Bundesministerium für
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Austrian Biomedical Research Outputs, 1991-2000

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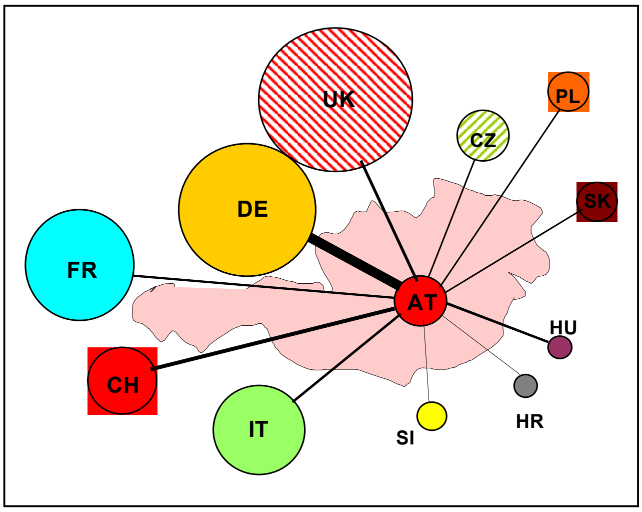

DAS ZUKUNFTSMINISTERIUM

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Austrian biomedical research outputs, 1991-2000

for the Ministry of Education, Science and Culture, Austria

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ZUSAMMENFASSUNG

In der vorliegenden Studie werden die österreichischen Publikationen in der biomedizinischen Forschung der Jahre 1991 bis 2000 analysiert. Diese annähernd 27.000 Publikationen stammen aus dem Science Citation Index[1] und dem Social Sciences Citation Index[2] und wurden in eine Datenbank transferiert. Es wurden alle Adressen kodiert, um die österreichischen Forschungseinrichtungen und die internationale Zusammenarbeit analysieren zu können. Zusätzlich wurden alle Publikationen auf ihre Förderungsanerkennungen (Funding Acknowledgements) hin überprüft.

Die Publikationen wurden nach 32 verschiedenen Forschungsbereichen und Disziplinen, nach dem Forschungsniveau zwischen klinischer und Grundlagenforschung und dem Impact-Faktor der jeweiligen Fachzeitschrift eingeteilt. Weiters wurden jene Zitierungen analysiert, die in den ersten fünf Jahren nach der Veröffentlichung erschienen sind. In den Jahren 1991 bis 1997 waren es Zitierungen in Summe von mehr als 16.000 Publikationen.

Sämtliche Publikationen dieser Datenbank wurden mit den Publikationen der Schweiz, Deutschlands, Israels, Schwedens und Großbritanniens verglichen.

Sämtliche genannte Faktoren der Publikationsdatenbank wurden individuell im Rahmen einer Regressionsanalyse analysiert.

Österreich stellt weniger Fördermittel für biomedizinische Forschung zur Verfügung, als die fünf Vergleichsländer (nur ca. 0.9% des BIP in Österreich). Somit hat Österreich in diesem Vergleich mit ca. 2.600 Publikationen pro Jahr auch den niedrigsten Publikationsoutput, nämlich 1% des weltweiten Outputs. Der österreichische Output an Publikationen in der biomedizinischen Forschung nimmt jedoch stetig zu.

Der Großteil der Publikationen dieser Datenbank ist englischsprachig. Der Anteil der deutschsprachigen Publikationen sank im letzten Jahrzehnt von 20% auf 8%. Im Steigen ist die Zahl der internationalen Co-Autorenschaften (42% im Jahr 2000), insbesondere jene mit EU-Mitgliedstaaten (siehe Kapitel 1).

