NIFU Norwegian Institute for Studies in Research and Higher Education

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Chemistry departments at Norwegian Universities

Expenditure for Research and Development (R&D)

Scientific Personnel

Data from Norwegian R&D Statistics 1995

Commission from the Research Area for Science and Technology
at the Research Council of Norway

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Introduction

The following presents tables on R&D expenditure and scientific personnel at units in Norway's four universities and the Agricultural University of Norway. These units may be called university departments of *chemistry* in the sense that most of their R&D activities are related to chemistry. The included units are[1]:

University of Oslo:
Department of Biochemistry
School of Pharmacy - Section of Medicinal Pharmacy
School of Pharmacy - Section of Pharmacognocy
Department of Chemistry

University of Bergen:
Department of Biochemistry and Molecular Biology
Department of Chemistry

University of Trondheim (NTNU from 1.1.1996)[2]:
Department of Organic Chemistry, NTH
Department of Inorganic Chemistry, NTH
Department of Physical Chemistry, NTH
Department of Biotechnology, NTH
Department of Chemistry, AVH

University of Tromsø:
Institute of Medical Biology
Institute of Mathematical and Physical Science

Agricultural University of Norway:
Laboratory of Analytical Chemistry

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1 The selection of the units was undertaken in collaboration with the Research Area for Science and Technology at the Research Council of Norway. As can be seen in Table 6, work is done in areas and disciplines *other than* chemistry at these departments. Departments at the Norwegian University of Science and Technology tend to classify a large part of their work under technology. However, borders between chemistry and other related fields, above all the biosciences and technology, are not always clear-cut. The classification of activities must, therefore, be based on discretion. In *this* context we will, nevertheless, regard all 14 units as university departments of chemistry.

2 Abbreviations:
NTNU: Norwegian University of Science and Technology (from 1.1.96)
NTH: Norwegian Institute of Technology at the University of Trondheim (before 1.1.1996)
AVH: College of Arts and Science (before 1.1.1996)

R&D expenditure

R&D expenditure statistics for 1995 have not yet been completed. Table 1 includes preliminary figures[3] based on estimates for total R&D expenditure in the higher education sector (HES). We do not yet have amounts by disciplinary areas and subdisciplines.

Table 1 R&D expenditure in chemistry in relation to total R&D expenditure in 1993 and 1995[1)] (NOK million)

Category	1993	1995	Change in per cent
Total R&D expenditure in Norway	14.336	14.933	4,2
Hereof Higher Education Sector	3.894	4.100	5,3
Hereof Natural Science	1.134	..	..
Hereof Chemsitry	216	..	..

[1)] 1995 figures are preliminary

Source: NIFU

However, we do have survey data for externally funded R&D activities as well as for that part of the basic appropriations which is used for current costs and scientific equipment. We do not have expenditures for salaries. Tables 2-5 build upon available - but preliminary - figures on R&D expenditures at university departments of chemistry. The School of Pharmacy, Section of Medicinal Pharmacy, at the University of Oslo did not answer our queries, thus we are not able to include expenditure figures for this department in the tables[4].

Table 2 R&D percentage of current costs[1)] and scientific equipment costs by main source of funding at university departments in 1995 (NOK 1000)

Main source of funding	R&D share of current costs	R&D share of costs for scientific equipment	Total
Basic appropriation	8.846	4.060	12.906
External funds	23.187	2.717	25.904
Total	32.032	6.777	38.809

[1)] Excluding salary expenditure, but including coverage/overhead for stipend recipients

Source: NIFU

3 See "Weekly Statistics" no.44/96 from Statistics Norway.

4 This also applies to the Laboratory of Analytical Chemistry at the Agriculture University of Norway. As Tables 2-5 do not include these two units, total real sums will actually be somewhat higher than they appear.

About NOK 32 million of the current costs of departments (excluding salaries) went to R&D in 1995. The R&D component used for buying new equipment was close to NOK 7 million. Together this made up about NOK 39 million, of which NOK 13 million were financed through the institutions' basic appropriations chapters and NOK 26 million came from external funding.

