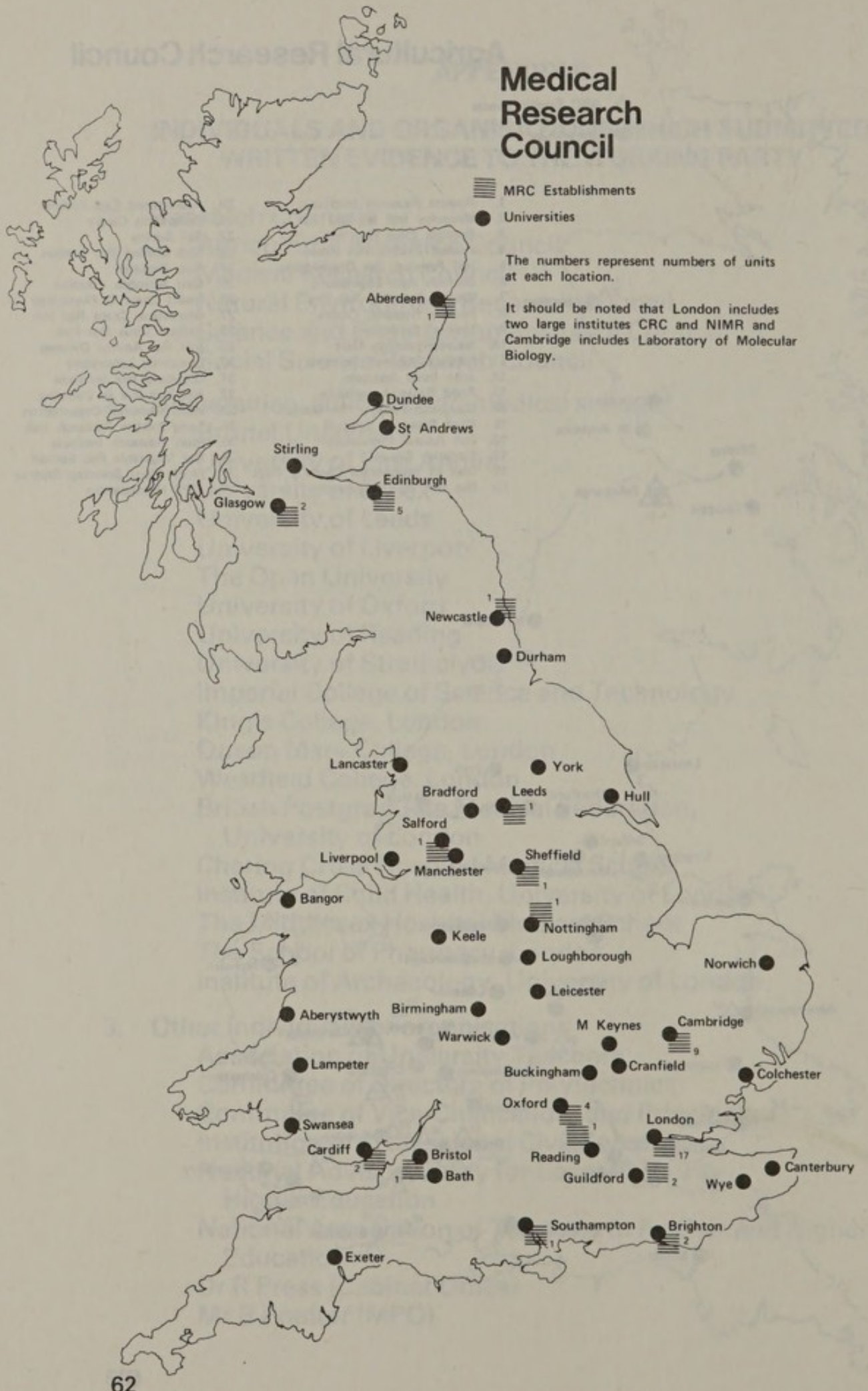
Appendix C

Agricultural Research Council



1. Rowett Research Institute
2. Macaulay Inst for Soil Res
3. Scottish Crop Res Inst
4. Animal Disease Res Assoc
5. Hill Farming Res Organisation
6. Scottish Agri Engineering
7. Animal Breeding Res Org
8. Poultry Research Centre
9. Unit of Statistics
10. Neurophysiology Unit
11. Hannah Research Institute
12. John Innes Institute
13. Food Research Institute
14. Houghton Poultry Res Station
15. Plant Breeding Institute
16. Inst Animal Physiology
17. Statistics Group
18. Unit of Inverebrate Chem & Phys
19. Nat Inst Agri Engineering
20. Rothamsted Exp Station
21. Computing Centre
22. Soil Survey
23. East Malling Res Station
24. Hop Research
25. Unit Nitrogen Fixation
26. Insect Chem & Physiology
27. Glasshouse Crops Res Inst
28. Animal Virus Res Inst
29. Inst Res Animal Diseases
30. Letcombe Laboratory
31. Grassland Res Institute
32. Nat Inst Res in Dairying
33. Weed Research Organisation
34. Long Ashton Research Inst
35. Meat Research Institute
36. Nat Vegetable Res Station
37. Welsh Plant Breeding Station
38. ARC Headquarters

