

Third Report on the Organization of Pharmacology in Great Britain

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1 The results presented in this Report on the Organization of Pharmacology in the United Kingdom are based on replies to questionnaires sent out in 1983. In addition to academic and industrial research and development (R&D) departments we also surveyed industrial departments of toxicology, sales, clinical liaison and medical information, as well as specialized research units with no formal teaching function. The overall response rate was 87%.

2 Since the last Report in 1971, the total number of pharmacologists has doubled to 2220, and they are now almost equally distributed between Universities and Industry. The most striking feature has been a major (3 fold) increase in the total number of industrial pharmacologists to 1014. In contrast, there was only a 1.3 fold increase in the number (99) of pharmacologists in established academic posts, over half of which are in the new departments of clinical pharmacology.

3 Of the established pharmacologists in academic departments only 8% were less than 30 years of age and 22% over 50, whereas in industrial R&D departments the corresponding figures were 44% and 6% respectively. Since 1971 the proportion of pharmacy graduates in established academic or industrial R&D posts has fallen from 30% to 13% but the proportion with a medical qualification is almost unchanged.

4 In academic departments, there was a net loss of established staff during 1982 and 1983 compared with a net gain of almost 100 appointments in industrial departments. The major single cause of academic pharmacologists leaving posts was early retirement, whilst in the industrial sector the major single destination was another industrial department.

5 In 1983, 227 students graduated with a special B.Sc. degree in Pharmacology compared with 67 in 1971. The same period saw a decline in pharmacy students specializing in pharmacology (293 to 204) and the emergence of Joint Honours courses that include pharmacology.

6 Pharmacology students who graduated in 1983 were also sent a questionnaire. From those responding (57%) over 90% were satisfied with their course and over 80% considered it adequate preparation for their future occupation.

7 At the time of the survey in 1983, only 8% of students graduating in 1982 were unemployed, but all of the 1982 postgraduates were employed.

Introduction

This Third Report on the Organization of Pharmacology in Great Britain was undertaken at the suggestion of the Committee of the British Pharmacological Society. Previous reports have analysed the state of pharmacology in 1964 (Bakhle & Paton, 1966) and 1971 (Bakhle, Straughan & Webster, 1974). Since then important changes have occurred. The membership of the Society has increased from 791 in 1971 to 1,734 in 1983 and there are more courses for the B.Sc. Pharmacology Degree. In 1971 there were 12

Universities offering this new degree, but now there are at least 17 degree courses in pharmacology and some Joint Honours courses with a substantial pharmacology component. The main aims of the present Report were to bring up to date the facts on the production of pharmacologists and their distribution throughout the various sectors of occupation after graduation.

The Report covers Great Britain and Northern Ireland and questionnaires were sent to all known

academic departments of pharmacology, joint departments (physiology and pharmacology) and departments possibly or probably teaching pharmacology (Polytechnics teaching for applied biology qualifications). In the industrial sector, we set out to obtain information from as many pharmaceutical firms as we could, irrespective of their size or research base. In attempting to examine 'non-vocational' employment, we particularly asked the sales, library and clinical liaison departments about their employment of pharmacologists. We also tried to reach the toxicology sections of pharmaceutical firms as well as the purely toxicological laboratories. The research units were, as before, a highly heterogeneous group.

In addition to academic and industrial departments, most of those students who graduated in the Summer of 1983 received a questionnaire kindly sent out by their home departments.

The information provided for this Report refers to the situation on September 30, 1983 unless otherwise stated and where possible we have compared our present results with those from the earlier Reports but in some important instances, the comparisons are not strictly valid and we make this clear as appropriate.

Responses to Survey

Forms were sent to 77 academic departments likely to teach pharmacology in Universities and Polytechnics; 69 replies were received. The non-responders were

three Polytechnics and five University departments. The industrial sector gave a slightly lower response rate, 70 out of 82. For the research units there were four non-responders out of 30 units circulated. The overall response was 87%. Of the students circulated, replies were received from 157 out of 254 (64%) graduating with a Single or Joint Honours degree in pharmacology and from 124 out of 238 (52%) pharmacy students specializing in pharmacology.