Table 3 R&D expenditure for current costs[1)] and scientific equipment costs at university departments of chemistry by main source of funding in 1995 (NOK 1000)

Institution	Basic appropriation	External funds	Totalt
Univ. of Oslo	*4.344*	*6.196*	*10.540*
Department of Biochemistry	1.141	1.048	2.189
School of Pharmacy - Section of Medicinal Pharmacy	No information		
School of Pharmacy - Section of Pharmacognocy	270	179	449
Department of Chemistry	2.933	4.969	7.902
Univ. of Bergen	*3.870*	*2.806*	*6.676*
Department of Biochemistry and Molecular Biology	1.320	2.130	3.450
Department of Chemistry	2.550	676	3.226
Univ. of Trondheim (NTNU from 1.1.1996)	*2.910*	*14.946*	*17.856*
Department of Organic Chemistry/NTH	233	353	586
Department of Inorganic Chemistry/NTH	902	6.683	7.584
Department of Physical Chemistry/NTH	402	1.205	1.607
Department of Biotechnology/NTH	636	6.600	7.236
Department of Chemistry/AVH	737	106	842
Univ. of Tromsø	*1.781*	*1.957*	*3.738*
Institute of Medical Biology - biochemistry	560	1.311	1.871
Institute for Mathematical and Physical Science - chemistry	1.221	646	1.867
Agricultural University of Norway	*0*	*0*	*0*
Laboratory of Analytical Chemistry	..	..	..
Total	12.905	25.904	38.809

[1)] Excluding salaries, but including coverage/overhead for stipend recipients

Source: NIFU

Table 4 R&D share of the basic appropriations for current costs and scientific equipment costs at university departments of chemistry in 1995 (NOK 1000)

Institution	R&D share of current costs	R&D share of scientific equipment costs
Univ. of Oslo	*3.089*	*1.256*
Department of Biochemistry	700	441
School of Pharmacy - Section of Medicinal Pharmacy	No information	
School of Pharmacy - Section of Pharmacognocy	200	70
Department of Chemistry	2.188	745
Univ. of Bergen	*2.446*	*1.424*
Department of Biochemistry and Molecular Biology	896	424
Department of Chemistry	1.550	1.000
Univ. of Trondheim (NTNU from 1.1.1996)	*1.932*	*979*
Department of Organic Chemistry/NTH	202	32
Department of Inorganic Chemistry/NTH	752	150
Department of Physical Chemistry/NTH	293	109
Department of Biotechnology/NTH	361	275
Department of Chemistry/AVH	324	413
Univ. of Tromsø	*1.379*	*402*
Institute of Medical Biology - biochemistry	440	120
Institute for Mathematical and Physical Science - chemistry	939	282
Agricultural University of Norway	*0*	*0*
Laboratory of Analytical Chemistry	..	..
Total	8.846	4.060

Source: NIFU

Table 5 Externally funded R&D at university departments of chemistry by source of funding in 1995 (NOK 1000)

Institution	Source of funding				
	Business/ industry	Research Council of Norway	Other public funding	Other sources/ foreign	Total
Univ. of Oslo	*2.609*	*8.371*	*351*	*1.660*	*12.991*
Department of Biochemistry	24	638	0	1.225	1.887
School of Pharmacy - Section of Medicinal Pharmacy	No information				
School of Pharmacy - Section of Pharmacognocy	0	716	73	76	865
Department of Chemistry	2.585	7.016	278	359	10.238
Univ. of Bergen	*1.506*	*6.198*	*0*	*2.690*	*10.394*
Department of Biochemistry and Molecular Biology	1.196	4.213	0	2.479	7.888
Department of Chemistry	310	1.985	0	211	2.506
Univ. of Trondheim (NTNU from 1.1.1996)	*23.819*	*7.187*	*64*	*3.608*	*34.677*
Department of Organic Chemistry/NTH	1.159	597	0	466	2.222
Department of Inorganic Chemistry/NTH	10.518	2.250	0	1.933	14.701
Department of Physical Chemistry/NTH	1.142	1.044	0	308	2.493
Department of Biotechnology/NTH	11.000	2.800	0	800	14.600
Department of Chemistry/AVH	0	497	64	102	663
Univ. of Tromsø	*306*	*3.322*	*200*	*1.860*	*5.688*
Institute of Medical Biology - biochemistry	266	1.355	200	1.650	3.471
Institute for Mathematical and Physical Science - chemistry	40	1.967	0	210	2.217
Agricultural University of Norway	*0*	*0*	*0*	*0*	*0*
Laboratory of Analytical Chemistry	..	..	..	..	..
Total	28.240	25.078	615	9.818	63.750

Source: NIFU

The way in which departments distribute the current costs to R&D by discipline and type of activity many be seen in Tables 6 and 7. Only half of these departments classify the largest part of their R&D activities as within chemistry. All the departments, with the exception of those at the Norwegian Institute of Tecnology, say that their R&D activities mainly concern basic research. At the Norwegian Institute of Tecnology, the departments call about half of their R&D activity basic research.

