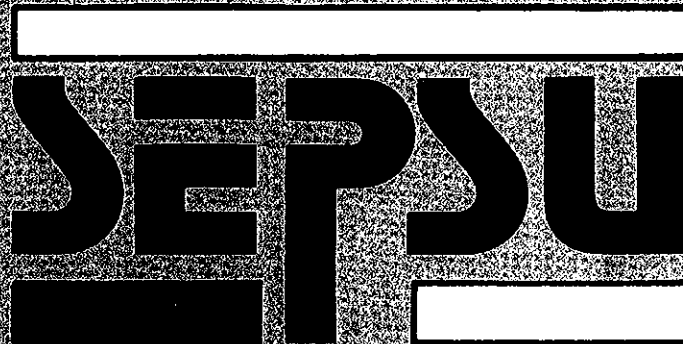


Box 1993



Policy Study No. 8

**THE MIGRATION OF  
SCIENTISTS AND ENGINEERS  
1984-1992**

**SCIENCE AND ENGINEERING POLICY STUDIES UNIT**

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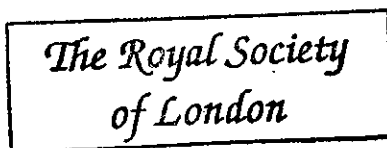
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**THE MIGRATION OF  
SCIENTISTS AND ENGINEERS  
1984-1992**

M J Ringe

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**SCIENCE AND ENGINEERING POLICY STUDIES UNIT**  
of  
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*The Royal Society  
of London*

10 Nov 1993



# Foreword

Why should you want to read this report? As the White Paper *Realising our potential* has emphasised, a vigorous research base is a key ingredient in our national well-being. The UK is only a small element of the global research base, so an international approach is essential. Indeed, it is the policy of many funding agencies to foster international collaboration. But, while short-term mobility directly strengthens the national research base, long-term emigration does not. So up to date factual evidence on the state of the 'brain drain' in academe, as presented in this report, will be of interest to all concerned with the health of the national research base: the responsible Ministers and their advisers, the managers of various parts of the system, those who seek to benefit from academe, and academic researchers themselves.

During the 1980s it was received wisdom that substantial numbers of scientists and engineers were leaving the UK, to the detriment of the national research base. SEPSU therefore undertook a study to examine the quantitative basis for this belief, producing hard data on both emigrants and immigrants. Our report, published in 1987, helped to move the discussion onto a firmer and more balanced basis. With the generous support of the Nuffield Foundation, to whom I should like to express my thanks, we have now repeated our earlier analysis of movements to and from academic posts (the main focus of migration). We thus have directly comparable data sets for the two periods 1975–85 and 1984–92.

Between the two periods, our data show that migration from the UK has slowed a little in some subjects and remained similar in others, while migration into the UK has increased slightly. But the down side, as before, is that emigrants tend to take long-term posts while immigrants tend to take short-term posts. Moreover, British emigrants leave for professional reasons but return, if they do, primarily for personal reasons. So we should be careful not to draw too much comfort from the simple numerical head-count. This conclusion is reinforced by the continuing increase in the proportion of Fellows of the Royal Society who live overseas.



# Summary

This report describes a study of the migration of scientists and engineers to and from the UK over the period 1984–92. The report follows closely the format of a previous SEPSU study published in 1987 which collected similar data for the period 1975–85.

The report concentrates on five broad fields of science and engineering in the UK — biochemistry, chemistry, earth science, electrical engineering and physics. The main method of data collection was a questionnaire survey of heads of departments and of leaders of university research groups in the five subject areas. This asked for details about migration of young research workers (i.e. recently qualified PhDs), postdoctoral research assistants (PDRAs) and more established, permanent members of staff. In addition to data on migration to and from the UK it also collected data on movement to other UK employment from academia. The response rate was a little under 70%, with a total of 371 replies. In addition a series of interviews was undertaken to follow up the questionnaire findings.

Respondents named 447 UK scientists and engineers who left the UK for overseas posts during the years 1984–92. Of these, 228 were experienced scientists and engineers and 219 were recently qualified PhDs. Respondents also named 462 scientists and engineers who entered the UK from abroad during the same period. Of these 144 were UK nationals returning, along with 318 foreign immigrants.

For postdoctoral research assistants and more senior members of university research groups the average emigration rate during the period 1984–92 was 2.1% annually (similar to the 2.3% reported for the years 1975–85). The rate was much lower for more senior staff from departments, at around 0.3% annually (compared with 0.5% previously reported), whereas the emigration rate for recently qualified PhDs was around 13.5%, virtually identical to that previously reported.

The immigration rate to university research groups (excluding those coming to study for higher degrees) was 4.0% annually, up slightly on the previously

reported 2.9%, whilst immigration to university departments was 0.5% annually, up slightly from 0.4% reported for the previous decade.

Overall such figures suggest that emigration of UK scientists and engineers has, if anything, fallen slightly over the recent period. In addition the number of overseas staff being attracted to the UK has increased slightly, as has the overall proportion of such incomers who are British nationals returning home. However, there are concerns that it is the highest quality staff who are leaving, to the detriment of the UK. Evidence, both from the survey and from other indicators such as the geographical distribution of Fellows of the Royal Society, supports this view.

The survey confirmed the previous findings for 1975–85 that UK staff emigrate for professional reasons (such as career opportunity, levels of equipment) but return primarily for personal reasons.

One interesting change between the earlier survey and the present one is the increasing popularity of other EC countries as a destination for emigrating UK scientists and engineers. If this trend continues it could suggest the increasing integration of the UK and EC research communities.

Migration of scientists and engineers is not in itself the controversial policy issue today that it has been in the past. Respondents thought that the world economic recession had had a significant dampening effect on migration of staff, particularly to senior, permanent positions. It was suggested that once the world economic recovery got underway migration rates were likely to increase, to the detriment of the UK. The research selectivity exercises and the concentration of resources into centres of excellence were thought to have played a part in attracting high quality UK (and other) staff from overseas, but many respondents were concerned about the general expansion of the university system (with its associated teaching commitments), the introduction of quality assessment (for teaching and research) and the increasing demands on limited financial resources. Many thought that these factors would make the academic profession less attractive in relation to other professions and that scientists and engineers would look to other professions or places of employment.

Does migration matter? Clearly intellectual exchange is vital if the UK is to retain the excellence and vigour of its science and engineering base. There are major



benefits, for the individual and the UK, of young scientists and engineers gaining experience and contacts abroad. Indeed, there are many publicly funded schemes promoting such movement. There is, however, concern that the UK academic environment is becoming less attractive than overseas employment and therefore less able either to attract the most talented staff back from overseas, or to stop them moving to non-scientific and engineering employment. This matters, both for the intrinsic cultural life of the nation and because UK industry needs a healthy UK science and engineering base as a source of skilled scientists and engineers who generate creative ideas and provide a route through which to access and participate in the development of the global knowledge base.

The 1980s were a time of change for the UK Science and Engineering Base. The 1990s seem set to be a time of greater change. It is important to monitor the effects of this change. Migration provides one relevant, albeit complex, measure for this purpose. Our work shows that between 1975–85 and 1984–92, the scale and pattern of migration changed in modest but significant ways. Whether this remains the case over the next decade is worth keeping under observation.



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# I. Background and study design

The migration of scientists and engineers is a subject of continuing interest to all those concerned with the state of the UK science and engineering base and the overall economy. It is a complex phenomenon. The popular phrase the Brain Drain implies a one-sided movement, to the detriment of the home country, but it is important to attempt to look at the whole picture — who has migrated away, to where, for how long, why, have they returned; who has migrated into the UK, again from where, why and for how long; the relative quality of the incomers and outgoers; is migration a significant factor — for whom (the migrants, the institutions or the country), based on what criteria? It should also be remembered that the movement of scientists and engineers between countries is actively encouraged by many organizations (e.g. the Royal Society, the European Science Foundation, the European Community). At what stage, if ever, does migration change from a policy objective to a policy problem?

This study updates one published by SEPSU in 1987\*. Coming at a time of vigorous but largely anecdotal discussion the earlier report provided hard data and proved to be an influential source of insight. Since migration remains a topical policy issue SEPSU, with support from the Nuffield Foundation, has now generated fresh data, covering the years 1984–92, to inform the current debate.

## PREVIOUS STUDIES

The 1987 SEPSU report investigated migration in five broad fields of science and engineering — biochemistry, chemistry, earth sciences, electrical engineering and

\* *Migration of scientists and engineers to and from the UK*. SEPSU Policy Study No. 1. (1987).

A similar questionnaire was sent to heads of departments in the five subjects asking for information about the movement of more senior university staff (primarily permanent academic staff members).

In both questionnaires respondents were asked to supply in confidence the names of migrants, to help eliminate duplication between the two questionnaires. This also served as a safeguard against exaggeration.

## **RESPONSES**

The final response rate was a little below 70%, compared with the response rate of 83% in the previous survey. We received a number of letters and telephone calls wishing the study well but stating that the department simply could not now spare the time to complete the questionnaire. One replied that they received over 50 official/semi-official data-gathering forms per year and ours was simply a low priority. Response rates are given in table 1.1.

The distribution of questionnaire responses matches quite closely the distribution of departments as graded in the UFC research rating exercises. The sample is therefore representative of the broad mix of departments within the system.

Overall, the response rate is sufficient for purposes of policy analysis. SEPSU is indebted to all those who found the time to complete the questionnaires.

## II. Questionnaire analysis

### Part I — Movement of staff to and from the UK

#### NUMBER OF MIGRANTS NAMED BY RESPONDENTS

A total of 447 UK scientists and engineers who left the UK for overseas posts during the years 1984–92 were named in 371 questionnaires. Of these 228 were 'experienced' scientists and engineers and 219 had just gained their PhD.

Respondents also named 462 scientists and engineers who entered the UK from abroad during the same period. Of these 144 were British staff who returned from overseas, along with 318 foreign immigrants.

As in the previous study, we explicitly asked respondents to exclude foreign postgraduate students who stayed in this country for not more than 3/4 years to study for a higher degree. They do not represent long term migration to the UK as most leave the country on completion of their degrees, although some respondents commented that foreign postgraduates now formed a major part of their research groups.

Some respondents supplied only general statements about staff movements; these responses were not included in the analysis.

*The following analysis deals only with professional scientists and engineers of PhD or equivalent status and only with emigrants of British nationality or immigrants of any nationality.*

Tables 2.1A and 2.1B show the number of named scientists and engineers leaving or entering the UK by each of the categories of respondent and the proportion of respondents who reported no migration in either direction. 72% reported some migration to or from their group or department during 1984–92,

**Table 2.1A**  
**Occurrence of migration by category of respondent (all disciplines)**

	<i>RGL</i>		<i>HoD</i>		<i>Total</i>	<i>1975-85</i> <i>Total %</i>	
No migration	43	21%	60	36%	103	28%	33%
Migration to UK only	33	16%	35	21%	68	18%	13%
Migration from UK only	47	23%	27	16%	74	20%	23%
Migration to and from the UK	83	40%	43	26%	126	34%	31%
Total respondents	206	100%	165	100%	371	100%	N=486

*RGL* = responses from Research Group Leaders, primarily about short-term staff.  
*HoD* = responses from Heads of Departments, primarily about permanent academic staff.

*Total 1975-85* = total responses from the university sector in our earlier study.

Source: SEPSU Policy Study No. 8.

**Table 2.1 B**  
**Numbers of migrants by category of respondent**

	<i>RGL</i>	<i>HoD</i>	<i>Total</i>
<i>Individuals leaving the UK 1984-92</i>			
UK Staff	130	98	228
Recent PhDs	219	n/a	219
Total	349	98	447
<i>Individuals coming to the UK 1984-92</i>			
UK nationals returning	22	122	144
Non- UK immigrants	269	49	318
Total	291	171	462

Source: SEPSU Policy Study No. 8.



with research group leaders more likely to report migration than heads of departments. These figures are broadly comparable with our earlier study for 1975–85.