[1] http://www.isinet.com/isi/products/citation/sci/

[2] http://www.isinet.com/isi/products/citation/ssci/index.html

Der Publikationsoutput Österreichs in der biomedizinischen Forschung variiert in den 32 verschiedenen Fachgebieten zwischen mehr als 400 Publikationen im Jahr in der Onkologie bis zu 14 Publikationen jährlich in der Humangenetik. Weltweit betrachtet gab es in Österreich viel mehr Publikationen in den klinischen Forschungsbereichen wie z. B. der Anästhesie oder der Chirurgie als in den Grundlagenfächern wie der Neurowissenschaften oder der Genetik. Der potentielle und tatsächliche Einfluss der Zitierungen (Citation Impact) der österreichischen Publikationen korreliert stark mit dem Forschungsbereich, und ist in den Grundlagenfächern tendenziell höher als in den klinischen Forschungsbereichen. Beide Indikatoren in den letzten Jahren stark angestiegen, vor allem in englischsprachigen Publikationen und in Publikationen mit mehreren Autoren und mit internationalern Kooperationen (siehe Kapitel 2).

Die biomedizinische Forschung Österreichs ist im Vergleich zu den oben genannten Ländern weitgehend klinisch orientiert. Daher erscheinen die österreichischen Publikationen im Vergleich in Fachzeitschriften mit niedrigeren Impact-Faktoren und werden auch weniger zitiert. Besondere Ausnahmen sind die Bereiche der Dermatologie und der Venerologie, in welchen Österreich im Vergleich zu den anderen fünf Ländern sowohl beim Indikator Impact-Faktor als auch bei den Zitierungen an erster Stelle liegt.
Hervorzuheben sind weiters die Forschungsbereiche Genetik, Infektiologie, Biochemie/ Molekularbiologie (alles Grundlagenfächer!), bei welchen die österreichischen Publikationen im Vergleich an zweiter oder dritter Stelle liegen (siehe Kapitel 3).

Die drei medizinischen Fakultäten in Wien, Graz und Innsbruck machen fast zwei Drittel der Publikationen in der biomedizinischen Forschung Österreichs aus. Auf die vier naturwissenschaftlichen Fakultäten (Wien, Graz, Innsbruck und Salzburg) und die Krankenhäuser fällt je ein Siebtel der analysierten Publikationen. All diese Institutionen haben ihren Publikationsoutput im letzten Jahrzehnt deutlich erhöht (bis auf manche Krankenhäuser).
Der Anteil der Firmen an den Publikationen stagniert allerdings bei 7%, insbesondere der Output von großen Pharmafirmen. Genau jene Publikationen weisen jedoch den höchsten Impact auf, im Vergleich zu den Krankenhäusern und den „sonstigen“ Einrichtungen mit dem niedrigsten Impact (siehe Kapitel 4).

Funding Acknowledgements kommen in ca. 55% aller österreichischen biomedizinischen Publikationen vor. Hauptsächlich werden die Forschungsarbeiten aus öffentlichen Geldern (Bund und Länder) finanziert, hier ist im besonderen der Fonds zur Förderung der wissenschaftlichen Forschung (FWF) zu nennen. Die Anzahl der Funding Acknowledgements hat in den letzten Jahren zugenommen, vor allem die Nennung von internationalen Organisationen wie zum Beispiel die der Europäischen Union (in 5% der Publikationen im Jahr 2000). In den grundlagenorientierten Forschungsbereichen wie zum Beispiel der Genetik kommen die Nennungen häufiger vor (>80%) als in den klinischen Forschungsbereichen (<25% Acknowledgments in chirurgischen Publikationen).

Publikationen mit mehreren Funding Acknowledgements werden generell in Zeitschriften mit höheren Impact-Faktoren veröffentlicht und werden auch öfter zitiert: Dieser Effekt tritt bei bis zu oder mehr als 6 Nennungen ein (siehe Kapitel 5).

Der Effekt dieser verschiedenen Input-Faktoren wurde mit Hilfe einer multiplen Regressionsanalyse bestimmt. Eine solche Methode erlaubt die Analyse jeder einzelnen Variable der Datenbank, wie zum Beispiel die Autorenanzahl oder die Anzahl internationaler Kooperationen. In Fachzeitschriften mit hohen Impact-Faktoren wurden durchschnittlich mehr Autoren und mehr Funding Acknowledgements in einzelnen Publikationen angeführt, wie auch mehr Kooperationen mit den USA oder Mitgliedstaaten der EU. Die Angabe mehrerer Adressen zeigte den gegenteiligen Effekt.