Table 6 Estimated distribution of current costs for R&D by field of science at departments of chemistry in 1995. Percentage.

Institution	Field								
	Chemistry	Physics	Bioscience	Geoscience	Other natural sciences	Technology	Medicine	Agricultural sciences/fishery	Total
Univ. of Oslo									
Department of Biochemistry	80						20		100
School of Pharmacy - Section of Medicinal Pharmacy	No information								
School of Pharmacy - Section of Pharmacognocy			5		26	26	33	10	100
Department of Chemistry	86	4			7	1	2		100
Univ. of Bergen									
Department of Biochemistry and Molecular Biology			40				60		100
Department of Chemistry	95					5			100
Univ. of Trondheim (NTNU from 1.1.1996)									
Department of Organic Chemistry/NTH	100								100
Department of Inorganic Chemistry/NTH	30					70			100
Department of Physical Chemistry/NTH	35	20				45			100
Department of Biotechnology/NTH	20		20			60			100
Department of Chemistry/AVH	100								100
Univ. of Tromsø									
Institute of Medical Biology - biochemistry			50				50		100
Institute for Mathematical and Physical Science - chemistry	100								100
Agricultural University of Norway									
Laboratory of Analytical Chemistry	70		20	10					100

Source: NIFU

Table 7 Estimated distribution of current costs for R&D by type of activity at departments of chemistry in 1995. Percentage.

Institution	Type of activity			
	Basic research	Applied research	Develop-ment	Total
Univ. of Oslo				
Department of Biochemistry	85	10	5	100
School of Pharmacy - Section of Medicinal Pharmacy	No information			
School of Pharmacy - Section of Pharmacognocy	90	10		100
Department of Chemistry	82	17	1	100
Univ. of Bergen				
Department of Biochemistry and Molecular Biology	80	18	2	100
Department of Chemistry	80	20		100
Univ. of Trondheim (NTNU from 1.1.1996)				
Department of Organic Chemistry/NTH	50	50		100
Department of Inorganic Chemistry/NTH	50	50		100
Department of Physical Chemistry/NTH	20	25	55	100
Department of Biotechnology/NTH	50	40	10	100
Department of Chemistry/AVH	90		10	100
Univ. of Tromsø				
Institute of Medical Biology - biochemistry	90	10		100
Institute for Mathematical and Physical Science - chemistry	100			100
Agricultural University of Norway				
Laboratory of Analytical Chemistry	80	10	10	100

Source: NIFU

R&D personnel

Tables 8-12 present figures on scientific personnel at departments of chemistry. Please note that statistics for 1995 have not been completed. We do not, however, expect major changes.

Table 8 Scientific personnel in *chemistry* at universities and university-level colleges in relation to total scientific personnel in 1993 and 1995[1)]

Category	1993	1995	Change in per cent
Total scientific personnel	8.567	8.781	2,5
Hereof in Natural Science	2.109	2.196	4,1
Hereof in Chemistry	416	398	-4,3

[1)] 1995 figures are preliminary

Source: NIFU

Table 8 shows that about 400 persons had scientific positions in departments of chemistry. This is 18 per cent of the total scientific personnel in the natural sciences which included 2,200 persons in 1995. The total number of scientific personnel at

universities and university-level colleges was almost 8,800 persons regardless of field of science.

Table 9 Scientific personnel at university departments of chemistry by institution and professional rank in 1995

Institution	Professor	Senior lecturer	Lecturer	Total tenured personnel	Recruits	External	Total
Univ. of Oslo	*46*	*18*	*2*	*66*	*64*	*19*	*149*
Department of Biochemistry	10	0	0	10	5	1	16
School of Pharmacy - Section of Medicinal Pharmacy	2	1	0	3	3	0	6
School of Pharmacy - Section of Pharmacognocy	3	1	0	4	4	1	9
Department of Chemistry	31	16	2	49	52	17	118
Univ. of Bergen	*23*	*14*	*2*	*39*	*37*	*8*	*84*
Department of Biochemistry and Molecular Biology	9	7	1	17	19	4	40
Department of Chemistry	14	7	1	22	18	4	44
Univ. of Trondheim (NTNU from 1.1.1996)	*26*	*16*	*1*	*43*	*62*	*21*	*126*
Department of Organic Chemistry/NTH	3	3	0	6	6	0	12
Department of Inorganic Chemistry/NTH	4	5	0	9	19	9	37
Department of Physical Chemistry/NTH	4	1	1	6	8	1	15
Department of Biotechnology/NTH	6	0	0	6	21	9	36
Department of Chemistry/AVH	9	7	0	16	8	2	26
Univ. of Tromsø	*10*	*4*	*0*	*14*	*16*	*4*	*34*
Institute of Medical Biology - biochemistry	3	2	0	5	9	0	14
Institute for Mathematical and Physical Science - chemistry	7	2	0	9	7	4	20
Agricultural University of Norway	*1*	*1*	*0*	*2*	*2*	*1*	*5*
Laboratory of Analytical Chemistry	1	1	0	2	2	1	5
Total 1995	106	53	5	164	181	53	398
Total 1993	92	66	8	166	206	44	416