Number and distribution of pharmacologists

In Table 1, the numbers in the three sectors shown are compared with those in the 1969 and 1971 Reports. The academic pharmacologists comprise those in medical schools, University departments and Polytechnics. In joint departments (physiology and pharmacology or biology), only those actually involved in teaching pharmacology have been counted. In the industrial categories, there are separate entries for research and development (R&D) departments and for departments of toxicology, sales, etc. In the last two sub-groups, only those classified as pharmacologists through experience, training or function have been included. The same selection has been carried out for the Research Unit category. The total number of pharmacologists has increased since the last report by about 1000, to nearly double the total in 1971, more growth having occurred in the industrial, than in the academic sector. Academic pharmacologists comprised 69% of the total pharmacologists in 1971 but only

Table 1 Total numbers in pharmacology departments

	1964			1971			1983		
	Total staff	No. of Depts (n)	Average staff per Dept	Total	n	Average staff per Dept	Total	n	Average staff per Dept
<i>Academic</i>									
Established staff*	216		5.1	348		6.8	447		6.6
Research staff*	252	42	6.0	412	51	8.1	290	68	10.4
Research students*							414		
Total	468		11.4	760		14.9	1151		16.9
<i>Industrial</i>									
R&D*	223	28	8.0	276	27	10.2	832	35	23.7
Sales etc.†	—	—	—	—	—	—	141	35	4.0
Toxicology†‡	—	—	—	28	38	0.7	41	24	1.7
Total	223			304			1014		
<i>Research units</i> ‡	34	10	3.4	40	34	1.2	138	25	5.5
Grand totals	<u>725</u>			<u>1104</u>			<u>2220</u>		

*Numbers refer to total staff or students in the departments.

†Only those staff with pharmacological training (B.Sc. Pharmacology or Pharmacy) are included.

‡Research units and Toxicology departments are further analysed in Tables 13 and 14.

about half (56%) in 1983. This contrasts with the greater growth in the number of academic departments (+ 17 since the last report) relative to the industrial R&D departments (+ 8). Over the period since the first report nearly 20 years ago, the number of academic pharmacologists has increased almost 2.5 fold while the industrial pharmacologists have increased 3.5 fold and the contribution of the Research Units about 4 fold. However, the majority of the increases in these latter two sectors occurred after 1971.

Within the academic sector there has been, since 1971, an increase of about 100 established staff which, with the increased number of departments, gives an average of 6.6 staff per department, essentially unchanged since the last report. This increase includes a considerable contribution from clinical pharmacology departments, many of which did not exist in 1971. We were able to trace 12 such departments with 13 professors and a total staff of 52. This, of course, is not an accurate assessment of the number of clinical pharmacologists for, whilst their departments can be easily identified by title, not all their members are clinical pharmacologists and more importantly, these departments are not the sole source of clinical pharmacologists, even in the academic sector. Our analysis shows that only 38 of the 52 members of these departments were engaged in clinical pharmacology, whereas 43 persons in other departments claimed such activity. A survey by McDevitt in 1984 (personal communication) in fact traced 183 clinical pharmacologists in Great Britain (United Kingdom) who had been trained in that discipline over the previous ten years although 72 of them considered that they were not now working in clinical pharmacology.

From Table 1, it can be seen that there has been a striking increase (70%) in the numbers of non-established research staff and students in academic departments since 1971, compared with only a 28% increase in established staff. The ratio of research:established staff has thus increased from 1.18 to 1.57 in 1983.

In the industrial sector, there are more R&D departments involved in pharmacology and there is a remarkable increase in staffing of the departments, by 3 fold, since 1971. The numbers of pharmacologists in sales, library and clinical liaison posts was not large. At least 13 of the responding departments were without anyone with specialist pharmacology training in their sales staff. This may not imply an inherent unsuitability of pharmacologists for this or similar non-vocational jobs as one large multi-national firm said that no pharmacologists had applied for positions in the medical information and clinical liaison departments.

The number of toxicology departments has fallen since 1971 but the utilization of pharmacologists has increased. This loss of departments perhaps reflects the greater use of contract laboratories to perform toxicology rather than of 'in house' toxicological units. The number of pharmacologists in Research Units has increased more than 4 fold since 1971 but they still comprise only 6% of all pharmacologists. The decreased number of units (25 vs 34) but higher average number of pharmacologists per unit may be affected by the fact that those units who employ more pharmacologists are anyway more likely to reply. For instance, clinical pharmacology units outside universities would be included here and they would be most likely to make a return.

Composition of Pharmacology departments

The established staff in academic and industrial R&D departments were further analysed in terms of their qualifications at first degree level (Table 2). As it is possible to hold two Bachelor's degrees, the totals in this Table may exceed the total numbers in Table 1. In the present survey, qualifications were split into 4 groups, in contrast to the 3 groups in 1971; because there were very few graduates in pharmacology in 1971, such graduates were included in the 'Other Sciences' group. Therefore, a direct comparison of the

Table 2 Number of established staff in academic and industrial departments according to qualifications

		<i>Medicine</i>		<i>Pharmacy</i>		<i>Pharmacology</i>		<i>Other Sciences*</i>	
		1971	1983	1971	1983	1971	1983	1971	1983
Academic	No. of staff	77	125	115	110	—	114	135	134
Depts.	% *	24%	26%	35%	23%	—	24%	41%	28%
Industrial	R&D only	9	70	64	64	—	255	203	443
Depts.		3%	8%	23%	5%	—	29%	74%	58%
Totals		86	195	179	174	—	369	338	577
		14%	15%	30%	13%	—	28%	56%	44%

*Please note that in 1971, 'Other Sciences' would have included an unknown but probably small number of graduates in pharmacology. In 1983, these graduates have been classified separately.