## **POPULATION REPRESENTED BY RESPONDENTS**

The questionnaire replies necessarily represent only a sample of UK research effort. It is difficult to assess what proportion of the total relevant scientist and engineer population was covered: in the university sector the total number of researchers in any one discipline is difficult to measure from central sources as they tend to be structured around cost centres. We therefore asked respondents to give an indication of the size of their groups or departments, and of the average number of specific grades in the group or department over the survey period. Some respondents, particularly, but not only, in earth sciences, gave details of departmental mergers which had occurred during the late 1980s. In such cases we calculated average group sizes over the whole period 1984–92.

The estimated total population for each is included in table 2.2A.

## **RATES OF MIGRATION**

### **(i) By category of respondent**

To estimate the rate of migration the numbers of migrants in each category were compared with the corresponding estimated population. Table 2.2A shows that the total number of migrants who left or entered the UK is small in comparison with the total number of scientists and engineers. For postdoctoral research assistants and more senior members of university research groups the emigration rate was 2.1%. Heads of departments reported an emigration rate of 0.3%, slightly lower than the 0.5% reported previously. Overall these figures are broadly similar to those for 1975–85.

The rate of emigration from university research groups of UK postgraduates who had just completed a PhD is more difficult to measure, since the total postgraduate population (843) in the group survey includes foreign postgraduates and also those at different stages of their courses. However, an estimate can be made of the relevant population for the years and disciplines covered by the survey, by using other information on the typical nationality distribution of individual disciplines and by assuming that 30% complete PhDs in any given year.

**Table 2.2 A**  
**Rate of migration by category of respondent (all disciplines)**

	<i>PhD students</i>	<i>RGL PDRA + senior</i>	<i>HoD</i>
Total number of staff in sample	843	799	3539
-----			
Estimated average number of UK staff in relevant disciplines in sample	592	679	3362
Total emigrants in sample	219	130	98
Average leaving UK per year 1984-1992	24	14.4	11
% of estimated population leaving UK per year	13.5%*	2.1%	0.3%
-----			
Total immigrants in sample	na	291	171
Average entering UK per year 1984-1992			
Total	n/a	32	19
Of which UK		2	13.6
Of which non UK		30	5.4
% of estimated population entering UK per year			
Total	n/a	4.0%	0.54%
Of which UK		0.25%	0.38%
Of which non UK		3.75%	0.15%
-----			

\* Rate related to estimated number of pg gaining PhD each year (i.e of total population some 30% gaining degree each year, = 178)

NB period 1984-92 treated as 9 academic years for this analysis. UK populations estimated as in table 2.2B.

Source: SEPSU Policy Study No. 8.

From this the emigration rate for recently qualified UK PhDs was 13.5%, very similar to the 13.4% revised rate for PhDs reported in the previous study.

Immigration rates to research groups were 4.0%, an increase from 2.9% in the previous study. Heads of departments reported an annual immigration rate of 0.5%, a slight increase over the previous rate of 0.4%.

**Table 2.2 B**  
**Rate of migration by category of respondent and discipline**

	Biochemistry	Chemistry	Earth Sciences	Electrical Engineering	Physics	All disciplines
<b>University research groups</b>						
Total responses	40	56	28	27	55	206
<i>(i) Research students</i>						
Total population	122	246	105	106	264	843
UK population (estimate*)	88	185	79	42	198	592
UK pg gaining PhDs each year (estimate*)	26.4*	55.5*	23.7*	12.6*	59.4*	177.6*
Emigrants per year	5	9	3	1	6	24
Annual rate of emigration%	18.9%	16.2%	12.7%	7.9%	10.1%	13.5%
<i>(ii) More senior staff</i>						
Total population	132	161	96	143	267	799
UK population (estimate **)	112.2	136.9	81.6	121.6	227.0	679.2
Emigrants per year	4.0	3.3	1.8	0.6	4.9	14.4
Annual rate of emigration %	3.6%	2.4%	2.2%	0.5%	2.2%	2.1%
Immigrants per year	6.3	11.7	2.8	2.3	9.2	32.3
Annual rate of immigration %	4.8%	7.3%	2.9%	1.6%	3.4%	4.0%
<b>Heads of Departments</b>						
Total responses	36	40	25	28	36	165
Total population	669	882	529	669	790	3539
UK population (estimate ***)	635.6	837.9	502.6	635.6	750.5	3362.1
Emigrants per year	1.8	2.6	1.0	3.0	2.6	11
Annual rate of emigration %	0.3%	0.3%	0.2%	0.5%	0.3%	0.3%
Immigrants per year	2.8	5.0	3.1	2.6	5.6	19.0
Annual rate of immigration %	0.4%	0.6%	0.6%	0.4%	0.7%	0.5%

\* Population of PhD students estimated as follows:

Total population from survey divided by % of UK nationals, divided by a rate of 30% for annual completion rate for PhDs

Total populations were divided between UK and other nationals using rates from Atkinson *et al.* *An anatomy of research personnel in UK universities* (SERC, 1992) (i.e. Biological Sciences 72% UK nationals, Physical Sciences 75%, Engineering and Technology 39.5%)

\*\* Population of research groups estimated using data from Atkinson *et al.* that 85% are UK nationals

**Table 2.3A  
UK women emigrants**

	PhD		RGL		HoD		Total		
	All emigrants	Women	All emigrants	Women	All emigrants	Women	All emigrants	Women %	
Biochemistry	45	10	36	4	16	1	97	15	15%
Physics	55	4	44	3	23	0	122	7	6%
Electrical engineering	9	0	5	0	27	1	41	1	2%
Earth Sciences	25	1	15	0	9	0	49	1	2%
Chemistry	85	10	30	3	23	0	138	13	9%
<b>Totals</b>	<b>219</b>	<b>25</b>	<b>130</b>	<b>10</b>	<b>98</b>	<b>2</b>	<b>447</b>	<b>37</b>	<b>8%</b>

Source: SEPSU Policy Study No. 8.

**TABLE 2. 3B**  
**Women immigrants to UK**

(i) <i>All nationalities</i>	<i>RGL</i>		<i>HoD</i>	
	<i>Total</i>	<i>Women</i>	<i>Total</i>	<i>Women</i>
Biochemistry	57	12	25	3
Chemistry	105	16	45	6
Earth Sciences	25	5	28	4
Electrical Engineering	21	6	23	2
Physics	83	8	50	2
Totals	291	47	171	17
		16%		10%

	<i>(ii) Non-UK immigrants</i>			<i>(iii) UK immigrants</i>		
	<i>Total</i>	<i>Women</i>	<i>%</i>	<i>Total</i>	<i>Women</i>	<i>%</i>
Biochemistry	57	11	19%	25	4	16%
Chemistry	108	17	16%	42	5	12%
Earth Sciences	27	8	30%	26	1	4%
Electrical Engineering	32	6	19%	12	2	17%
Physics	94	9	10%	39	1	3%
Totals	318	51	16%	144	13	9%

Source: SEPSU Policy Study No. 8.

## MIGRATION AND RESEARCH RATINGS

It was suggested that the UFC research assessment exercises and the subsequent concentration of resources in a relatively small number of centres of excellence was having the effect of enhancing such centres, but only at the expense of the remainder. Migration data were therefore analysed by departmental research rating. The sample included many departments rated 5, 4, or 3 (i.e. international or national excellence in most areas), but many fewer responses from departments rated 2 or 1. The data were therefore condensed into two groups — those departments rated

4 or 5 and those rated 1, 2 or 3. For comparison, data were normalized to migration per year per 100 staff members. Data are given in table 2.4.

For permanent staff there is evidence that for departments rated 4 and 5 there was a net inflow of UK immigrants over UK emigrants, although there was some variation between subjects. In earth sciences, the only discipline to have undergone a full 'rationalization', the evidence strongly suggests that departments rated 4 and 5 were successful in attracting UK staff to them (i.e. 0.3 UK emigrants per year per 100 staff compared to 0.7 UK immigrants per year per 100 staff, and 1.0 immigrants of all nationalities). It was only in electrical engineering where this was not the case.

**Table 2.4**  
**Migration by departmental research ratings**

	RGL		HoD		
	<i>UK emigr. per year per 100 staff</i>	<i>All immigr. per year per 100 staff</i>	<i>UK emigr. per year per 100 staff</i>	<i>UK immigr. per year per 100 staff</i>	<i>All immigr. per year per 100 staff</i>
<b>Rating 4 or 5</b>					
Physics	5.3	7.5	0.4	0.4	0.7
Chemistry	4.0	13.1	0.3	0.5	0.6
E. Science	3.0	4.5	0.3	0.7	1.0
Elec. Eng.	1.3	3.0	0.3	0.2	0.4
Biochemistry	4.3	4.9	0.2	0.5	0.5
Total	4.1	7.1	0.3	0.5	0.7
<b>Rating 1,2,3</b>					
Physics	1.7	3.9	0.2	0.6	0.9
Chemistry	3.6	9.4	0.3	0.4	0.5
E. Science	2.3	4.0	-	0.3	0.2
Elec. Eng.	0.4	2.9	0.6	0.1	0.3
Biochemistry	5.6	5.8	0.4	0.3	0.2
Total	2.9	5.5	0.3	0.3	0.5

Source: SEPSU Policy Study No. 8.

For departments rated 1, 2 or 3 the combined data suggest that the number of UK emigrants was balanced with UK immigrants. There is, however, considerable variation. For example, physics departments seemed to be particularly attractive to both UK and non-UK immigrants, as, to a lesser extent, did chemistry and earth sciences. On the other hand, electrical engineering in particular, and biochemistry to a lesser extent, had more UK emigrants than immigrants.

For new PhDs and short-term staff there is evidence of increased migration, in both directions, with increasing grade of department in four of the five disciplines.

Care should be taken not to over-interpret these data. However, they do seem to indicate that departments rated 4 and 5 were successful at attracting a net migration of permanent UK staff to them from overseas, and that there had been a considerable turnover of younger staff moving to and from them.

## QUALITY OF MIGRANTS

Since, at a broad level, emigration and immigration were still roughly balanced for experienced scientists and engineers, the net effect of migration on UK research would depend on the relative quality of the migrants and whether migration was permanent or short term. Although any measure of quality is difficult to define, respondents were asked, as in the previous study, how many of the migrants they had named would be regarded as 'outstanding'. This is a very subjective question, but the answers do add a dimension to our understanding of migration.

Overall, respondents appear to have treated the question seriously, although a number refused to answer it. Some respondents qualified their answer (i.e. 'good' but not 'outstanding').

Of those migrating from the UK, 50% of the total were said to be outstanding, an increase over approximately 40% in the previous study. Heads of departments noted that approximately 62% of leavers were outstanding, whereas 68% of incomers were so labelled. Research group leaders' responses indicated that some 50% of PhDs who emigrated were outstanding, whilst only some 42% of more experienced/PDRA staff were so classified. This appears to be something of a reversal from the previous study which showed some 40% of young PhDs and some 50% of more experienced staff who emigrated were so classified.

Some 54% of the immigrant scientists and engineers to the UK were also regarded as outstanding, compared with around 30% in the previous study.

This apparent increase in the quality of migrants in each direction is consistent with a situation of generally increasing competitiveness in the job market: migrants have to be good to get work permits.

## **EFFECTS ON EMIGRATION OF BRITISH RESEARCH**

309 respondents commented on the effects of emigration of UK scientists and engineers on UK research. Of these, 63% (67% of heads of departments and 61% of research group leaders) thought that emigration was having an adverse effect, down from 73% in the previous survey: the increasing quality of emigrants being more than matched by the increasing quality of immigrants. Of those who believed migration was having an adverse effect, half thought the effect was 'serious' and half thought it was 'minor'.