Source: NIFU

Table 9 shows that the Department of Chemistry at the University of Oslo, with 118 persons, is by far the largest unit in chemistry. The department had almost 1/3 of the total scientific personnel within chemistry in Norway. The University of Bergen is the next largest with about 40 persons in its two departments. Table 9 also shows the distribution of personnel by professional rank. In 1995, tenured personnel constituted 41 per cent of the positions, recruitment personnel 45 per cent and externally funded personnel (excluding recruits) 13 per cent.

In Table 10 personnel are distributed by subdisciplines. We would like to point to some difficulties with this kind of distribution. The Research Personnel Register at NIFU categorises people under the discipline which is "most characteristic" for the R&D activities at the unit where they work, i.e. en bloc according to this criterion.

Within chemistry, however, individual departments were requested to classify *each individual* under the discipline where s/he does the most R&D. Only a few of the departments undertook such a classification. It is also important to remember that some departments do less than half of their R&D work in chemistry. Three departments did not mention chemistry at all in regard to the type of R&D work they do, cf. Table 6. Thus, there is no consistent connection in the data between on the one hand the percentage distribution of R&D activities that the institutes were asked to undertake, and on the other the categorisation of scientific personnel by scientific fields. If we compare the distribution of subdisciplines in 1989 and 1995 - see Table 12 - an additional factor is that in 1989 personnel were classified by the Council Secretariat in the former Norwegian Research Council for Science and the Humanities, while the departments' own coding was used as a basis in 1995. This means that discretion should prevail when comparing distributions by subdisciplines.

Table 10 Scientific personnel at university departments of chemistry by subdiscipline and professional rank in 1995

Subdiscipline	Professor	Senior lecturer	Lecturer	Total tenured personnel	Recruits	External	Total
Analytical chemistry	6	4	0	10	6	1	17
Biochemistry	29	9	1	39	58	14	111
Physical/Theoretical chemistry	32	16	1	49	42	13	104
Nuclear chemistry	2	1	0	3	3	2	8
Organic chemistry	24	12	1	37	36	4	77
Inorganic chemistry	13	10	2	25	29	12	66
Chemistry unspecified	0	1	0	1	7	7	15
Total	106	53	5	164	181	53	398

Source: NIFU

As Table 12 shows, 28 women were in scientific positions at departments of chemistry in 1995. Seventeen per cent of these were in tenured positions. The corresponding figure for 1989 was 13 per cent. The percentage of women is thus higher in chemistry than in the natural sciences in total (11 per cent in 1995), but somewhat lower that for all the tenured positions regardless of field of learning (20 per cent).

From Table 13 we see that 165 persons or 41 per cent of all scientific personnel in chemistry had taken doctoral degrees. Of these, 27 per cent took their degrees abroad. Of the 135 Norwegian doctoral degrees, only 14 per cent were taken at an institution *different from* the one where the person took his/her graduate degree.

Table 11 Scientific personnel at university departments of chemistry by institution and subdiscipline in 1995