*Percentage of all established staff in each department category in either 1971 or 1983; for totals, see appropriate entry in Table 1.

first two groups, medicine and pharmacy, is possible, but 'Other Sciences' in 1971 should be strictly compared to 'Other Sciences' plus Pharmacology in 1983.

In academic departments in 1983, the established staff were fairly evenly divided into the four categories used. Compared with the situation in 1971, this meant a decrease in the proportion of pharmacy graduates but a maintained share of medical graduates. It is however interesting that the 'Other Sciences' graduates still comprise about a quarter of the established staff. Analysis of the clinical pharmacology subgroup of 52 academic pharmacologists showed the expected preponderance of medical graduates (83%) but no pharmacy graduates and whilst about 20% had specialist pharmacology training, most of these (8 out of 9.5) had taken an intercalated B.Sc. in Pharmacology. More marked changes have occurred in the industrial R&D departments, with an increase in medical graduates and a more dramatic decrease in pharmacy graduates. Now, pharmacology graduates account for about a quarter of the staff with Other Science graduates providing more than half of the industrial pharmacologists.

The proportion of established staff with Ph.D. degrees in academic departments has increased to 84% compared with 71% in 1971 (Table 3A). Of these, three-quarters were classified as having a Ph.D. in pharmacology and included 41 in clinical pharmacology. In industry, those with a Ph.D. comprised a slightly higher proportion (42%) but only half of these doctorates were in pharmacology.

The age structure of established staff (Table 3B) shows a marked divergence between academic and industrial departments. In academic departments there are very few staff under 30 years, with the majority aged between 30 and 50 years. For industry, there are many more 'young' (< 30 years) and very few 'old' (> 50 years) pharmacologists. This structure would be compatible with the relatively sharp growth in the industrial sector. Most of the 400+ increase over the last 10 years could well have been new

Table 3A Numbers of staff with Ph.D. or equivalent higher degrees in pharmacology departments

	<i>Total no. Ph.D.s</i>		<i>Pharmacology Ph.D.s</i>
	1971	1983	1983
Academic	232	377	283
Industrial (R&D)	106	347	176

Table 3B Age range of established pharmacologists

	<i>Numbers in each age band (and as percentage of total)</i>		
	< 30 years	30–50 years	> 50 years
Academic	38 (8%)	312 (70%)	97 (22%)
Industrial (R&D)	364 (44%)	416 (50%)	51 (6%)

graduates below 30 years of age. This would still allow industry to hire personnel with recent Ph.D.s, as they prefer to do (83% of those responding), rather than hiring new graduates and training them 'in house' to the same standard. The comparative lack of 'young' pharmacologists in academic departments probably reflects the longer time required to reach the standard for a lectureship and to the lack of expansion in Universities generally over the past 5 years.

Research funding for pharmacologists

Support for research has been analysed in Table 4 in terms of the source of funds for different groups of research workers. The graduate research staff includes postdoctoral fellows, research assistants and visiting research workers. Although, by definition, Ph.D. students are graduates, they have been grouped separately as research students. The total numbers of both research staff and research students have greatly

Table 4 Source of funds for research staff and students

	<i>Internal</i>		<i>Res. Councils</i>		<i>Numbers of people supported by:</i>						<i>Total</i>	
	1971	1983	1971	1983	<i>Industry</i>		<i>Res. Fdns.</i>		<i>Other Sources*</i>		1971	1983
Research staff	16	22	42	99	10	50	—	85	37	34	105	290
% of total	15	8	41	34	9	17	—	29	36	12		
Research students	52	43	113	161	23	50	—	42	66	118	254	414
% of total	20	10	44	39	9	12	—	10	26	29		
Total	68	65	155	260	33	100	—	127	103	152	359	704
% of total in year	19	9	43	37	9	14	—	18	29	22		

*In the earlier report, the 'Other Sources' category included Research Foundations e.g. Wellcome Trust, British Heart Foundation (as Res. Fdns. in Table). In 1983, the Research foundations have been classified separately.