Durch diese Regressionsanalyse wird auch die zuvor beobachtete Rangordnung der medizinischen und naturwissenschaftlichen Fakultäten relativiert, nicht jedoch die hohe Reputation der medizinischen Fakultät Innsbruck im Vergleich zu den beiden anderen (siehe Kapitel 6).

EXECUTIVE SUMMARY

1 This report presents the results of an analysis of Austrian biomedical research from 1991-2000, as revealed by papers published in the serial literature and recorded in the Science Citation Index and the Social Sciences Citation Index. A database of nearly 27 000 papers was created and they were looked up in libraries to determine their funding acknowledgements. Their addresses were coded to permit an analysis by research institution and of international collaboration. They were also classified as being in one (or more) of 32 subject areas, by their research level (from clinical to basic) and by the impact factors of their journals (from low to high). Citations in the five years following publication (years 0 to 4) were determined for over 16 000 papers published from 1991-97. Comparisons of Austrian outputs were made with those of Switzerland, Germany, Israel, Sweden and the UK. The effects of the different input factors on the papers' impacts were analysed individually by means of a regression analysis.

2 Austria provides less support for biomedical research (about 0.9% of GDP) than the five comparator countries and has the lowest output of papers, about 2600 per year during 1991-2000, or 1.0% of the world total, but this is increasing rapidly. Most papers are in English – the proportion in German has decreased from 20% to 8% - and an increasing number, 42% in 2000, are co-authored internationally, especially with other European Union Member States. (Chapter 1)

3 Austrian outputs in the 32 subject areas varied from over 400 per year in oncology down to 14 in human genetics. Relative to the world, Austria published many more papers in clinical sub-fields, such as anaesthesia and surgery, than in basic ones such as neuroscience and genetics. The potential and actual citation impact of Austrian papers in the different sub-fields were closely correlated, and tended to be much higher for basic subjects than for clinical ones. Both indicators have increased with time: they are much higher for English-language papers than ones in German, and for papers with more authors and with foreign collaboration. (Chapter 2).

4 In comparison with the five comparator countries, Austrian biomedical research in the different sub-fields is very clinical, and is ranked relatively modestly on both journal impact factors and citation scores. The exceptions are dermatology & venereology where it is placed first on both criteria; and genetics, infections and biochemistry & molecular biology (curiously, all rather basic subjects) in which it ranks second or third out of the six countries. (Chapter 3)

5 Within Austria, the three medical faculties (Vienna, Innsbruck and Graz) dominate output with almost two thirds of total papers. The four science faculties (Vienna, Graz, Innsbruck and Salzburg) account for about one seventh of the total, as do hospitals. All these institutions have increased their outputs noticeably, although some individual hospitals have declined, but company outputs, especially from major pharmaceutical companies, have stagnated at about 7% of the total. However the latter's work has the highest potential and actual impact; that of the hospitals and some "other" institutions, the lowest. (Chapter 4)

6 Funding acknowledgements occur on about 55% of Austrian biomedical papers. The Austrian government (including the nine Länder) was the leading source of funds; the Austrian Fund for Scientific Research received most individual acknowledgements. The numbers of funding acknowledgements per paper, and their presence, have increased with time, especially to international organisations such as the European Union, which in 2000 was acknowledged on 5% of Austrian biomedical papers. Basic sub-fields such as genetics are much more likely (> 80%) to record funding than clinical ones such as surgery (< 25%). Papers with more funding acknowledgements are published in higher impact journals and receive more citations: the effect persists up to six or more acknowledgements. (Chapter 5)

7 The effects of the individual input variables on the potential and actual impact of Austrian biomedical papers were determined by means of a multiple regression analysis. This allowed the influence of each variable, for example number of authors or foreign collaboration, to be seen in isolation from that of the others. More authors and more funding led to higher impact papers; conversely, more addresses had the reverse effect although co-

authorship with the USA or other EU Member States was beneficial. Funding from the EU also had a positive effect. However the apparently clear-cut ranking of the medical schools and science faculties previously observed almost disappeared when allowance was made for their choice of subjects and level of research. However there remained some evidence of the high standing of the Innsbruck medical school relative to those in Vienna and Graz. (Chapter 6).