If responses are broken down by discipline, biochemistry and chemistry heads of departments were more concerned about the effects of emigration on their research than earth scientists, physicists and electrical engineers. A similar pattern is seen in responses from research group leaders, although not so clearly defined.

## **EASE OF REPLACEMENT OF EMIGRANTS FROM THE UK**

Respondents were asked how easy it had been to find replacements of equal calibre to those who had emigrated. In the previous survey some 68% of university respondents said that, even when permitted, it had been difficult to find replacements of equal calibre. Although a common comment from the respondents in the current survey was that they could not replace staff on financial grounds, overall only 44% said that it was fairly or very difficult to find replacements. 32% of heads of departments had found it difficult or very difficult to replace staff (although they often responded that they were not allowed to fill vacancies), compared to 53% of research group leaders.

There were some differences between the subjects. For instance, in electrical engineering some 77% of research group leaders noted it was difficult or very difficult to find replacements, as did 56% of heads of departments. However, of a



small number of earth sciences heads of departments, only a little over 10% had found it difficult to find replacements.

## REASONS FOR UK STAFF GOING OVERSEAS

Respondents were asked to list the most common reasons that persuaded the named scientists and engineers to migrate to and from the UK. Whilst acknowledging that it is difficult to judge motives for other people, we believe that respondents would have a good idea of the motives of the migrants.

Table 2.5A shows the reasons given by each group of respondents. Each respondent was asked to choose a maximum of three reasons from a list of motives thought to be related to migration, and to supplement this where appropriate.

	<i>RGL</i>	<i>HoD</i>	<i>Total</i>
Low rates of pay in UK	46	37	83
Low status of science in UK	47	38	85
Greater science vigour overseas	47	23	70
Higher levels of equipment overseas	66	41	107
Higher standard of living overseas	32	25	57
Enhanced career prospects overseas	87	50	137
Desire to widen experience	72	14	86
Personal reasons	13	14	27
Political climate in UK	3	3	6
Other	8	8	16

Note: each respondent was asked to identify up to three reasons

Source: SEPSU Policy Study No. 8.

**Table 2.5B**  
**Reasons for non-UK staff coming to the UK**

	<i>RGL</i>	<i>HoD</i>	<i>Total</i>
High rates of UK pay	15	4	19
High status of science in UK	30	11	41
Scientific vigour in UK	54	17	71
Higher levels of equipment in UK	65	23	88
Higher standard of living in UK	29	17	46
Enhanced career prospects in UK	22	12	34
Personal reasons	17	13	30
UK education for children	6	8	14
UK culture	7	8	15
Political climate in UK	23	13	36
Others	28	10	38

Note: each respondent was asked to identify up to three reasons.

Source: SEPSU Policy Study No. 8.

As in our previous study, the most common reason why UK scientists and engineers were thought to have left the UK was the opportunity of enhanced career opportunities abroad (and the implied career limitations in the UK). The availability of higher levels of equipment was also an important factor and the desire to widen experience, the overall low status of science in the UK and general higher levels of pay overseas were also significant. The data confirm the common finding in surveys of this sort that the hopes of a higher standard of living outside the UK are not the primary motives for emigration.

The most common reasons given for the immigration of non-UK scientists and engineers (table 2.5B) were the overall high level of equipment in the UK and the higher scientific vigour of UK science. However, many respondents noted this was relative to the migrants' home country and said this was by contrast with the developing countries rather than with the USA and Western Europe. The desire to widen experience was the main 'other' reason, although some noted that time spent

**Table 2.5C**  
**Reasons for UK staff returning to the UK**

	<i>RGL</i>	<i>HoD</i>	<i>Total</i>
High rates of UK pay	0	0	0
High status of science in UK	0	2	2
Scientific vigour in UK	9	8	17
Higher levels of equipment in UK	5	4	9
Higher standard of living in UK	0	1	1
Enhanced career prospects in UK	10	12	22
Personal reasons	73	67	140
UK education for children	38	40	78
Return to UK culture	64	59	123
Political climate in UK	6	7	13
Others	10	14	24

Note: each respondent was asked to identify up to three reasons.

Source: SEPSU Policy Study No. 8.

in the UK enhanced migrants' career prospects once they returned home. The reputation of a particular group or department was also noted as being a major reason for individuals migrating to the UK.

As our previous report highlighted, the reasons UK scientists and engineers returned home from overseas (table 2.5C) were overwhelmingly thought to be personal rather than professional reasons, usually family ties and commitments, the desire to return to UK culture and the desire to educate their children in the UK.

## **DESTINATION OF EMIGRANTS FROM THE UK**

For many years the United States of America and Canada have been the most popular destinations for emigrating UK scientists and engineers. However, as table 2.6 shows, whereas the previous report indicated that some 63% of

**Table 2.6**  
**Destination of emigrants from UK by category of respondent**

<i>Destination</i>	<i>RGL</i>		<i>HoD</i>		<i>Total</i>		<i>1975-85</i>
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>%</i>
Africa	5	1%	2	2%	7	2%	3%
Oceania	21	6%	17	17%	38	9%	7%
Eastern Europe	0	0%	0	0%	0	0%	0%
Western Europe	116	33%	23	23%	139	31%	22%
Far East	18	5%	2	2%	20	5%	3%
Indian subcontinent	0	0%	1	1%	1	<1%	<1%
Middle East	1	<1%	1	1%	2	<1%	1%
Central/S America	1	<1%	0	0%	1	<1%	<1%
N America	186	53%	51	51%	237	53%	63%
Not given	1	<1%	1	1%	2	<1%	<1%
Totals	349	100%	98	100%	447	100%	N=740

Source: SEPSU Policy Study No. 8.

all emigrating staff went to North America now only around 53% do so. Western Europe attracted some 31% of emigrants, a considerable increase over 22% previously reported.

Increased migration towards Europe in the future was highlighted in the previous report and this prediction is confirmed by the data presented here. It is consistent with efforts in recent years to promote migration within Europe.

## NATIONALITY OF IMMIGRANTS

The nationalities of foreign scientists and engineers who came to the UK were rather more evenly distributed (table 2.7). The largest number of immigrants were from Western European countries, although this declined slightly from 20% of the total in 1975-85 to 18% in 1984-92. Other categories to show a fall in % terms were migrants from Oceania, from the Indian subcontinent, from the Middle East and from North America. Balancing these decreases there was an increase in migrants from Africa, from Eastern Europe and from the Far East.

**Table 2.7**  
**Nationality of immigrants to UK by category of respondent**

<i>Origin</i>	<i>RGL</i>		<i>HoD</i>		<i>Total</i>		<i>1975-85</i>
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>%</i>
Africa	15	5%	2	1%	17	4%	2%
Oceania	19	6%	9	6%	28	6%	9%
Eastern Europe	30	10%	7	4%	37	8%	3%
Western Europe	68	22%	17	9%	85	18%	20%
Far East	63	21%	1	<1%	64	14%	9%
Indian subcontinent	21	9%	2	<1%	23	5%	10%
Middle East	11	4%	2	<1%	13	3%	8%
Central/S America	13	4%	1	<1%	14	3%	1%
N America	29	10%	8	5%	37	8%	11%
UK (returning)	22	8%	122	71%	144	31%	25%
Totals	291	100%	171	100%	462	100%	N=556

Source: SEPSU Policy Study No. 8.

Overall, 31% of immigrants to the UK were UK nationals (up from 25% previously). Responses from research group leaders indicate that the number of UK returners to research groups (generally at PDRA level) fell from 10% to 8% of all immigrants, whilst heads of departments noted an increase in the UK number from 64% to 70% of all immigrants to more permanent positions. This could reflect a view about the increased job security needed to persuade an emigrant to return to the UK.

## **NATURE OF OVERSEAS POSTS OF EMIGRANTS FROM THE UK**

Table 2.8 gives data on the nature of overseas employment of emigrants from the UK. In the previous study 55% of migrants went to academic posts and 23% went to industry/commerce. The data for 1984-92 show an increase to 67% moving to academic posts and 17% going into industry.

Table 2.9 shows the number of UK emigrants moving to long-term (>3 years) or short-term (<3 years) posts overseas. Heads of departments reported very

**Table 2.8**  
**Nature of overseas employment of emigrants from UK by category of respondent**

	<i>RGL</i>			<i>HoD</i>			<i>Total</i>		
	<i>N</i>	<i>%</i>	<i>1975/85 %</i>	<i>N</i>	<i>%</i>	<i>1975/85 %</i>	<i>N</i>	<i>%</i>	<i>1975/85 %</i>
University/ Equivalent	238	68%	53%	60	61%	61%	298	67%	55%
Student	0	0%	2%	0	0%	0%	0	0%	1%
Industry/ commerce	59	17%	22%	16	16%	28%	75	17%	23%
Indep. res. inst.	34	10%	10%	9	9%	4%	43	10%	8%
Gov/public service	9	3%	8%	7	7%	5%	16	4%	8%
Non sci. employment	2	<1%	<1%	4	4%	<1%	6	1%	<1%
Other	3	<1%	<1%	1	1%	0%	4	<1%	1%
Not given	4	1%	5%	1	1%	2%	5	1%	4%
Totals	349	100%	N=570	98	100%	N=170	447	100%	N=740

Source: SEPSU Policy Study No. 8.

**Table 2.9**  
**Length of overseas post of emigrants from UK by category of respondent**

	<i>RGL</i>			<i>HoD</i>		
	<i>N</i>	<i>%</i>	<i>1975/85 %</i>	<i>N</i>	<i>%</i>	<i>1975/85 %</i>
Short term	227	65%	41%	13	13%	9%
Long term (>3 yrs)	120	34%	57%	83	83%	84%
Not known	2	<1%	2%	4	4%	7%
Totals	349	100%	N=570	98	100%	N=170

Source: SEPSU Policy Study No. 8.

similar percentages to the previous report (with 83% of staff moving to long-term positions: c.f. 84%). However, research group leaders reported that 65% of leavers had left to short-term positions compared to 41% previously. Thus it could be argued that scientists and engineers holding short-term posts in the UK are less likely than they were to need the lure of a long-term post as an incentive to emigration.

## NATURE OF EMPLOYMENT OF IMMIGRANTS TO THE UK

Of scientists and engineers entering UK universities from overseas, some 69% were non-British (table 2.10). Of these non-British staff some 77% took up short-term posts (just under 80% previously), while some 23% took up long-term posts. In contrast, 15% of immigrating UK nationals took up short-term work and some 85% took up longer-term positions.

**Table 2.10**  
**Length of UK post held by immigrants to UK by category of respondent**

<i>Post in UK</i>	<i>RGL</i>			<i>HoD</i>			<i>Total</i>		
	<i>N</i>	<i>%</i>	<i>1975/85 %</i>	<i>N</i>	<i>%</i>	<i>1975/85 %</i>	<i>N</i>	<i>%</i>	<i>1975/85 %</i>
Short term	249	86%	85%	12	7%	13%	261	56%	65%
of which UK	14	5%		8	5%		22	5%	
of which non-UK	235	81%		4	2%		239	52%	
Long term	36	12%	15%	159	93%	86%	195	42%	35%
of which UK	8	3%		114	67%		122	26%	
of which non-UK	28	10%		45	26%		73	16%	
Not given	6	2%					6	1%	<1%
Totals	291	100%	N=403	171	100%	N=153	462	100%	N=556
of which UK	22	8%		122	71%		144	31%	25%
of which non-UK	269	92%		49	29%		318	69%	75%

Source: SEPSU Policy Study No. 8.

There appears to have been a major change in the proportion of immigrants to the UK who stay. This table shows that while the proportion of immigrants who subsequently left the UK has remained similar at departmental level, the proportion of immigrants to research groups remaining in the UK has increased from 36% to 58%.