Table 5 Total staff appointed or lost

	1970 and 1971			1982 and 1983		
	Appointed	Lost	Net change	Appointed	Lost	Net change
Academic Departments Teaching	107	39	+ 68	45.5	52.5	- 7
Research				120.0	62.5	+ 57.5
Industrial (R&D only)	124	90	+ 34	200.5	104	+ 96.5

Of total (teaching plus research) staff lost from academic departments, 12 went to Consultant or Clinical Senior Lecturer posts in U.K., and 3 went to similar posts abroad.

increased since the last report and the pattern of funding shows some changes. Internal funds support a smaller proportion than they did in 1971 and industry have increased their support of research workers outside the CASE scheme, which has been included in the Research Council category. The Research Foundations and other sources in 1971 supported almost 30% of the research workers and in 1983 they had increased their share to 40%. The Research Councils still provide the largest single source of support for research scientists either as students or as graduate research workers. They also supported in 1983, about the same proportion of students (39% of all research students) and staff (34%). The Research Foundations and industry supported relatively more staff (34% and 17% respectively) than students (10% and 12%). Within the numbers supported by 'Other Sources' in 1983, there were sizeable numbers of research staff (24) and students (75) supported by funds from outside the U.K.

Employment in Pharmacology

The totals of staff appointed or lost are shown in

Table 5 with those from the previous report for comparison. The term 'lost' refers to losses from a particular department and as later analysis shows, these losses are mostly transfers within the general pool of pharmacologists. 'Turnover' is the sum of all movements, i.e. appointments plus losses in the two years to September 1983.

In the academic sector, with a turnover of 280.5, there was an excess of appointments (50.5) but this was entirely due to the strong growth in research posts, with teaching posts showing a net decline. Another indication of this decline is the total of 46.5 positions reported as frozen or lost in the academic sector overall.

In the industrial sector, with slightly higher turnover (304.5), the picture is one of strong growth, almost 100 new jobs being filled during the two years.

(a) *Appointments* The numbers of those appointed to academic departments, as teaching or research staff, and to industrial R&D departments in the two years 1981-1983 were further analysed in terms of their previous training and previous employment. In terms of their training (Table 6) only half of the teachers

Table 6 Recruitment to pharmacology departments, previous training (experience) of new staff

	Academic (Teaching posts only)		Industrial (R&D)	
	1970-71	1982-83	1970-71	1982-83
Pharmacology Basic	53	13	59	71.5
Clinical		10.5		3
Pharmacy	3	2	6	1
Medicine	9	6	1	16.5
Veterinary Medicine	—	1	—	2
Physiology	11	5	3	14
Biochemistry	11	2	16	42.5
Immunology	—	0	—	13
Molec. Biol.	—	0	—	7
Biol./Zool.	1	—	14	—
Toxicology	—	2	—	0
Others	1	4	20	30
Total	89	45.5	119	200.5

Table 7 Recruitment to pharmacology department: previous employment of new staff

	<i>Academic</i> (Teaching posts only)		<i>Industrial</i> (R&D)	
	1970-71	1982-83	1970-71	1982-83
Undergrad. courses	} 24	0	} 38	66
Postgrad. courses		7		41
Universities, Medical	} 52	19	} 29	27
Schools		8		10
Hospital departments	10	0	26	33
Industrial depts	2	5	2	9
Govt. research	3	2	4	5
Abroad	—	5	—	—
Own staff or students	16	2	25	—
Others	107	48	124	191
Total				

appointed to non-clinical posts were pharmacologists, where those appointed to clinical pharmacology posts mostly (80%) considered themselves to be clinical pharmacologists already. No medical graduates took positions to teach basic pharmacology but physiology and biochemistry graduates were almost as acceptable as pharmacologists. The sources of those appointed to academic teaching posts are shown in Table 7. In 1982-1983, about 70% came from 'academic' sources to fill the academic teaching posts, the same proportion as in 1970-1971. The number of clinical pharmacologists appointed (12.5) came almost equally from University posts or from medical practice (either in hospitals or in general practice). Note however that no appointments to academic posts from industry were made in 1982 and 1983 compared with a sizeable proportion (10%) reported in the earlier survey.

In industry, pharmacology graduates were the largest single group appointed but medical, physiology

and biochemistry graduates together accounted for 36% of the total. In the previous report (in 1970-71), only 1 medical graduate was appointed in R&D departments compared with the 16.5 (including 3 clinical pharmacologists) appointed in 1982-1983. The main source (53%) of appointments to industry was graduates fresh from the University (either first degree or postgraduate courses), a larger proportion than previously reported (30%) in the second survey. The proportion from salaried posts in Universities and hospitals (18%) was less than that previously recorded (23%) and recruitment from other industrial departments was also lower than before (16% compared with 21%). The greater utilization of new graduates is compatible with the younger age profile of industrial R&D departments presented in Table 3B.