1 AUSTRIA IN A WORLD CONTEXT

1.1 Introduction and overview of study

Austria has a long tradition of excellence in medicine, both in the provision of facilities – the Kinderkrankeninstitut was established in 1788 by Joseph Johann Mastalir and the Children's hospital in 1837 – and through famous names in medical research. Mention should be made of Leopold Auenbrugger (1722-1809) who developed means of percussing the chest to diagnose pulmonary disease, Johann Peter Frank (1745-1821) for his work in public health, and Ignaz Semmelweis (1818-65) for his work on the origins of puerperal fever in neonates and the need for basic hygiene in the treatment of patients. In the last century, Sigmund Freud (1856-1939) achieved renown for his work on the subconscious and psychoanalysis and, more controversially, the 1927 Nobel prizewinner Julius Wagner-Jauregg (1857-1940) for his discovery of the therapeutic value of malaria inoculation in the treatment of dementia paralytica. A common theme in Austrian biomedicine has been great strength in clinical diagnosis and treatment, but perhaps rather less excellence in basic biomedical research.

This study, although historical in the sense that it looks back in time to the 1990s, is concerned more with overall indicators of Austrian medical research capability and production than with the achievements of individual scientists and clinicians. Such studies, which treat the publication of research papers in refereed journals as statistical items for counting and classification, are now becoming relatively common outputs from the new science of bibliometrics, which seeks to evaluate research outputs and provide comparative indicators of their magnitude and their utility or quality. However it should be stressed at the outset that the objective of biomedical research is primarily to improve human (and, on some definitions, animal) health, through better patient care and less illness, and that the links between research papers and these ultimate goals are often long and tortuous, see Figure 1.1.

This study examines the production of biomedical articles, notes and reviews with at least one Austrian address that were covered in the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI; both © The Institute for Scientific Information) from 1991-2000. (Details of how they were selected and retrieved are given in Annex 1.1.)