Institution	Analytical chemistry	Biochemistry	Physical/Theoretical chemistry	Nuclear chemistry	Organic chemistry	Inorganic chemistry	Chemistry unspecified	Total
Univ. of Oslo	*9*	*16*	*47*	*6*	*42*	*15*	*14*	*149*
Department of Biochemistry	0	16	0	0	0	0	0	16
School of Pharmacy - Section of Medicinal Pharmacy	0	0	0	0	6	0	0	6
School of Pharmacy - Section of Pharmacognocy	0	0	0	0	9	0	0	9
Department of Chemistry	9	0	47	6	27	15	14	118
Univ. of Bergen	*2*	*40*	*18*	*0*	*14*	*10*	*0*	*84*
Department of Biochemistry and Molecular Biology	0	40	0	0	0	0	0	40
Department of Chemistry	2	0	18	0	14	10	0	44
Univ. of Trondheim (NTNU from 1.1.1996)	*4*	*40*	*25*	*0*	*17*	*40*	*0*	*126*
Department of Organic Chemistry/NTH	0	0	0	0	12	0	0	12
Department of Inorganic Chemistry/NTH	0	0	0	0	0	37	0	37
Department of Physical Chemistry/NTH	0	0	15	0	0	0	0	15
Department of Biotechnology/NTH	0	36	0	0	0	0	0	36
Department of Chemistry/AVH	4	4	10	0	5	3	0	26
Univ. of Tromsø	*0*	*15*	*14*	*0*	*4*	*0*	*1*	*34*
Institute of Medical Biology - biochemistry	0	14	0	0	0	0	0	14
Institute for Mathematical and Physical Science - chemistry	0	1	14	0	4	0	1	20
Agricultural University of Norway	*2*	*0*	*0*	*2*	*0*	*1*	*0*	*5*
Laboratory of Analytical Chemistry	2	0	0	2	0	1	0	5
Total	17	111	104	8	77	66	15	398
Source: NIFU								

Table 12 Tenured scientific personnel at university departments of chemistry by subdiscipline and gender in 1989 and 1995

Subdiscipline	1989			1995		
	Women	Men	Both	Women	Men	Both
Analytical chemistry	1	5	6	3	7	10
Biochemistry	6	29	35	6	33	39
Physical/Theoretical chemistry	6	44	50	5	44	49
Nuclear chemistry				0	3	3
Organic chemistry	5	29	34	7	30	37
Inorganic chemistry	2	26	28	7	18	25
Chemistry unspecified				0	1	1
Total	20	133	153	28	136	164
Source: NIFU						

Table 13 Scientific personnel with doctorates at university departments of chemistry by subdiscipline and professional ranking in 1995

Subdiscipline	Professor	Senior lecturer	Lecturer	Total tenured personnel	Recruits	External	Total
Analytical chemistry	5	3	0	8	1	0	9
- Degree from Norwegian institution	5	3	0	8	1	0	9
- Hereof: doc. inst. diff. from educ. inst.	*1*	*0*	*0*	*1*	*1*	*0*	*2*
- Degree from abroad	0	0	0	0	0	0	0
Biochemistry	28	6	0	34	1	10	45
- Degree from Norwegian institution	21	5	0	26	1	9	36
- Hereof: doc. inst. diff. from educ. inst.	*4*	*0*	*0*	*4*	*0*	*1*	*5*
- Degree from abroad	7	1	0	8	0	1	9
Physical/Theoretical chemistry	25	12	0	37	1	10	48
- Degree from Norwegian institution	22	11	0	33	1	10	44
- Hereof: doc. inst. diff. from educ. inst.	*6*	*0*	*0*	*6*	*1*	*0*	*7*
- Degree from abroad	3	1	0	4	0	0	4
Nuclear chemistry	2	1	0	3	0	1	4
- Degree from Norwegian institution	2	1	0	3	0	0	3
- Hereof: doc. inst. diff. from educ. inst.	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Degree from abroad	0	0	0	0	0	1	1
Organic chemistry	19	11	0	30	0	3	33
- Degree from Norwegian institution	12	7	0	19	0	3	22
- Hereof: doc. inst. diff. from educ. inst.	*2*	*3*	*0*	*5*	*0*	*0*	*5*
- Degree from abroad	7	4	0	11	0	0	11
Inorganic chemistry	9	9	0	18	0	4	22
- Degree from Norwegian institution	8	9	0	17	0	3	20
- Hereof: doc. inst. diff. from educ. inst.	*0*	*0*	*0*	*0*	*0*	*1*	*1*
- Degree from abroad	1	0	0	1	0	1	2
Chemistry unspecified	0	0	0	0	0	4	4
- Degree from Norwegian institution	0	0	0	0	0	4	4
- Hereof: doc. inst. diff. from educ. inst.	*0*	*0*	*0*	*0*	*0*	*0*	*0*
- Degree from abroad	0	0	0	0	0	0	0
Chemistry total	88	42	0	130	3	32	165
- Degree from Norwegian institution	70	36	0	106	3	29	138
- Hereof: doc. inst. diff. from educ. inst.	*13*	*3*	*0*	*16*	*2*	*2*	*20*
- Degree from abroad	18	6	0	24	0	3	27
Percentage doctorates of total scientific person	83	79	0	79	2	60	41

Source: NIFU