Overall, many fewer academic pharmacologists were appointed to teaching (established) posts in 1982-1983 than in 1970-1971, but in the industrial

Table 8 Recruitment of research staff by academic departments, 1981-1983

<i>Previous training</i>	<i>Present post</i>		<i>Previous training</i>	<i>Present post</i>	
	<i>Basic</i>	<i>Clinical</i>		<i>Basic</i>	<i>Clinical</i>
Pharmacology Basic	65	1	Undergrad.	27	2
Clinical	0	15	Postgrad. courses	41	4
Pharmacy	5	1	Univ./salaried posts	4	4
Medicine	5	2	Hospital depts	4	8
Physiology	4	1	Industrial depts	0	0
Immunology	2.5	0	Govt. research	3	0
Molec. Biol.	0.5	0	Abroad	8	1
Biol./Zool.	—	—	Own staff or students	17	0
Toxicology	1	0	Others	0	0
Others	6	1			
Total	89	21	Total	104	19

Table 9 Losses in graduate staff

<i>Moved to:</i>	<i>Academic</i> (Teaching, research staff)			<i>Industry</i> (R&D)
	<i>From:</i>	<i>Basic</i>	<i>Clinical</i>	<i>Consultants</i>
Univ./Med. School		12	16	5
Hosp. Clin. Pharm.		2	2	4
Others		9	5	3
G.P.		0	5	
Polytechnics		0	0	
Industry		17	5	
Govt. Research		4	0	
Unemployed		4	0.5	
Normal retirement		4	0	
Early retirement		17.5	1	
Abroad		13	9	3
Others		5	1	
Total		87.5	40.5	15
				104

sector appointments almost doubled over the same period.

The research staff in academic departments have been analysed separately because no comparable data were collected in previous reports. Here (Table 8) pharmacologists and allied graduates (medicine, pharmacy) comprise 75% of the research staff in basic pharmacology, whereas in clinical pharmacology almost all the staff were from those disciplines. Clinical pharmacology also attracted 40% of its research workers from hospital posts outside the subject, an indication perhaps of the dissemination of the principles of clinical pharmacology throughout hospital departments.

(b) *Losses* The losses from academic departments have not been separated into teaching and research posts, but separate results for basic and clinical pharmacology have been obtained and an analysis of their subsequent fate, i.e. where they went to, is given in Table 9. For basic pharmacologists, the largest single fate was early retirement (21%), followed closely by transfer to the industrial sector. Redistribution within the University pool and emigration also comprised about 15% each of the losses. Few clinical

pharmacologists left for hospital posts in this speciality (5%) with more entering other specialities (14%). Redistribution within the University sector accounted for 40% of clinical pharmacologists.

In the industrial R&D departments, the losses were chiefly to other industrial departments (40%), with the University sector absorbing 14% of the losses. This result contrasts with those in Table 7, where there were no established members of academic staff coming from the industrial sector. Perhaps the losses from industry were to postgraduate student, but not to research worker, positions. Early retirement here was 5% of the total, a proportion equivalent to those retiring at normal age.

Training of pharmacologists

(a) *Course options* Pharmacology training now takes two forms, either Single or Joint Honours B.Sc. courses, which we have referred to as 'specialist' teaching, or the teaching of medical, pharmacy etc. graduates, which has been called 'ancillary' teaching.

The numbers of students receiving specialist teaching during the past 2 years are compared with those of 10 years ago in Table 10. There has been a marked

Table 10 Pharmacology as a special subject: Student numbers

<i>Course</i>	<i>Year</i>		
	1971-72	1981-82	1982-83
B.Sc. Pharmacology	67	240	227
B.Sc. Joint Honours	—	63	142
Others (e.g. M.I. Biol.)	36	77	74
Intercalated B.Sc.	74	68	84
B.Pharm.	293	206	204
Total	470	654	731

increase (over 3 fold) in the numbers of students taking the B.Sc. Pharmacology course as a Single Honours course since the last report. This is only to be expected from the expansion of the courses existing in 1971 together with the establishment of others since then, although two courses which were proposed in 1971 have not been implemented. Nevertheless, there are now 17 B.Sc. Pharmacology single subject courses offered in the academic sector, compared with 12 offered in 1971/1972. More recent and more rapid growth is seen in the Joint Honours courses where pharmacology is taken with another biological science (physiology, biochemistry or toxicology). These courses did not exist 10 years ago and the striking growth in numbers over the last 2 years suggests that, where these courses have been devised, they have proved popular with students.

These two results may explain the decrease in pharmacy students taking pharmacology as a special subject. Perhaps those interested in pharmacology now prefer to take it as a major subject than as a component of a 3-year pharmacy degree course. There is also a tendency in some Pharmacy schools to introduce other special options more closely related to the clinical aspects of pharmacy and to toxicology and which may provide other (and better) job prospects than competing with pharmacology graduates for jobs in research or teaching.

Specialist teaching also includes postgraduate courses in pharmacology. Here also (Table 11), the numbers have grown since 1971. In the last 2 years the total number of postgraduates remained steady at twice the 1971 value. The increase is shared equally by the Masters courses and Doctoral courses. This is also comparable with the increase in B.Sc. Pharmacology undergraduate numbers and might reflect the extent to which those receiving an undergraduate training in pharmacology continue in the subject, rather than taking up some non-scientific type of career.