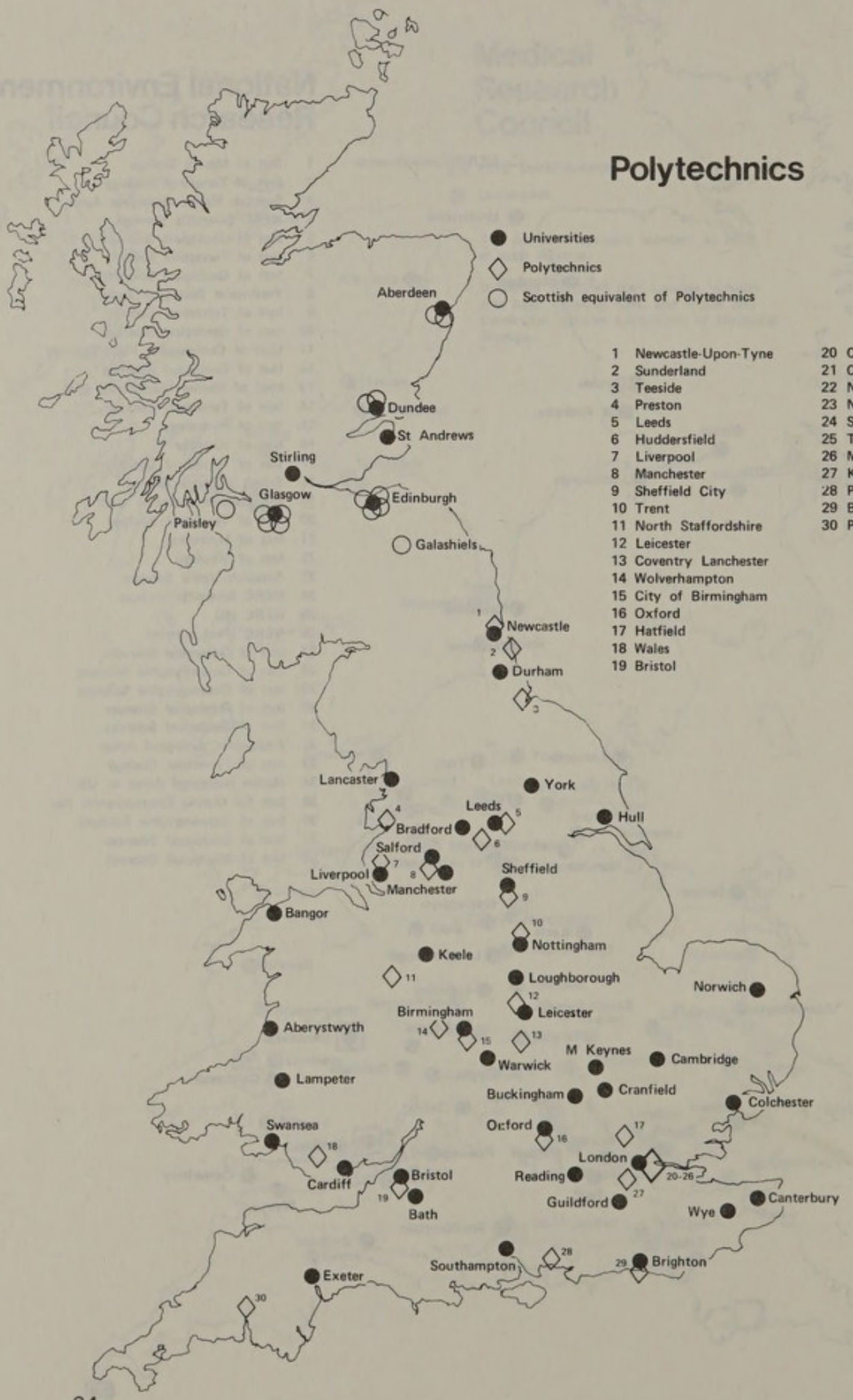
Medical Research Council



National Environment Research Council

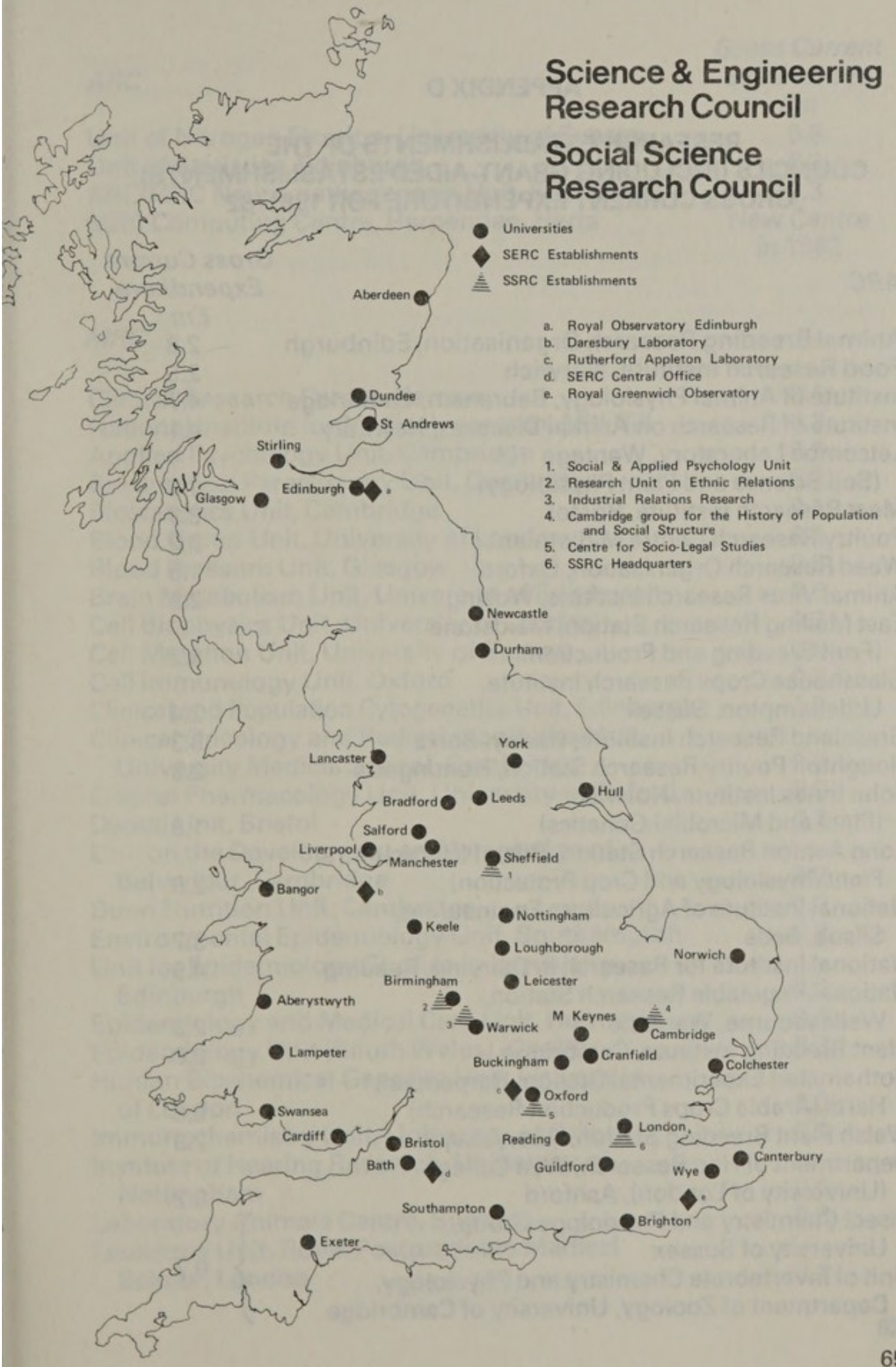
1 Inst of Marine Biology
2 Inst of Terrestrial Ecology
3 Scottish Marine Biological Assoc
4 NERC Scientific Services
5 Inst of Geological Sciences
6 Inst of Terrestrial Ecology
7 Inst of Geological Sciences
8 Freshwater Biological Assoc
9 Inst of Terrestrial Ecology
10 Inst of Geological Sciences
11 Unit of Comparative Plant Ecology
12 Inst of Geological Sciences
13 Unit of Marine Invertebrate Biol
14 Inst of Terrestrial Ecology
15 Inst of Hydrology
16 Inst of Virology
17 Inst of Terrestrial Ecology
18 British Antarctic Survey
19 Sea Mammal Research Unit
20 Inst of Terrestrial Ecology
21 Inst of Hydrology
22 Inst of Virology
23 Research Vessel Services
24 NERC Scientific Services
25 NERC HQ
26 NERC (Pied a terre)
27 Inst of Geological Sciences
28 Inst of Oceanographic Sciences
29 Inst of Oceanographic Sciences
30 Inst of Geological Sciences
31 Inst of Geological Sciences
32 Freshwater Biological Assoc
33 Inst of Terrestrial Ecology
34 Marine Biological Assoc of UK
35 Inst for Marine Environmental Res
36 Inst of Oceanographic Sciences
37 Inst of Geological Sciences
38 Inst of Geological Sciences