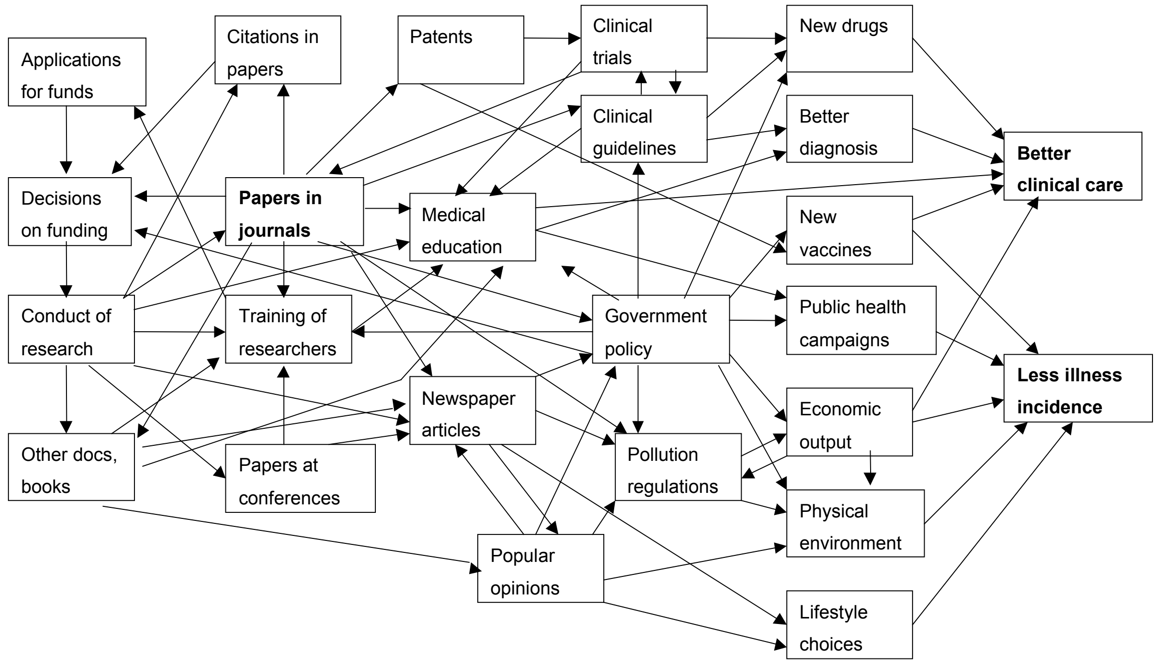

Figure 1.1 The links between biomedical research outputs and better health

The papers were classified in numerous ways in order to provide different cross-sections through the Austrian biomedical research activity. They were classified:

- by their date of publication;
- by sub-field or subject area;
- by the level or type of research (clinical or basic);
- by the type and identity of institution where the research was conducted; and
- by the source(s) of funding for the research.
-

Outputs were counted, and also categorized on the basis of the numbers of citations received in other papers and on the impact factor of the journal in which they were published, as given by its mean citation score over a similar period (five years).

To be meaningful, indicators of research output such as these must be set in a context. For the main indicators of numbers of papers, research level, potential impact category and citation counts, comparisons were made of Austrian papers with those from five other countries: Germany, Israel, Sweden, Switzerland and the United Kingdom. Such indicators are intended to show Austrian strengths and weaknesses so that adjustments to research funding policy can be made, if appropriate. This is the intended outcome of this report: although the numbers and indicators may be of interest to many people, it is intended above all to inform Austrian biomedical research policy so that this can be more reliably evidence-based.

1.2 Expenditures on biomedical research

In this section, the six countries used for the international part of the study are presented so that their main characteristics can be seen. Table 1.1 shows a number of salient statistical data for the countries, including data on their overall research and development expenditures and that proportion attributable to biomedicine.

Table 1.1 Main parameters of six countries used for this study

		AT	*CH*	*DE*	*IL*	*SE*	*UK*
Parameter	*units*	*Austria*	*Switzerland*	*Germany*	*Israel*	*Sweden*	*U K*
Population	*m (95)*	8.05	7.04	81.68	5.40	8.83	58.60
Growth rate	*% per yr*	0.4	0.7	0.3	3.4	0.4	0.3
GDP	*Euro bn (95)*	180	234	1850	68	184	860
GDP per caput	*Euro (95)*	22 400	33 200	22 600	12 600	20 800	14 700
Health spend	*Euro bn (95)*	15.3	22.5	188.7	5.6	14.9	59.3
	% of GDP	8.5	9.6	10.2	8.2	8.1	6.9
R&D spend	*Euro bn (95)*	2.8	6.3	41.8	1.9	6.3	17.0
	% of GDP	1.56	2.70	2.26	2.76	3.46	1.98
Scientific output	*SCI(91-00)/yr*	4552	10 145	45 882	6626	11 235	48 555
Biomedical output	*SCI(91-00)/yr*	2608	5378	19 908	3281	7149	26 700
Percent biomed.	*ratio*	57%	53%	43%	50%	64%	55%
Biomed R&D	*Euro bn (95)*	1.6	3.3	18.0	1.0	6.9	17.5
	% of GDP	0.89	1.43	0.98	1.37	2.20	1.09
	Euro per caput	200	470	220	180	780	300
Doctors in practice	*Number in 00*	25 900	25 200	295 100	22 400	28 400	117 300
Doctors trained/yr	*Mean, 91-00*	1170	800#	12 640$^{\Phi}$	600#	770	4950*
Medical schools	*Number in 95*	3	5	36	4	6	27