(b) *Course duration* In the B.Sc. year, intercalated students concentrate even more on pharmacology

Table 11 Postgraduate degrees in pharmacology

	1971	1981-82	1982-83
M.A./M.Sc.	24	55	46
M.Phil.	5	13	11
Ph.D.	71	134	143
M.D.		12	9
Others		2	8
Total	100	216	217

(87% of their time on average) than the specialist B.Sc. students (70%) in their final year. Pharmacy students give only 46% of their time to the subject, even when it is their final year specialization. None of these appear to receive much instruction in toxicology.

The time devoted to the ancillary teaching of pharmacology to students taking professional examinations varies considerably (Table 12). Although pharmacy students still receive more instruction (216 h on average) than other students this is much less than in 1971 (390 h). Surprisingly, instruction in basic pre-clinical pharmacology (106 h) for medical students appears less than in 1971 (112 h) but at that time the report made no attempt to distinguish between the pre-clinical and clinical components. In 1983 these students received 44 h of instruction in clinical pharmacology in addition to their pre-clinical course. Dental students seem to have expanded instruction in pre-clinical (25 h) and clinical (25 h) pharmacology whilst in Veterinary Sciences the respective durations are 64 and 59 h. The total time for these two groups 50 and 128 h show some increase over 1971 (31 and 105 h). As in 1971, these average times do not reflect the considerable range in the duration of the various courses. Thus, pre-clinical courses for medical and dental students can apparently extend from 20-200 and 2-60 h whilst the clinical components range from 6-108 and 10-40 h. Much of this difference must depend on how the schools define pre-clinical and clinical pharmacology and whether they distinguish

Table 12 Duration of courses in pharmacology for students seeking professional qualifications (ancillary teaching)

	Pharmacy	Medicine	Dentistry	Veterinary Medicine
1983				
No. of hours, mean	216	106 (44)	25 (25)	67 (57)
Preclinical (Clinical)				
No. of courses	15	29 (23)	7 (9)	3 (3)
1971				
No. of hours	390	112	31	105
Preclinical and Clinical				

Table 13 Disposition of pharmacology students

	Graduates			Postgraduates		
	1971	1982	1983	1971	1982	1983
Higher degrees	40	90	71	7	13	12
Undergrad. courses	69	39	32	5	5	0
Other postgrad. courses	—	18	22	—	0	4
Univ./school teaching	3	7	3	14	16	11
Industry	47	57	37	18	31	32
Research posts in Univ/Hospital*	19*	19	19	21*	50	63
Admin. or business*	—	23	15	—	3	4
Unemployed	4	26	24	1	0	6
Others	—	42	40	—	5	4
Total	187	321	263	68	147	163

*In 1971, these two categories were combined.

between them in teaching pharmacology and by establishing separate departments. It is interesting that, although there are 23 courses with instruction in clinical pharmacology, returns were received from only 12 departments of clinical pharmacology (and therapeutics).

Disposition of specialist trained pharmacologists

The attraction of a pharmacological job for new pharmacology graduates (first degree or after postgraduate training) can be assessed from Table 13. In this Table, those taking a B.Sc. Pharmacology as an intercalated degree in their medical course have been excluded as have pharmacy graduates who entered hospital or retail pharmacy despite specializing in pharmacology. About half of these went on to higher degree courses, or to vocational posts in industry, or as research workers, much as in 1971. Clearly the number of pharmacological jobs and their attractiveness for the pharmacology graduate has been maintained. However, in the last year (1983), the numbers entering Ph.D. courses, industry and the administration/business sectors have all fallen, whereas the total number of B.Sc. Pharmacology graduates increased (Table 10). Further comparison of these new graduates with the earlier report shows that in relative terms, fewer now enter industry (17% and 15% in 1982 and 1983), than in 1971 (25%) but that more (28% and 29% in 1982 and 1983) went on to Ph.D. courses (1971, 21%). Nevertheless, the absolute numbers entering Ph.D. courses in the last 2 years are less than those obtaining this higher degree (see Table 11) in the same time, and there was a decline in entrants over the 2 years. If these were the only entrants to Ph.D. courses, output in 1985–1986 would be down to 50% of that in 1982–1983. However, the additional entry from pharmacology M.Sc. students and

graduates from other scientific disciplines (physiology and biochemistry) may increase the final numbers of pharmacology Ph.D.s. One controlling factor must be the number of MRC and SERC studentships available and these have clearly decreased over the past few years.