In each period the great bulk of re-emigrants came from the non-UK holders of short-term posts on research grants; it may be that the recent expansion of the university system has created better opportunities for such staff to remain in the UK.

Table 2.11 shows the nature of previous overseas employment of immigrants to the UK. The majority of immigrants come from academic posts, or were PhD students who came to the UK for postdoctoral research.

**Table 2.11**  
**Nature of previous overseas employment of immigrants to UK by category of respondent**

	<i>RGL</i>			<i>HoD</i>			<i>Total</i>		
	<i>N</i>	<i>%</i>	<i>1975/85</i> <i>%</i>	<i>N</i>	<i>%</i>	<i>1975/85</i> <i>%</i>	<i>N</i>	<i>%</i>	<i>1975/85</i> <i>%</i>
University/ equiv.	174	60%	57%	119	70%	67%	293	63%	60%
Student	67	23%	26%	9	5%	9%	76	16%	22%
Industry/ commerce	12	4%	5%	14	8%	6%	26	6%	5%
Indep. research inst.	9	3%	5%	20	12%	10%	29	6%	6%
Govt/Public Service	20	7%	6%	7	5%	1%	27	6%	5%
Non-science employ.	0	0%	0%	0	0%	<1%	0	0%	<1%
Other	2	<1%	<1%	0	0%	<1%	2	<1%	<1%
Not given	7	2%	1%	2	1%	5%	9	2%	2%
<b>Totals</b>	<b>291</b>	<b>100%</b>	<b>N=403</b>	<b>171</b>	<b>100%</b>	<b>N=153</b>	<b>462</b>	<b>100%</b>	<b>N=556</b>

Source: SEPSU Policy Study No. 8.



**Table 2.12**  
**Age of emigrants**

Age	PhD	RGL: PDRA + senior			HoD		
	N	N	%	1975/85 %	N	%	1975/85 %
≤30 yrs	213	97	75%	76%	9	9%	15%
31–39 yrs	5	26	20%	16%	45	46%	44%
≥40 yrs	0	3	2%	2%	42	43%	36%
?	1	4	3%	6%	2	2%	5%
Total	219	130	100%	N=570	98	100%	N=170

Source: SEPSU Policy Study No. 8.

**Table 2.13**  
**Age of immigrants**

Age	RGL			HoD		
	N	%	1975/85 %	N	%	1975/85 %
≤30 yrs	139	48%	47%	83	49%	46%
31–39 yrs	109	37%	33%	74	43%	43%
≥40 yrs	31	11%	11%	10	7%	7%
?	12	4%	10%	4	3%	3%
Total	291	100%	N=403	171	100%	N=153

Source: SEPSU Policy Study No. 8.

**Table 2.14**  
**Age distribution in universities (1987/88)**

Age	Wholly university funded staff		Not wholly university funded staff	
	Eng. & Tech.	Science	Eng. & Tech.	Science
≤30 yrs	6.6%	5.8%	59.7%	58.4%
30–39 yrs	23.5%	21.9%	30.4%	32.6%
≥40 yrs	69.9%	72.3%	9.9%	9.1%

Source: USR.

## **QUALIFICATIONS OF MIGRANTS**

Well over 90% of emigrants held doctorates or equivalent qualifications. Virtually all UK staff who returned from abroad held doctorates.

## **AGE OF MIGRANTS**

The great majority of staff emigrating from research groups were less than 31 years old, with a much smaller proportion of older staff leaving (table 2.12). Heads of departments noted some 46% of UK emigrants were of the age 31–39 and 43% were aged over 39.

About 48% of immigrants to the UK research groups were aged less than 31 years old, 37% were between 31–39 years and 11% were over 39 years (table 2.13). Heads of departments noted a similar pattern of immigrants, with some 49% aged less than 31 years, 43% aged between 31–39 years and 6% aged over 39 years old. These figures are broadly similar to those obtained previously.

Table 2.14 shows, for a year in the middle of our period, the population distribution of staff in UK universities for engineering and science disciplines, by source of funding. The wholly university funded staff equate with those permanent academic staff identified by responses from heads of departments, whereas the not-wholly university funded staff equate with the generally shorter-term staff identified by research group leaders. It is clear that for both types of staff the ones most likely to leave are drawn from the younger end of the age distribution.

## **SENIORITY OF MIGRANTS**

We asked respondents to specify the grade of migrants to and from the UK (i.e. PDRA, lecturer, reader, professor). The responses are given in table 2.15A and 2.15B.

As expected, emigrants from the research group leaders were dominated by recently qualified PhD students and short term PDRA staff. Responses from heads of departments showed that of UK emigrants some 54% left lecturer/assistant lecturer posts, some 30% were senior lecturers, research fellows or readers and 13% were professorial staff.

**Table 2.15A**  
**Seniority of emigrants from permanent staff — position on emigrating**

<i>Grade</i>	<i>N</i>
Lecturer	53
Sen. Lecturer	15
R. Fellow	6
Reader	9
Professor	13
?	2
Total	98

Source: SEPSU Policy Study No. 8.

**Table 2.15B**  
**Seniority of immigrants — position taken up in UK**

<i>Grade</i>	<i>UK</i>	<i>All nationalities</i>
Lecturer	98	144
Sen. Lecturer	2	2
R. Fellow	2	2
Reader	2	3
Professor	13	14
?	5	6
Total	122	171

Source: SEPSU Policy Study No. 8.

Heads of departments noted that of UK immigrants some 82% returned to lecturer grade posts, 5% returned to senior lecturer, research fellow or reader posts and 11% returned at professorial level. Virtually all overseas staff who immigrated to UK departments were employed at the lecturer grade.

14% moved to non-scientific positions. Of 569 recently qualified PhDs, 24% had moved to an educational establishment, whereas 47% moved to industrial R&D positions. 13% moved to non-scientific positions and a further 6% were classified as unknown, including those thought or known to be unemployed.

## **GENDER**

Of 305 permanent staff identified as moving to other employment, 92% were male and 8% female. Of the PDRA staff 82% of movers were male, 15% female (plus 3% unspecified), whilst of recent PhDs 78% of movers were male, 20% female (plus 2% unspecified).

## **SHORT-TERM VS LONG-TERM**

Of the 305 permanent staff members moving to other UK employment some 92% went to long-term (greater than three years) positions, with only 6% going to short-term posts. Of the 285 postdoctoral research staff some 61% went on to long-term positions compared with 29% who went to short-term (9% unknown), which was virtually identical to that found for the recently qualified PhDs.

## **AGE OF MOVERS**

Of the permanent members of staff moving to other academic positions, some 10% were less than 31 years old, compared with some 43% aged 31–39 years and 45% over 39 years old. Of those staff moving to positions outside academia some 17% were under 31 years old, 32% aged 31–39 years and 50% were over 39 years old.

Of the postdoctoral research workers who moved, some 70% were under 31 and 22% were 31–39 years old. As would be expected virtually all the recently qualified PhDs were less than 31 years old.

## **POSITION ON LEAVING ACADEMIA**

For permanent members of staff who left for non-academic employment some 66% were from the lecturer scale, 9% were senior lecturers, 6% were readers and 11% were of professorial grade. Virtually all the postdoctoral staff identified had moved from short-term posts.

## **QUALITY OF MOVERS**

The questionnaire asked respondents how many of the identified movers they would classify as 'outstanding' in their fields. Overall heads of departments only rated 21% of the movers identified as being 'outstanding' (cf. of over 60% of those moving overseas). Between disciplines the proportion varied from 10% in earth sciences to 30% in physics.

Similarly, of postdoctoral research workers 18% of those moving to UK employment (including academia) were classified as outstanding, as were 19% of recent PhDs. This compares with 50% of PhDs and just over 40% of PDRAs moving overseas who were so classified.

## **EFFECTS OF MOVEMENT ON BRITISH RESEARCH**

Respondents were asked whether movement of staff to other UK employment was having an adverse effect on research and, if so, was the effect serious or minor. Just under 30% of heads of departments and just over 50% of research group leaders thought such movement was having an adverse effect. Of those 50% of heads of department and 72% of research group leaders thought this was a serious effect.

## **EMPLOYMENT OPPORTUNITIES FOR NEW PHDs**

The questionnaire asked respondents whether they felt that the prospects for employment for recently qualified PhDs were very good, good, average, fairly poor or very poor in both academia and industry. As may be expected in the face of the recession, the responses, on the whole, were pessimistic. Some 67% of research leaders and 82% of heads of departments said that employment prospects were fairly or very poor within academia. It should be noted that our question asked about permanent (or at least longer-term) employment. A number of respondents did note that prospects for short-term work were considerably better within academia.

Respondents thought that, whilst still poor, prospects in industry were slightly better, with 51% of heads of departments and 58% of research leaders believing prospects were fairly or very poor. However, neither group suggested prospects for permanent employment in the UK were good. It should also be noted

emigrants reported did not match his overall view of migration. A number noted that they were unable to fill vacant positions because of financial constraints and that this had had the effect of slowing migration down.

*Because of the inhibitions on university funding the mobility opportunities amongst staff have been severely restricted. After my own appointment to Professor in 1984 and subsequent two appointments (filling retirements) there have been cutbacks in recruitment.*

Biochemistry HoD.

*.. of 23 staff currently in post the average length since the date of their appointment is 19 years. Recruitment has been very static.*

Biochemistry HoD.

*We have had little movement of staff since 1984. This is mainly due to retiring staff not being replaced.*

Biochemistry HoD.

*Although it is highly perceived that there is a migration of British scientists away from the UK, my own experience is that there is very little mobility of permanent staff in British universities. In the current economic climate there is even less.*

Electrical Engineering HoD.

The general feeling of stagnation was reinforced by the economic recession in the UK and overseas. This had caused, as in many other professions, fewer permanent positions to become available, both within academia and particularly within industry. Respondents noted that the world recession had had an overall dampening effect on migration rates since the late 1980s.

## **LACK OF OPPORTUNITY**

A common thread running through many comments was that the lack of career opportunities within the UK was a major reason for emigration. At postdoctoral level respondents stated that, at least in some subjects, opportunities for finding short-term contracts were good, but the problem was lack of anything more permanent. However, others were more pessimistic even for such short-term posts.

There was a view, particularly from some research group leaders, that emi-

gration was often the only option a young scientist had if he/she wanted to continue a career in science or engineering. It was stated that the lack of opportunities in the UK meant emigration, unemployment or a change of career, and that it should not be surprising therefore that when opportunities arose young people emigrated.

*The principal cause of migration overseas is simply lack of opportunity [in the UK].*

Physics RGL.

*In my subject new PhDs just awarded their degrees are almost forced overseas in order to find any kind of job. I think science is a universal activity and that we should not be parochial in talking about 'UK science'. But I think it is bad that new PhDs should have to go overseas to pursue their career, many don't really want to for personal reasons but feel they have no choice.*

Biochemistry RGL.

*The lack of permanent posts, and frequently lack of temporary posts, forces many PhDs/post-docs into non-scientific employment from which they generally do not return. It is often not a matter of choice but necessity.*

Biochemistry RGL.

Heads of departments also noted this lack of career opportunity for the younger generation and believed this could lead to serious consequences in the medium term, with a few respondents talking of 'losing a generation' of scientists and engineers.

Lack of career opportunity was also raised by more senior staff in that career development within a department was severely curtailed, primarily by financial constraints, and that as a broader consequence there were few opportunities to progress once in permanent employment.

There were mixed comments concerning the numbers and quality of applicants for positions within departments. Some commented that the quality and number of applicants for a position were overwhelming, particularly for permanent positions (i.e. 117 applicants for one position of whom 25 were 'outstanding'), whilst others noted (especially for the short-term positions and in some disciplines such as engineering) that they found it hard to attract good UK applicants. It was stated that at least for short-term positions the best applicants were often from

overseas and that such staff were now forming a significant part of research groups (see below).