Polytechnics



Science & Engineering Research Council

Social Science Research Council



APPENDIX D

RESEARCH ESTABLISHMENTS OF THE COUNCILS (INCLUDING GRANT-AIDED ESTABLISHMENTS) GROSS CURRENT EXPENDITURE FOR 1981/82

ARC	*Gross Current Expenditure £m*
Animal Breeding Research Organisation, Edinburgh	2.8
Food Research Institute, Norwich	2.5
Institute of Animal Physiology, Babraham, Cambridge	4.7
Institute of Research on Animal Diseases, Newbury	4.1
Letcombe Laboratory, Wantage (Soil Science and Plant Physiology)	1.3
Meat Research Institute, Bristol	2.3
Poultry Research Centre Midlothian	2.2
Weed Research Organisation, Oxford	1.8
Animal Virus Research Institute, Woking	2.9
East Malling Research Station, Maidstone (Fruit Breeding and Production)	3.2
Glasshouse Crops Research Institute, Littlehampton, Sussex	2.4
Grassland Research Institute, Hurley, Berks	3.3
Houghton Poultry Research Station, Huntingdon	2.3
John Innes Institute, Norwich (Plant and Microbial Genetics)	1.9
Long Ashton Research Station, Bristol (Horticulture, Plant Physiology and Crop Protection)	2.9
National Institute of Agriculture Engineering, Silsoe, Beds	3.7
National Institute for Research in Dairying, Reading	4.9
National Vegetable Research Station, Wellesbourne, Warwick	2.3
Plant Breeding Institute, Cambridge	3.0
Rothamsted Experimental Station, Harpenden, Herts (Arable Crops Production Research)	6.8
Welsh Plant Breeding Station, Aberystwyth	2.9
Department of Hop Research, Wye College (University of London), Ashford	0.2
Insect Chemistry and Physiology Group, University of Sussex Unit of Invertebrate Chemistry and Physiology, Department of Zoology, University of Cambridge	0.7

ARC	*Gross Current Expenditure £m*
Unit of Nitrogen Fixation, University of Sussex	0.8
Unit of Statistics, Edinburgh	0.3
ARC/MRC Neuro-pathogenesis Unit, Edinburgh	0.3
MRC Computing Centre, Harpenden, Herts	New Centre in 1982