The reduced proportion of first degree graduates entering industry in 1982 and 1983 may be balanced in part by an increased entry of postgraduates. Overall, the number of postgraduates available in the last two years was more than twice the number available in 1971 and their entry into industrial jobs has almost been maintained; these represented in 1982, 170% and in 1983, 177% of the 1971 value. The possession of a Ph.D. degree would not disadvantage applicants to most firms as only 6% of the respondents preferred to hire new first degree graduates and train them in house to the Ph.D. standard. The proportion of postgraduates taking up research posts in Universities, Polytechnics, hospitals and Research Council Units has remained reasonably constant (29 and 39% compared with 31% in 1971), whereas entry into teaching positions has clearly decreased in 1982 and 1983 (9% and 7%) as against 21% in 1971. This picture of expanding research but stable teaching in the academic sector agrees with the situation as represented in Table 1 and with the appointments (Tables 8 and 9).

Fortunately, from the numbers taking up 'other' jobs there seems, at present, a buffer for graduates and postgraduates which is keeping unemployment down. It must be made clear that the unemployed category in Table 13 was defined as those known to be without definite employment by their graduation date. Most departments do not keep formally in touch with their graduates and thus subsequent employment cannot be assessed from this Table. However, in our associated survey of the final year graduates of 1983

the unemployment rate was 6% out of 281 respondents, considerably less than the 13% and 17% reported for graduates in Table 13. It is also relevant to note that the graduate responses were mostly received between October and December 1984 and it is probable that the percentage of unemployed was higher amongst those not responding.

Toxicology Units in Industry The composition of the 19 Toxicology departments responding is outlined in Table 14A. Few graduates had any formal teaching in pharmacology (62) and, together with those having some experience in pharmacology, comprised only 23% of all graduate toxicologists. Over the past 2 years, only 11 out of 78 new appointments were medical, pharmacy or pharmacology graduates, so there is no obvious trend towards a greater proportion of these graduates being employed in this area.

Research Units The composition of the Research Units is shown in Table 14B. In this heterogeneous group varying from Clinical Pharmacology units in non-University hospitals to Toxicology units, pharmacologists comprise only 8% of graduate staff. However, the total of those with some pharmacology training i.e. the three categories in Table 14B, was nearly a third (33%) of all graduate staff. A slightly smaller proportion of staff had a Ph.D. degree (61%) than in the academic sector, and only 31 were in pharmacology with 11 in clinical pharmacology. These units also have a number of graduates studying for higher degrees in pharmacology (33) and in clinical pharmacology (8).

As employers, the Research Units appointed 20 pharmacologists in 1982 and 1983. However in the same time, 40 pharmacologists had been lost, 12 going abroad and 14 leaving pharmacology altogether. The numbers involved are small but the trend is similar to that observed in the academic teaching departments. There were also 10 vacancies suitable for pharmacologists and clinical pharmacologists and a further 32 posts were forecast over the next 3 years. Although this would lead to a doubling of the pharmacological complement in the Research Units, the absolute numbers are small. Thus, the disbanding of one of the larger Research Units could immediately

provide enough candidates to take up the available posts without any new graduates being involved. In such a small sector of pharmacology, the closure of any unit could have a marked effect on employment prospects for new graduates.

Conclusions on the supply of, and demand for, pharmacologists

One of the major questions for those concerned with the teaching of pharmacology must be the matching of supply with demand. There seems to be no sign of a significant decrease in the supply of pharmacologists. Student numbers are being maintained as far as possible and the excess of applications over places (8 fold in London University for 1984 entry) has not decreased. The popularity of Joint Honours courses continues but fewer pharmacy graduates are specializing in pharmacology and do not seem to compete with pharmacologists for jobs. If supply continues at the same level, how will it match future demand?

It is likely that job opportunities in the academic sector will decrease in the next few years, despite the New Blood lectureship infusion, as UGC funds, student numbers and research funds are reduced. One alternative source of funding for academic research, namely the pharmaceutical industry, may also be feeling the financial pinch of recent Governmental decisions. Overall, these factors may well lead to a substantial decrease in Ph.D. students in pharmacology, a continuation of the trend visible in Tables 11 and 13.

In industry, the demand for pharmacologists is predicted to stay much the same as it is with only a minority (8/39) predicting an increased demand. However, the non-research posts in industry in marketing, medical information, library staff and clinical trial liaison are relatively unpopulated by pharmacologists. Half of the respondents from these 'non-vocational' departments in industry classified in Table 1 as 'sales, etc.' had no staff with either pharmacology or pharmacy degrees or M.I.Biol. qualifications in pharmacology. In these the Medical Directors would be the only members of the sales, information and liaison staff with any formal training in phar-

Table 14 Pharmacologists in toxicology departments (A) and research units (B)

	Total graduate staff	Medical, Pharmacy, Pharmacol. qualification			Ph.D. any subject
A	460*	21	19	22	145
B	421	83	14	41	256†

*43 other graduates had 'substantial experience of pharmacology' (but no formal qualification).