*A major problem is recruiting good quality PDRAs and PhD students. Very often the brightest students go into non-academic careers. Many post-doc positions are taken by staff who do not intend to pursue a career in science, e.g. spouses whose husbands or wives have a good job locally and it is a convenient source of a second income. Thus many PDRAs do not really have the commitment or motivation which is essential for a top scientist.*

Biochemistry RGL.

It was said, particularly but not exclusively by electrical engineers, that although the number of applications for positions was often high, the overall quality of applicants was often low. They believed this was, at least in part, due to the fact that industry had, over recent years, shed a large number of scientists and engineers but had, quite naturally, retained the best staff. Despite the recession, at least some industrial companies were still recruiting the best young scientists and engineers, who were willing to move into industry for the better career prospects, levels of equipment/resources and remuneration. This was having the effect of creating a lack of high quality young PDRAs for university positions.

## **LACK OF CAREER STRUCTURE**

Many respondents commented on the lack of a proper career path for academics, especially but not only younger scientists and engineers. This is partly linked with the lack of positions being available, as mentioned above. However, there was a strongly held view that unless there were more clearly defined paths for young staff then young staff would either seek permanent positions overseas or seriously look at alternative careers. This was seen as a significant factor in both increasing emigration rates of UK staff, and making the UK less attractive to staff seeking to return.

*The biggest problem is a lack of career structure - males tend to leave because of financial pressure, females whose husbands are also earners are able to stay and enjoy the science with less financial worries but they tend to forgo any career structure at all. This is not a sexist view - it just happens to turn out that way. What is needed is a second academic structure for technically gifted post-docs who don't want or can't handle the hassle of trying to set up, run and fund a group by themselves.*

Biochemistry RGL.



The answer was seen as either increasing the number of well funded, longer-term positions available within the UK Science and Engineering Base, or adopting a more selective approach.

*In my view [a] major problem is that many (very many) post-docs are not able to realise their potential because they are inadequately equipped or funded. It is completely wrong that we employ post-docs giving them a salary of - say £15K [totalling £20 K with NI etc] and then give them only £2000 or £3000 to spend.*

Biochemistry RGL.

Respondents commented on the need to make it easier for UK staff working overseas to maintain links with their UK based counterparts. Suggestions revolved around setting up collaborations with senior UK staff based overseas involving one or two trips of about one month duration per year to the UK department. Such trips would need to be long enough to allow the visitor to play a significant role in the research life of a department. This would allow overseas staff to remain living overseas and yet remain in close collaboration with their UK counterparts, whilst the UK would keep open access to the vitality and scientific vigour of such staff and their overseas colleagues.

### **1960s RECRUITMENT BULGE**

Another factor raised was the progression of the 1960s recruitment bulge through the university system. Respondents noted that over the 1980s this had been a major factor contributing to the lack of career opportunities, both for more experienced staff and as a blockage to recruitment of younger staff to permanent positions. It was noted this influenced opportunities in two ways: staff did not move or retire, and the system had become top heavy with experienced senior staff, using considerable financial resources that could then not be directed towards younger staff. Comments were optimistic that as the bulge led to an increased number of retirements there would be considerably more opportunities for permanent or longer-term positions within academia. One respondent gave an example of a department that had taken the opportunity of the retirement of three senior staff to restructure and recruit five younger staff (two of whom were UK staff attracted back from overseas) after some ten years of virtually no staff migration. Such opportunities were thought likely to increase during the rest of the 1990s.

## POSITIVE EFFECTS OF MIGRATION

Migration of young scientists and engineers overseas was said to be extremely beneficial for the individuals involved and for the scientific community as whole. Many actively encouraged their group members to spend time overseas. Some noted that with the increasing movement of post-docs and others to Europe rather than North America there were additional benefits such as enhanced language skills and general enhanced collaboration between research groups which could be beneficial in the medium term, particularly for gaining access to overseas (i.e. EC) funding.

*This is a very useful experience for them, but we need special schemes for attracting them back.*

Biochemistry RGL.

## RESEARCH SELECTIVITY

The research selectivity exercises and the moves towards centres of excellence and other, less well equipped, teaching dominated departments / universities brought a range of comments. Some comments regarding the earth science review were, now it has happened, in favour of the rationalization process, agreeing that the institutes did need shaking up and that some excellent centres had been created - which had attracted senior UK scientists back to the UK.

Respondents from centres of excellence commented on how the concentration of resources had led to excellent research facilities and the attraction of high quality staff (both UK and other nationals), but also often commented on the overall state of UK academic research away from such centres.

*We have a consistent net inflow of talented overseas professionals at the department. This is likely to continue as resources are concentrated.*

Electrical Engineering HoD.

*My department's involvement in this process [migration] at lecturer level was via the UGC New Blood Initiative. Such initiatives and the UGC Earth Sciences review itself play a key role in encouraging migration to the UK.*

Earth Science HoD.

However, whilst there was general agreement as to the quality of the centres of excellence created as a result of the selectivity exercises, many also saw more negative effects resulting from such actions.

*Our science base will become increasingly limited and will continue to specialise in a relatively small number of areas. Unless the cultural attitude to science changes, there will continue to be a drain to the USA.*

Biochemistry HoD.

*Most recent postgraduates will work abroad for a period of postdoctoral study in either the USA or Europe where research excellence, facilities and vigour are generally better than on offer in the UK. The number of positions available in the UK 'centres of excellence' is not adequate to absorb the many high quality pgs requiring training.*

Biochemistry RGL.

## **IMPROVED COMMUNICATION**

We asked whether, with modern communication systems (particularly computer networks and e-mail) and ease of travel, it actually mattered where scientists and engineers resided. The consensus of opinion was an overwhelming yes, that it did matter. Many stated that the most important aspect of scientific communication was having the opportunity to discuss work informally, openly and with staff with a range of expertise in order to develop novel ideas and approaches (i.e. the coffee room syndrome). It was said that even with well established international collaborations there was considerable scope for misunderstanding or misinterpretation which was difficult to rectify at a distance, but which was easily overcome face-to-face. Others stated this was equally as important for the development of industrial technology. It was pointed out that industry needed access to relatively local experts to help develop ideas and the science behind promising findings.

There were comments concerning the flow of information within the UK academic system. It was suggested that as a result of universities increasingly earning additional funding by working under contract there was a danger that the flows of information of the research undertaken would be inhibited. This was seen as a potentially serious problem. However, there was little evidence to confirm this had actually happened.

## INDUSTRIAL INVESTMENT

We received rather mixed views concerning the role of industry, both specifically towards migration and also more generally towards the role that industry/academic links play.

Some respondents commented that migration from the UK was not a major problem and saw the lack of technological investment from UK industry as being far more serious (i.e. UK industry did not use the resources it had so a few going overseas would not matter!). Others made similar comments concerning particular industrial sectors — either that to work in industry in a specific field staff had to emigrate, or that they would need to do so in a few years because the UK, whilst still being a leader of academic technology, was behind in its broader application/development.

*The erosion of the UK industrial sector is providing increasingly few challenging research opportunities for highly trained research engineers and scientists. The consequence for industry is a downward spiral towards a low wage, low skill workforce assembling scientific and engineering hardware designed outside the UK.*

Electrical Engineering HoD.

*UK industry is not investing enough in long-term research for products that would support the UK in 10 years time. Sadly many of the young UK scientists will not only be lost to the academic system but also to the UK industrial system, with serious consequences for UK research and for the UK economy.*

Physics RGL.

*Migration has not been a problem over the last 10 years but if the run down in the British engineering industry continues it will rapidly become very serious.*

Electrical Engineering RGL.

There were a number of comments concerning the actual linkages between academia and industry. In some subjects/ departments linkages were undoubtedly strong and mutually beneficial relationships had developed, usually based around individual academics or small teams. Elsewhere, there was concern that such linkages were not strong and many believed this was an area which could be significantly improved for the benefit of all.

*In fields of research which have a sound and genuine connection with industry there is*

*no real problem. The major problem is where the connection with industry is less strong.*

Physics RGL.

*The primary problem is poor migration between industry and academia in the UK and industry's apathy to academia.*

Electrical Engineering RGL.

It was suggested that industry / academia linkages had suffered considerably as a result of the economic recession since the late 1980s and that movement of research staff between UK industry and academia had fallen as a consequence. This was thought to be cause for serious concern, particularly for UK industry.

Some academics commented that migration of scientists and engineers from the UK had a definite negative effect on UK industrial competitiveness (lack of expertise on hand to discuss and develop new approaches or ideas), whereas others were more optimistic noting that most of the world's research was done overseas and that UK industry, if it was to remain competitive, should be tapping into all, not just UK, research. They saw the migration of scientists and engineers and the subsequent building of linkages and networks as a potentially major source / network of information, if industry learnt how to tap it.

## **WORLD ECONOMIC RECOVERY**

There was general agreement that emigration of UK scientists was likely to increase in the near future as the world economic recovery led to more employment opportunities becoming available. A considerable number of respondents commented that they would leave if the opportunity arose, or if they were younger with fewer family commitments. Whilst it would be easy to dismiss such comments (it is, after all, much easier to talk of migration than actually to migrate) such sentiments were held strongly in enough cases to take seriously. However, it should also be remembered that immigration rates would also be likely to increase.

*Currently the academic/research climate is generally unfavourable in all the developed countries — international economic recovery would unblock a log jam of dissatisfied academics (particularly in the early stages of their careers) unless recovery in the UK matches that overseas. Even if UK recovery occurred the stature and remuneration of scientists nationally would have to improve significantly if they are to be retained.*

Earth Science HoD.

## EUROPE

Respondents highlighted the effects of the actions of the European Community and the moves toward European collaboration and the creation of centres of excellence in other European countries. CERN was identified as a typical example — excellent facilities, good salaries and a natural magnet for the best scientists and engineers.

The various EC and other programmes promoting mobility within Europe were noted as having the effect of giving the next generation of scientists and engineers a much more European outlook. There were examples of language courses for scientists and engineers being oversubscribed and an increasing number of students undertaking sandwich courses with time spent overseas. At a research level a similar move was noted. Although respondents stressed that science had for a long time been an international pursuit, the fact that many were looking to international funding sources, such as the EC Framework programme which required international collaborations as a prerequisite for funding, meant that such ties had become more formalised and were likely to lead to longer term collaboration and interchanges.

*[My group's initial success] was due to support from the SERC. Unfortunately in the last two years the support has not been forthcoming and the lead we had has almost disappeared. The most distressing aspect of the affair is that overseas collaborators were eager to help in developing and expanding our work in their laboratories - an option which now appears to be the only sensible alternative.*

Physics RGL.

*When the recession ends there will be a move of engineers towards Europe.*

Electrical Engineering HoD.

*The EEC will make it much easier for them to shoot over to France/Germany where their skills are much better recognised and rewarded. This worries us.*

Physics RGL.

*The Human Capital and Mobility Programme will strongly influence post-doc movements. The stipends on offer are equivalent to UK professorial rates. This will heighten discontent about low pay/stature of UK academics.*

Chemistry RGL.

## IMMIGRATION OF NON-UK STAFF

Respondents noted that some of their best PDRA staff came from overseas — Europe, China, Japan and others — and that such staff now formed a significant part of a research group's overall capabilities.

*I am actively trying to encourage suitably qualified and motivated research students and post-docs to join us particularly from the EC countries, primarily because the UK does not produce sufficient good people to work in my field, hence I need a wider catchment area.*

Earth Science RGL.

*Currently of our four research students one is English, one is German/English, one Korean and one from Sri Lanka. Of our three research assistants one is German, one is Malaysian and one is English. We also have a visiting research Fellow from Pakistan (EC supported) and one shortly from Russia.*

Physics RGL.