MRC	
Clinical Research Centre, Harrow	9.1
National Institute for Medical research, Mill Hill	8.2
Applied Psychology Unit, Cambridge	0.9
Biochemical Parasitology Unit, Cambridge	0.2
Biostatistics Unit, Cambridge	0.1
Blood Group Unit, University of London	0.1
Blood Pressure Unit, Glasgow	0.5
Brain Metabolism Unit, University of Edinburgh	0.6
Cell Biophysics Unit, University of London	0.7
Cell Mutation Unit, University of Sussex	0.8
Cell Immunology Unit, Oxford	0.2
Clinical and Population Cytogenetics Unit, Edinburgh	1.8
Clinical Oncology and Radiotherapeutics Unit, University Medical School, Cambridge	0.3
Clinical Pharmacology Unit, University of Oxford	0.3
Dental Unit, Bristol	0.2
Unit on the Development and Integration of Behaviour, Cambridge	0.2
Dunn Nutrition Unit, Cambridge	1.2
Environmental Epidemiology Unit, Southampton	0.2
Unit for Epidemiology Studies in Psychiatry, Edinburgh	0.2
Epidemiology and Medical Care Unit, Harrow	0.4
Epidemiology Unit (South Wales), Cardiff	0.3
Human Biochemical Genetics Unit, University of London	0.3
Immunochemistry Unit, University of Oxford	0.2
Institute of Hearing Research, University of Nottingham	0.6
Laboratory Animals Centre, Surrey	0.8
Leukemia Unit, Royal Postgraduate Medical School, London	0.2

MRC	*Gross Current Expenditure £m*
Lipid Metabolism Unit, London	0.3
Mammalian Development Unit, University of London	0.2
Mammalian Genome Unit, Edinburgh	0.2
Mechanisms in Tumour Immunity Unit, University Medical School, Cambridge	0.2
Medical Sociology Unit, Aberdeen	0.5
Mineral Metabolism Unit, Leeds	0.4
Laboratory of Molecular Biology, University of Cambridge	2.4
Molecular Haematology Unit, University of Oxford	0.1
Unit on Neural Mechanisms of Behaviour, London	0.2
Neurochemical Pharmacology Unit, University of Cambridge	0.4
Neuroendocrinology Unit, Newcastle upon Tyne	0.4
Neurological Prostheses Unit, London	0.2
Perceptual and Cognitive Performance Unit, University of Sussex	0.1
Pneumoconiosis Unit, Glamorgan	1.0
Radiobiology Unit, Didcot	1.8
Reproductive Biology Unit, Edinburgh	0.7
MRC/SSRC Social and Applied Psychology Unit, University of Sheffield	0.4
Social Psychiatry Unit, London	0.3
Toxicology Unit, Surrey	1.3
Trauma Unit, University of Manchester	0.3
Unit for Laboratory Studies of Tuberculosis, Royal Postgraduate Medical School, London	0.3
Tuberculosis and Chest Diseases Unit (London)	0.4
Virology Unit, Glasgow	0.8
Cyclotron Unit, London	2.3
Developmental Neurobiology Unit, London	0.3
Neuro-Otology, London	0.1
NERC	
Institute of Geological Sciences (various centres)	24.9
Institute of Oceanographic Sciences (Godalming, Bidston and Taunton)	6.0
Institute of Marine Environmental Research, Plymouth	1.4
Institute of Marine Biochemistry, Aberdeen	0.5

NERC	*Gross Current Expenditure £m*
Marine Biological Association of the United Kingdom, Plymouth	1.4
Unit of Marine Invertebrate Biology, Gwynedd	0.2
Institute of Hydrology, Wallingford and Powys	2.1
Freshwater Biology Association, Cumbria and Dorset	1.6
Institute of Terrestrial Ecology (various centres)	4.2
Institute of Virology, Oxford	0.7
British Antarctic Survey, Cambridge	6.2
NERC Scientific Services	3.5
NERC Research Vessel Services, Barry, Glamorgan	5.9
Sea Mammal Research Unit, Cambridge	0.3
Scottish Marine Biological Association, Oban	1.5
Unit of Comparative Plant Ecology, Sheffield	0.2
SERC	
Daresbury Laboratory, Warrington – Nuclear Structure Facility and Synchrotron Radiation Source	12.3
Rutherford Appleton Laboratory, Didcot – The Council's Multidisciplinary Research Laboratory	36.9
Royal Observatory, Edinburgh	3.0
Royal Greenwich Observatory, Herstmonceux	3.3
SSRC	
Cambridge Group for the History of Population and Social Structure	0.1
Centre for Socio-Legal Studies, Wolfson College, Oxford	0.3
Industrial Relations Research Unit, University of Warwick	0.2
Research Unit on Ethnic Relations, University of Aston	0.3
MRC/SSRC Social and Applied Psychology Unit, University of Sheffield	0.1

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