†Including 11 Ph.D.s in Clinical Pharmacology and 31 Ph.D.s in Pharmacology.

macology. This area would appear to be one in which considerable expansion of employment for pharmacology graduates is possible. It cannot be a disadvantage for the public, if the medical profession were to hear about new medicines from people who know the principles of pharmacology.

The other industrial area only sparsely populated by pharmacologists is toxicology. Here the suitability of pharmacology graduates is less obvious and at least 5 out of 13 respondents said that the present courses in pharmacology were not a suitable background for a career in toxicology. Nevertheless, the principles governing the observation of dose-related effects in whole animals seem to be equally applicable to toxic effects and the introduction of toxicology either as a Joint Honours subject or as a special option of a pharmacology course should increase the suitability and numbers of pharmacology graduates in toxicology departments.

Survey of graduates

We hoped to find out why students wanted to study pharmacology as a special degree subject or as a special topic in a pharmacy course and their reactions to the course, both in respect of content and as a training. Replies were received from 157 (64%) students graduating with a Single or a Joint Honours degree in pharmacology and from 124 (52%) pharmacy students specializing in pharmacology.

Of the reasons given for applying for a degree course in pharmacology, 33% said 'they were generally interested in pharmacology' and 29% felt it provided a 'good combination of biomedical subjects'. Another 18% had originally considered applying for medicine or dentistry, whilst 22% entered pharmacology having failed to gain entry to a medical course. Their average G.C.E. 'A' level score was 9.8, i.e. BCC and over half of the students obtained a 2:1 (47%) or 1st (7.5%) class degree.

The overall response of the students to their course has changed little since the last survey (1971 figures in brackets). Whilst only 38% (36) were 'completely satisfied', 56% (61) were 'fairly satisfied' although the specialist pharmacology students were generally more content (i.e. 46% 'completely satisfied') than those studying pharmacy (30%). Only 29% felt that the course fitted them very well for their occupation but 54% considered it 'adequate'. Their views on course content have also changed little over the years (Table 15). The coverage of pharmacokinetics seems to have improved but toxicology, the clinical use of drugs, gastrointestinal and reproductive and endocrine pharmacology still appear to be under-emphasized and cardiovascular pharmacology is now surprisingly less well covered than previously. Amongst supporting courses, the coverage of biochemistry has improved to be 'adequate' for 76% compared with 56% previously but mathematics was still 'inadequate' for a significant number (42%), as were the newer

Table 15 General reactions of graduates to teaching of components of their pharmacology course

<i>Subject</i>	<i>% Satisfactory</i>	<i>% Underemphasized</i>	<i>% Overemphasized</i>
Pharmacokinetics	71 (58.5)	20 (36)	9 (5.5)
Autonomic and peripheral nervous system	78 (68)	7 (4)	15 (28)
C.N.S.	63 (61)	13 (24.5)	24 (14.5)
Cardiovascular system	60 (70.5)	33 (24.5)	9 (6)
Reproductive and endocrine pharmacology	45 (61)	50 (35)	5 (5)
Renal pharmacology	56 (66.5)	38 (33.5)	6
Gastrointestinal pharmacology	56 (49.5)	40 (50.5)	4
Clinical use of drugs	30 (16)	70 (84)	
Toxicology	36 (40.5)	61 (59)	4
<i>Coverage of</i>			
Physiology	83 (91.5)	13 (7.5)	3 (1)
Biochemistry	76 (56)	12 (36)	12 (8)
Maths and statistics	42 (52.5)	48 (42)	10 (5.5)
Chemistry	51	13	36
Immunology	56	38	6
Molecular Biology	51	40	9

Data are for pharmacology graduates and pharmacy graduates specializing in pharmacology. (Figures in parentheses are from Second Report, 1971.)

subjects of molecular biology (40%) and immunology (38%). Although more satisfied overall with their courses and training than pharmacy students specializing in pharmacology, a higher percentage of pharmacology students found certain areas under-emphasized e.g. toxicology (77% compared with 38% of pharmacists), gastrointestinal pharmacology (54% cf. 20%), molecular biology (47% cf. 33%) and immunology (47% cf. 30%). Only in reproductive pharmacology and endocrinology were they more happy (59% cf. 41%).

The slightly higher risk factor in respect of employment for pharmacology graduates seems to be in keeping with their more diverse job opportunities

and salary range. Thus, 91 of 124 pharmacy graduates would earn between £4000 and £5000 and 23 between £5000 and £6000 with only 5 expecting more, possibly because 116 went into retail or hospital pharmacy. In contrast, 42 out of 157 pharmacology graduates expected to earn more than £6000 but 67 were on grant/salaries below £4000. Of the 39 pharmacology graduates going into industry, 8 went into information services and clinical investigation and 16 into sales; the latter finding is the first indication that this avenue of employment is now being utilized.

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