*I recruit about 70% of my research group from outside England [due to the narrow English education system]*

Chemistry RGL.

On the whole such high quality staff remain in the UK for relatively short periods of time before moving either on to a third country or moving back to their home countries. Time spent in a UK research group was often perceived as being beneficial for career enhancement on return to their home countries.

## EAST-WEST MOVEMENT

The break up of the Communist bloc has, in recent years, led to a noticeable increase in the number of immigrants from these countries. However as yet much of this movement (at least to the UK) has been of a short-term nature, resulting in a net inflow of such staff. Such immigration was on the whole viewed very positively and we received considerable comment as to the high quality of the immigrant staff.





## IV. Additional information on migration

### ROYAL SOCIETY FELLOWS LIVING OVERSEAS

Election to the Fellowship of the Royal Society is a recognition of very high achievement in research. Eligibility for election is restricted to citizens of British Commonwealth countries or the Irish Republic, or those 'ordinarily resident' in a British Commonwealth country or the Irish Republic. An analysis of the geographical distribution of the Fellowship therefore provides some measure of how migration affects some of the outstanding members of the UK scientific community.

The data (table 4.1 and Figure 4.1) shows that as the Fellowship (excluding Foreign Members) has grown, from 603 in 1960 to 1111 in 1992, both the number and proportion of those living outside the UK has also steadily grown, in particular from 1976. Since 1985 there has been another marked increase, with 24.2% of the Fellowship now living outside the UK. In particular the proportion of Fellows resident in the USA has grown from 2.8% in 1960 to 10.8% in 1992.

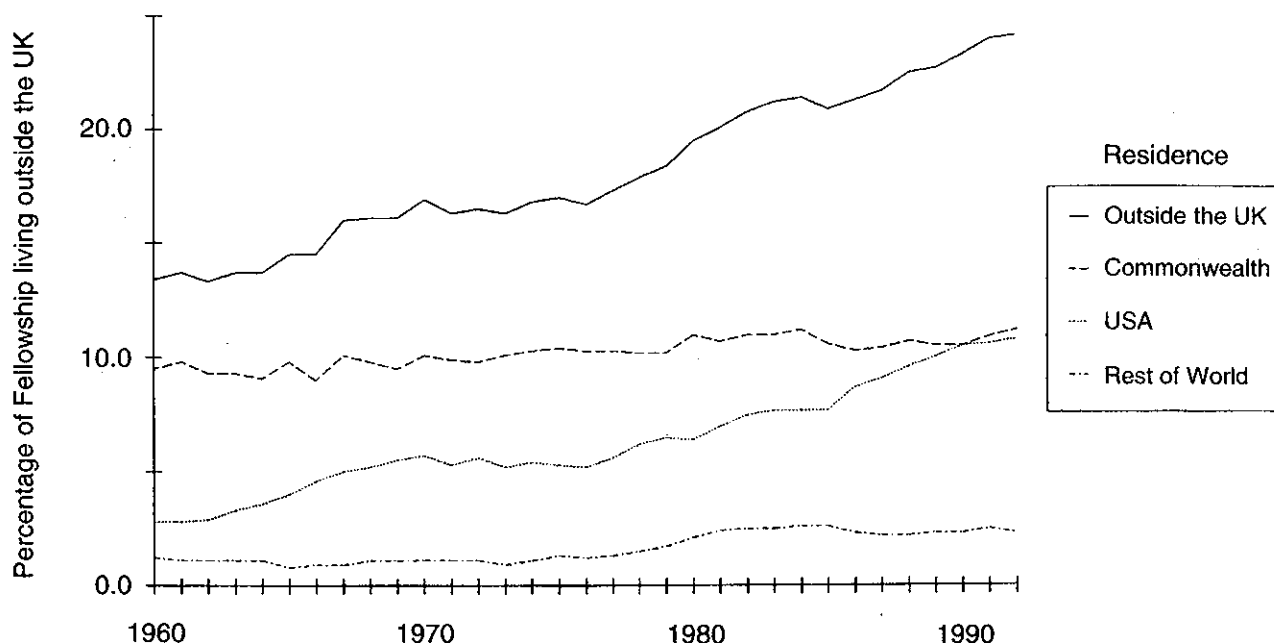
Similarly, the proportion of new Fellows elected to the Society each year (again excluding Foreign Members) living overseas at the time of their election has increased from 15.8% in 1960–62 to 27.5% in 1990–92 (falling from a peak of 31.7% in 1987–89). The proportion of newly elected Fellows living in the USA has risen from 3.9% in 1960–62 to 11.7% in 1990–92 (falling from a peak of 14.2% in 1987–89 — Figure 4.2).

Although the total Fellowship of the Royal Society is small in relation to the overall UK scientific population and covers the full range of scientific and technical disciplines, the steadily increasing number of Fellows working outside the UK adds credence to the view that outstanding scientists and engineers have left, and continue to leave, the UK (though it may also in part reflect greater familiarity with the work of Commonwealth scientists living outside the UK). However, the decrease in the number of Fellows living overseas seen in the last 3 year period (1990–92) should be noted. As can be seen from Figure 4.2, although the general

**Table 4.1 Geographical distribution of the Fellowship of the Royal Society (excluding Foreign Members)**

Year	Total Fellowship	Fellows living outside the UK	Fellows living in Commonwealth countries other than the UK	Fellows living in the USA	Fellows living in the rest of the world
1960	603	81 13.4%	57 9.5%	17 2.8%	7 1.2%
1961	610	84 13.7%	60 9.8%	17 2.8%	7 1.1%
1962	624	83 13.3%	58 9.3%	18 2.9%	7 1.1%
1963	633	87 13.7%	59 9.3%	21 3.3%	7 1.1%
1964	647	89 13.7%	59 9.1%	23 3.6%	7 1.1%
1965	654	95 14.5%	64 9.8%	26 4.0%	5 0.8%
1966	670	97 14.5%	60 9.0%	31 4.6%	6 0.9%
1967	682	109 16.0%	69 10.1%	34 5.0%	6 0.9%
1968	697	112 16.1%	68 9.8%	36 5.2%	8 1.1%
1969	713	115 16.1%	68 9.5%	39 5.5%	8 1.1%
1970	715	121 16.9%	72 10.1%	41 5.7%	8 1.1%
1971	735	120 16.3%	73 9.9%	39 5.3%	8 1.1%
1972	747	123 16.5%	73 9.8%	42 5.6%	8 1.1%
1973	763	124 16.3%	77 10.1%	40 5.2%	7 0.9%
1974	784	132 16.8%	81 10.3%	42 5.4%	9 1.1%
1975	790	134 17.0%	82 10.4%	42 5.3%	10 1.3%
1976	813	136 16.7%	84 10.3%	42 5.2%	10 1.2%
1977	833	144 17.3%	86 10.3%	47 5.6%	11 1.3%
1978	853	153 17.9%	87 10.2%	53 6.2%	13 1.5%
1979	874	161 18.4%	89 10.2%	57 6.5%	15 1.7%
1980	893	174 19.5%	98 11.0%	57 6.4%	19 2.1%
1981	914	184 20.1%	98 10.7%	64 7.0%	22 2.4%
1982	938	196 20.8%	103 11.0%	70 7.5%	23 2.5%
1983	963	204 21.2%	106 11.0%	74 7.7%	24 2.5%
1984	977	209 21.4%	109 11.2%	75 7.7%	25 2.6%
1985	994	208 20.9%	105 10.6%	77 7.7%	26 2.6%
1986	1009	215 21.3%	104 10.3%	88 8.7%	23 2.3%
1987	1023	222 21.7%	106 10.4%	93 9.1%	23 2.2%
1988	1038	234 22.5%	111 10.7%	100 9.6%	23 2.2%
1989	1060	241 22.7%	111 10.5%	106 10.0%	24 2.3%
1990	1070	249 23.3%	112 10.5%	112 10.5%	25 2.3%
1991	1092	262 24.0%	119 10.9%	116 10.6%	27 2.5%
1992	1111	269 24.2%	124 11.2%	120 10.8%	25 2.3%

Source: SEPSU Policy Study No. 8.



Source: SEPSU Policy Study No 8

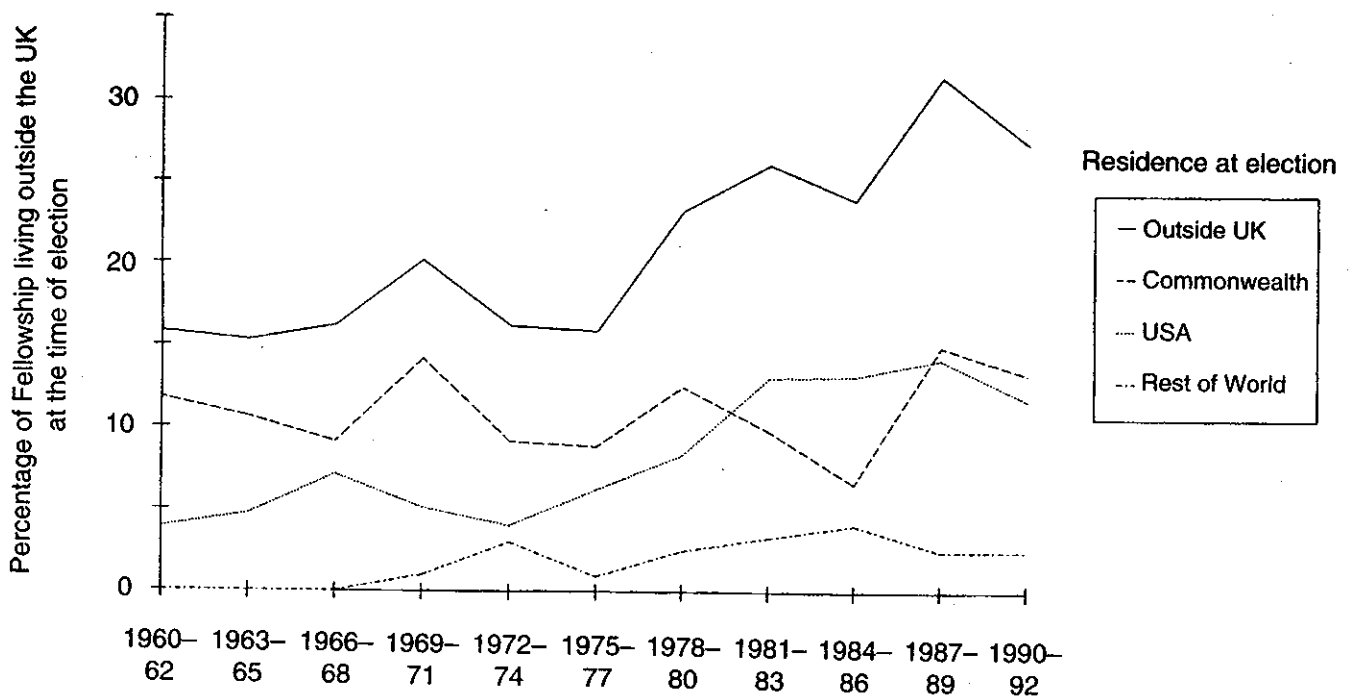
**FIGURE 4.1**  
**Residence of Fellows of the Royal Society**

trend over time has been upward, there has been considerable fluctuation within this. The latest fall in overall numbers may simply reflect this 'natural' fluctuation or it may be indicative of the beginnings of a levelling out or reversal of the overall upward trend.

## DATA FROM OTHER SOURCES

It is well known that as a result of increased recruitment during the universities expansion in the 1960s, the age profile within academia has been skewed. This was recognised in the early 1980s, when two early retirement schemes were introduced and a series of New Blood positions were created in order to ensure that younger staff members could find places within the system. In 1983 the Royal Society created the University Research Fellowships (URFs) scheme, which provides the brightest researchers with a long-term position (up to 10 years) to keep them within the UK system and allow them to compete for permanent positions as and when opportunities arise. The scheme has grown to some 200 posts at present.

Of the current holders of URFs, nearly 79% came from UK based employment (mainly, but not totally, from short-term positions within UK academia), whilst 21% returned to the UK from overseas positions (some 13% from the USA).



Source : SEPSU Policy Study No 8

**FIGURE 4.2**  
**Residence of Fellows of the Royal Society at the time of election**

Destination data on leavers from the scheme (108 to date) show that 83% moved to positions within UK higher education, a further 6.5% went to UK industry, whilst the remaining 11% emigrated to positions overseas (5.5% to the USA).

Although the numbers are small, the scheme does therefore seem to be successful in attracting bright young researchers back to the UK.

It is also interesting that, although actual numbers of staff are small (currently some 60 posts) 23% of current Royal Society professorships and senior fellowships are held by staff whose previous employment was overseas (7.7% from USA). Again this shows that, where good posts are available, high quality staff are attracted back to the UK.

## USR DATA

### (i) Total staff numbers within the UK university system

Table 4.2 gives basic data on staff numbers, by cost centre, for the years 1984 and 1991. This shows that the number of wholly university funded staff (i.e. permanent academic staff with teaching and research duties) in biochemistry, chemistry and physics has fallen or remained roughly constant. It also shows the increase in the total number of staff in the system is due to the large increase in the numbers of partly or not-university funded staff (i.e. the usually short-term contract research staff).

<i>(i) 1984</i>	<i>Bio-chemistry</i>	<i>Chemistry</i>	<i>Physics</i>	<i>Elec. Eng</i>	<i>Other Phy. Sci.</i>	<i>All subjects</i>
Wholly uni. funded	556	1411	1425	932	646	30974
Part/non-uni. funded	564	749	776	462	251	13114
Total UK staff	1026	1927	1954	1219	842	39799
Total overseas staff	94	233	247	175	55	4289
<b>Total staff</b>	<b>1120</b>	<b>2160</b>	<b>2201</b>	<b>1394</b>	<b>897</b>	<b>44088</b>
 <i>(ii) 1991</i>						
Wholly uni. funded	465	1207	1245	1081	722	32607
Part/non-uni. funded	800	935	1220	835	544	20347
Total UK staff	1068	1754	2055	1526	1087	45347
Total overseas staff	197	388	410	390	179	7607
<b>Total staff</b>	<b>1265</b>	<b>2142</b>	<b>2465</b>	<b>1916</b>	<b>1266</b>	<b>52954</b>

Source: USR

**Table 4.5**  
**Nationality of staff by cost centre**

Biochemistry	1984			1991			
	Wholly uni. funded	Part or non-uni. funded	Total	Wholly uni. funded	Part or non-uni. funded	Total	%
UK	527	499	1026	441	627	1068	84.4%
USA	8	6	14	2	14	16	1.3%
EC	8	22	30	6	59	65	5.1%
Commonwealth	9	11	20	12	30	42	3.1%
Rest of World	4	26	30	4	70	74	5.8%
Total overseas	29	65	94	24	173	197	15.6%
<b>Total</b>	<b>556</b>	<b>564</b>	<b>1120</b>	<b>465</b>	<b>800</b>	<b>1265</b>	

Physics	1984			1991			
	Wholly uni. funded	Part or non-uni. funded	Total	Wholly uni. funded	Part or non-uni. funded	Total	%
UK	1344	610	1954	1159	896	2055	83.4%
USA	12	11	23	13	23	36	1.5%
EC	14	35	49	21	60	81	3.3%
Commonwealth	24	41	65	22	53	75	3.0%
Rest of World	31	79	110	30	188	218	8.8%
Total overseas	81	166	247	86	324	410	16.6%
<b>Total</b>	<b>1425</b>	<b>776</b>	<b>2201</b>	<b>1245</b>	<b>1220</b>	<b>2465</b>	

Electrical Engineering	1984			1991			
	Wholly uni. funded	Part or non-uni. funded	Total	Wholly uni. funded	Part or non-uni. funded	Total	%
UK	871	348	1219	963	563	1526	79.6%
USA	3	2	5	6	2	8	0.4%
EC	14	18	32	25	43	68	3.5%
Commonwealth	17	11	28	17	15	32	1.7%
Rest of World	27	83	110	70	212	282	14.7%
Total overseas	61	114	175	118	272	390	20.4%
<b>Total</b>	<b>932</b>	<b>462</b>	<b>1394</b>	<b>1081</b>	<b>835</b>	<b>1916</b>	

Table 4.5 gives data on nationality of staff by cost centre (biochemistry, physics and electrical engineering). Among permanent staff in these three cost centres, the non-UK population averaged 6% in 1984 and 8% in 1991. Among short-term staff, the non-UK population increased from an average of 19% in 1984 to 27% in 1991. Thus the massive increase in short-term staff that has characterized universities over the past decade has been fuelled in significant measure by an influx of non-UK researchers.

**Table 4.6**  
**First destination of UK-domiciled first-degree graduates**

		<i>No. of known destination</i>	<i>Home employment &amp; academic research</i>	<i>Overseas employment &amp; academic research</i>
<b>Biological Sciences</b>	1984/85*	3891	2897	88
	1986/87	4607	3453	125
	1988/89	4532	3359	120
	1989/90	4888	3497	129
	1990/91	4998	3355	154
	1991/92	5425	3581	158
<b>Physical Sciences</b>	1984/85*	5306	4231	139
	1986/87	5954	4694	179
	1988/89	5315	4193	144
	1989/90	5554	4182	158
	1990/91	5609	3958	174
	1991/92	6239	4312	176
<b>Engineering &amp; Technology</b>	1984/85*	7996	7067	186
	1986/87	6868	6031	175
	1988/89	7185	6343	187
	1989/90	7344	6279	208
	1990/91	7020	5572	210
	1991/92	7269	5669	162

\* Minor changes in the definitions of subject categories between 1984/85 and 1986/87.

Source: USR

**Table 4.7**  
**First destination of UK-domiciled postgraduate students**

		<i>No. of known destination</i>	<i>Home employ- ment</i>	<i>Overseas employ- ment</i>	<i>Home academic research</i>	<i>Overseas academic research</i>	<i>Total overseas</i>
<b>Biological Sciences</b>	1984/85	941	595	69	153	70	139
	1986/87	1146	745	70	209	58	138
	1988/89	1033	662	65	211	45	110
	1989/90	1213	775	87	234	62	149
	1990/91	1220	775	67	217	68	135
	1991/92	1325	796	81	284	57	138
<b>Physical Sciences</b>	1984/85*	1384	892	81	263	104	185
	1986/87	1506	975	92	269	105	197
	1988/89	1503	1003	87	224	110	197
	1989/90	1659	1051	128	297	105	233
	1990/91	1723	1066	120	316	122	242
	1991/92	1924	1163	101	361	146	247
<b>Engineering &amp; Technology</b>	1984/85*	1598	1261	86	178	4	90
	1986/87	1732	1394	85	178	8	93
	1988/89	1552	1244	78	162	11	89
	1989/90	1578	1265	105	144	10	115
	1990/91	1550	1197	84	172	13	97
	1991/92	1791	1334	106	189	9	115

\* Minor changes in the definitions of subject categories between 1984/85 and 1986/87.

Source: USR

## FIRST DESTINATION DATA

Data on first destinations of first degree and postgraduate (both PhD and MSc) students are given in Tables 4.6 and 4.7. Over the period 1984/85 to 1991/92 the percentage of UK-domiciled graduates moving to overseas academic research or employment rose slightly in all three groups of disciplines. For postgraduates the proportion going overseas, about three times as great as for first-degree graduates, declined in biological sciences and increased in engineering and technology. Postgraduate engineers are nonetheless only half as likely to emigrate as biological or physical scientists.



## V. Summary of main findings

### RATES OF MIGRATION

This report, like the previous study, shows that although a significant number of scientists and engineers in the establishments surveyed came to or left the UK during 1984–1992 they represent only a small proportion of the overall professional population.

For postdoctoral research assistants and more senior members of university research groups the emigration rate was 2.1% annually, as compared with 2.3% for 1975–85. Emigration rates for senior staff of departments were much lower at about 0.3%, a fall from the 0.5% rate reported previously. The emigration rate for newly qualified PhDs was 13.5%, virtually identical to that reported for the years 1975–85.

The immigration rates to university research groups, excluding those who came to study for higher degrees, was 4.0%, an increase from the rate of 2.9% reported previously. Immigration rates to more permanent departmental positions have also increased slightly, from 0.4% to 0.5%.

For staff moving to other employment in the UK rates of movement are again relatively small. For permanent members of departments our data suggest a rate of around 1% per annum, of whom some 40% go to non-academic employment. This figure is lower than from USR data. For members of research groups the rate of movement was 4.7% per year, of which some 60% was to non-academic employment. For recently qualified PhDs the rate was 36%, with some 28% moving to non-academic employment.

### DISCIPLINES OF MIGRANTS

The annual rate of emigration of newly qualified PhDs in chemistry rose from around 12% during 1975–85 to 16% during 1984–92. The rates for biochemistry, physics and electrical engineering remained roughly constant over the two periods, at around 19%, 10% and 8% respectively. Only the emigration rate of recently qualified PhDs in earth sciences showed a significant decrease.

The increase in migration of chemistry PhDs was consistent with respondents' comments, as was the fall in the emigration of earth scientists which respondents related to the lack of employment opportunities overseas.

The emigration rate for more senior staff from research groups in chemistry and biochemistry increased, as did that for earth sciences. Electrical engineering and physics both reported a slight fall in emigration rates.

For permanent staff identified by heads of departments emigration rates were all small (below 1%) and remained roughly constant, or fell slightly over the two periods.

The immigration rate for senior staff to research groups increased slightly across all the disciplines. Immigration rates of permanent staff to departments showed an increase from 0.4% to 0.5% over the two periods, although within this, immigration to biochemistry departments fell whilst rates to chemistry and physics increased.

However, the amount of data in each subgroup was small and care should be taken to not over-interpret them.

## **GENDER**

The data indicate that the number of women emigrants was around half the number that could have been expected to migrate based on the ratio of males and females in the existing population.

Of those staff moving to other UK employment, movement of the sexes was roughly proportional to the male / female population distribution.

## **QUALITY OF MIGRANTS**

Overall, some 50% of those migrating from the UK were classified as 'outstanding', an increase from 40% reported previously. However, some 54% of immigrants were also classified as 'outstanding', again an increase over previous findings. It is interesting to note that whilst heads of departments regarded 60% of those leaving as 'outstanding', nearly 70% of those coming to the UK were also so classified.

Of staff moving to other UK employment, 21% of permanent staff were classified as outstanding, as were 18% of research group staff and 19% of recently qualified PhDs.

## **MIGRATION AND RESEARCH SELECTIVITY**

The data show that departments rated 4 and 5 (i.e. the centres of excellence) attracted more UK staff back to the UK from overseas than emigrated from these departments, and a significant number of high quality overseas staff. This is consistent with comments received. However, for departments rated 1, 2 and 3 the results were more ambiguous - whilst some showed emigration and immigration are roughly balanced there were examples of both immigration and emigration being dominant. There did not appear to be a major increase in emigration from these departments.

## **EFFECTS OF MIGRATION ON UK RESEARCH**

Of 309 respondents, 63% believed that emigration had had an adverse effect on UK research, a decrease from 73% in the previous study. Of those, 51% believed the effect was serious, compared to 45% of similar respondents in the previous study.

Of movement to other UK employment some 30% of heads of departments and 50% of research group leaders believed such movement had had an adverse effect on UK research.

## **DESTINATION OF EMIGRANTS**

Although the USA and Canada remained the most popular destination for emigrants there has been a noticeable shift towards migration to Western Europe, and a small increase towards Oceania.

For established members of research groups and departments the majority of movement to other employment in the UK, was either to other academic institutions or an industrial R&D setting. There was more variation in the employment destination of recently qualified PhDs, about 25% moved to academia and nearly 50% to industrial R&D. 13% moved to non-scientific employment.

and engineers, who can generate creative ideas, serve as a source of inspiration to the young and provide a route through which to access and participate in the development of the global knowledge base. Those benefits come through a relatively small number of key researchers, who serve as focal points attracting high quality staff, students and funds in a virtuous circle of excellence. A strong domestic science base does not, of itself, guarantee industrial success, but for an economy like that of the UK today it is widely regarded as one of the preconditions for success.

There are undoubtedly benefits to be gained for the individual from spending a period of time in a research environment overseas. Many respondents stated that they actively promoted overseas experience to their students and younger staff, and a number of publicly funded schemes have precisely this objective. However, respondents were also concerned that there were considerably fewer professional (as opposed to personal) attractions to bring staff back to the UK after such visits.

### **ATTRACTIVENESS OF AN ACADEMIC CAREER IN THE UK**

The changes to the university system over the past 5 years or so were said to have had major impacts on the attractiveness of a career in academic science and engineering, at least for those presently within it who have lived through the changes. Shortages of funding, particularly for long-term projects, increased teaching loads and increased bureaucracy had detrimentally affected research and, importantly, morale. Academia was perceived as offering a much less attractive (or perhaps simply different?) career than before, both to those within it, to youngsters yet to embark on a science or engineering career and to those UK scientists and engineers at present overseas who may be thinking of returning to the UK.

Such comments might be expected from staff involved in a system undergoing radical change. For all the negative comments made there was not evidence of a large exodus from the system, and indeed, as the evidence shows, if anything there has been a decrease in emigration and a slight increase in immigration of both UK and other nationals. The selectivity exercises have created centres of scientific excellence within the UK that have international reputations and as such are attractive to high quality staff. Our data do not show a corresponding selective movement away from the lower graded departments, though this could change in the future.

Migration at present is not the major issue that it has been in the past, and the effects of organizational changes to the university system were seen as far more important. However, there was no doubt that the changes taking place were affecting the perceptions of the quality of a career in academic science and engineering, and as such the consequences of such changes could/would be migration of existing staff to other employment within science and engineering, or possibly away from science and engineering altogether.

Another major factor within the university system has been the lack of career structure, particularly for younger scientists and engineers but also for more senior staff. This was seen as one of the most pressing problems within the system, where the effects of the recent White Paper would be crucial.

One reason for the lack of career structure for younger scientists and engineers has been the progress of the 1960s staff recruitment bulge through the system. This has meant that there have been, over the past 10 years or so, relatively few retirements of staff, resulting in fewer opportunities for younger staff to find permanent positions. This has been compounded by the economic climate within universities, whereby vacant posts have often been left unfilled. However, there are signs that the recruitment bulge is working its way through the system and that the number of retirements is increasing, allowing restructuring and recruitment.

## **RECESSION**

The economic recession, both within the UK and globally, has had a significant effect on migration patterns — there simply have been fewer posts available and hence less movement, particularly in the last three years or so. This has lowered the number of migrants, both to and from the UK and within it. It is likely that once the world economy begins to recover the migration patterns of scientists and engineers will change and the rate of movement increase. Our findings of a slight fall in the rate of emigration and an increase in immigration rates should be seen in this context of a subdued global economy.

## **EUROPEAN COMMUNITY**

There has been an increase in the number of staff moving to and from the European Community, for both long and short-term posts. Such movements are likely to continue to increase, particularly as more young scientists and engineers take

advantage of the various courses now available with time spent in an EC country. This, coupled with the increasing amounts of EC funding for collaborative research, will enhance linkages and in consequence lead to increased migration.

Enhanced migration between Member States is an explicit objective of Community policy, coupling the aim of building up social and economic cohesion with the aim of strengthening the Community's overall R&D capability. To the extent that the UK, as a member of the Community, benefits from this strengthening of the Community, increases in migration between the UK and the rest of the EC carry very different implications from migration between the UK and non-EC countries: they mark at the level of the individual researcher the UK's participation in the EC, rather than directly signalling a threat to the UK's R&D capacity, though there may well nevertheless be implications for the UK's industrial competitiveness.

## CONCLUSION

The UK Science Base has been in a state of change throughout the last decade. The new White Paper sets the direction of further change through the next decade.

Migration is sometimes used as a barometer of the health of the national Science and Engineering Base. It is a complicated barometer with a highly non-linear scale, for reasons explained earlier. Nevertheless, it is one that merits attention.

High quality researchers are a major national resource. The ability of the UK Science and Engineering Base to attract and retain their services matters, not just for the Science and Engineering Base itself but also for the nation as a whole.

Over the last decade rates of emigration have been static or slightly decreasing (depending on grade of staff), and immigration has slightly increased. The numbers involved are fairly modest, but these findings do not justify complacency about the state of the UK Science and Engineering Base. There is evident concern about the difficulty of building a career in science, which may inhibit those whose ultimate aim is a UK research job from migrating overseas and thus weakening their links with potential employing institutions in the UK. The global recession will have damped down migration along with other economic actions, and recovery from recession may herald increased migration. The White Paper could gradually bring about major changes in the cultural context of the UK Science and

Engineering Base. So, too, could the strengthening of the EC's presence in science and technology policy.

This report indicates that those entering the UK Science and Engineering Base seem to have been no more likely to emigrate during the past decade than they were during the previous decade. Whether this remains the case over the next decade is worth keeping under observation.





# ANNEX A

## Questionnaires

Two similar questionnaires were sent to Research Group Leaders and Heads of Departments asking for data on staff migration to and from their departments/groups. Below is an amalgamated version of both questionnaires.

### Migration of scientists and engineers Questionnaire

#### A Personal background of respondent

Q1. Name . . . . .  
Position . . . . .  
Specialization . . . . .  
Institutional address . . . . .

Q2. What is the average size of your research group/ department over the past 10 years (or since establishment if more recent).

Average number of :

PhD students . . . . .  
Postdoctoral research assistants . . . . .  
Permanent academic staff . . . . .  
Other . . . . .

#### B Migration of scientists & engineers from your research group

Q3. On the following sheet please list details of all members of your research group/ permanent academic members of your department who have left to work overseas since 1 January 1984.

Please include UK postgraduates who have emigrated on completion of their thesis but do not include overseas students who returned home on completion of their studies.

**Q3. Members of your research group(s) who have left to work overseas since 1 January 1984**

BACKGROUND OVERSEAS EMPLOYMENT LAST UK	(i) Name	
	(ii) Sex	
	(iii) Nationality	
	(iv) Main field of specialization (e.g. genetics; nuclear physics)	
	(v) Highest qualification (BSc, PhD)	
	(vi) Year highest qualification obtained (approx.)	
	(vii) Country of first destination	
	(viii) Nature of overseas employment (put appropriate letter as * below)	
	(ix) Short (S) or Long-term (L) (3 years) appointment overseas	
	(x) Year left UK	
	(xi) Approximate age when left UK (≤30 years, 31–39 years, ≥40 years)	
	(xii) Returned to UK? Yes (Y) : No (N) Not known (NK)	
	(xiii) Position in your research group when left UK (e.g. PDRA)	
	(xiv) Was this a short (S) or long-term (L) (3 years) appointment in UK group	

\* See (viii) above

(a) university/equivalent	(b) industry/commerce (non R&D)
(c) Independent research institutions	(d) government/public service
(e) non-scientific employment	(f) student
(g) other (specify in table above)	

If necessary, please continue on the additional sheet at the back of the questionnaire

Q4. Of those staff members listed in Question 3 who have migrated from the UK and are now working overseas, how many do you regard as 'outstanding'?

PhD students . . . . .

PDRA's . . . . .

Permanent academic staff . . . . .

Q5. What, in your opinion, were the THREE most common reasons that persuaded *British staff* to take up overseas posts? (Please mark accordingly).

- (a) Low rates of pay in UK [ ]
- (b) Low status of science in UK [ ]
- (c) Greater scientific vigour overseas [ ]
- (d) Higher level of equipment / research facilities overseas [ ]
- (e) Higher standard of living overseas [ ]
- (f) Enhanced career opportunities overseas [ ]
- (g) Desire to widen experience [ ]
- (h) Personal reasons (e.g. family connections) [ ]
- (i) Political climate in the UK [ ]
- (j) Other (please specify) [ ]

Q6. How easy has it been to find replacements of equal calibre for those who have migrated? (Please ring).

Very easy / Fairly easy / Average / Fairly difficult / Very difficult

Q7. What, in your view, are the present permanent employment opportunities in research in the UK for new PhDs/PDRAs in your field? (Please ring).

(a) Within academia

Very good / Fairly good / Average / Fairly poor / Very poor

(b) Within industry

Very good / Fairly good / Average / Fairly poor / Very poor

Q8. What proportion of recent PhDs (of British nationality) in your field: (please ring asterisks)

	<i>Majority</i>	<i>Minority</i>	<i>Very Few</i>	<i>None</i>
(a) continue in UK research;	*	*	*	*
(b) continue in other UK scientific work;	*	*	*	*
(c) take up scientific work abroad;	*	*	*	*
(d) leave scientific work altogether.	*	*	*	*

**D Migration of scientists and engineers to your research group**

Q15. On the following table please list all those who have joined your group/ department from overseas since 1 January 1984, EXCLUDING postgraduate students on short term (up to three years) attachment.

**Q.15 Members of your research group(s) who have joined from overseas since January 1984**

<b>B A C K G R O U N D  U K  P O S T</b>	(i) Name	
	(ii) Sex	
	(iii) Nationality	
	(iv) Main field of specialization (e.g. genetics, nuclear physics)	
	(v) Highest qualification obtained (approx)	
	(vi) Year highest qualification obtained (approx.)	
	(vii) Nature of previous overseas employment (put appropriate letter as * below)	
	(viii) Country of previous overseas employment	
	(ix) Year appointed to UK research group	
	(x) Approximate age when appointed (≤30 yrs, 31–39 yrs, ≥40 yrs)	
	(xi) Short (S) or Long-term (L) (3 yrs) appointment in UK research group	
	(xii) Position in research group (e.g. PDRA)	
	(xiii) If subsequently left UK, year of departure	

\* See (vii) above

(a) university/equivalent	(b) Industrial R&D
(c) Independent research inst.	(d) government/public service
(e) non-scientific employment	(f) student
(g) other (specify in table below)	

If necessary, please continue on the additional sheet at the back of the questionnaire

Q16. Of those listed in Question 15 how many do you regard as 'outstanding'?

- PhD students . . . . .
- PDRA's . . . . .
- Permanent academic staff . . . . .

Q17. What, in your opinion, were the THREE most common reasons that persuaded *British staff* to return to work in the UK? (Please mark accordingly).

- (a) High rates of pay in UK []
- (b) High status of science in UK []
- (c) Greater scientific vigour in UK []

- (d) Higher levels of equipment/ research facilities in UK
- (e) Higher standard of living in the UK
- (f) Enhanced career opportunities in UK
- (g) Personal reasons (e.g. family connections)
- (h) UK education system for children
- (i) Return to UK culture
- (j) Political climate in UK
- (k) Other (please specify)

Q18. What in your opinion were the THREE most common reasons that persuaded non-British staff to work in the UK. (Please use the appropriate letters as in Question 17 above).

### **E General comments**

Please use the space below to give additional details or comments pertinent to the phenomenon of migration to and from the UK academic system over the past 10 years. In addition, how do you think migration of scientists and engineers will effect the UK in the next 10 years. What factors are driving any changes?

*Thank you.*



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