* 1995 # Estimate based on private information – the official Swiss figure is confidential. $^{\Phi}$ Average for 1993-96

There are some major differences between the countries in terms of wealth (a ratio of almost three between Switzerland and Israel in terms of GDP *per caput*). Biomedical research expenditure is not formally published in the OECD science indicators and so it has been estimated on the basis of total R&D expenditure and the fraction of each country's scientific output that is classified as biomedical – the ratio varies from 43% for Germany to 64% for Sweden. Austria emerges from this table as a relatively small spender on biomedical research, with the lowest percentage of GDP of the six, and an expenditure *per caput* similar to that of Israel and Germany, but barely one quarter that of Sweden.

1.3 Scientific and biomedical outputs

Counts of papers (articles, notes and reviews) in the Science Citation Index for the six countries are shown in Figure 1.2 as three-year moving averages over the period 1991-2000. [The numbers for Germany and the UK have been divided by 5 to make them more comparable with the other countries.] This and subsequent figures use integer counting, where a paper with addresses in several countries is counted as unity for each. The actual numbers, and the percentages that they represent of the world total for the two quinquennia, are given in Table 1.2.

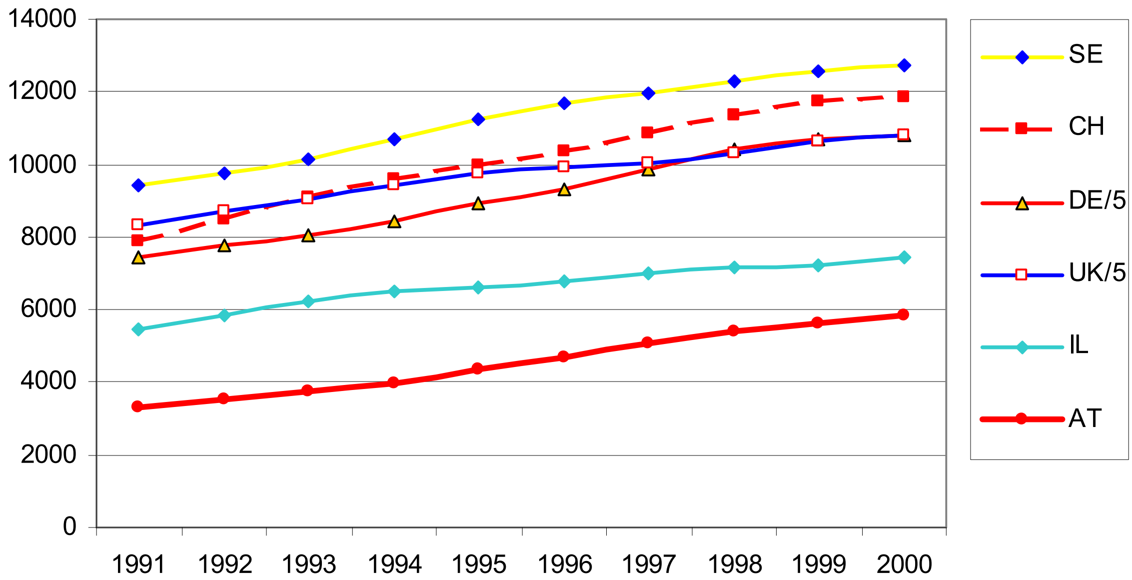

Figure 1.2 Outputs of SCI papers from six countries, 1991-2000 (three-year moving averages)

There has been a steady increase in outputs of papers from all six countries, and Austrian output has nearly doubled over the period although it is still the lowest of the six. This increase partly reflects the general increase in science over the decade but all six countries have also increased their percentage presence in the world of science: Austrian output now accounts for 1.0% of the world total compared with 0.7% in 1990.

Table 1.2 Numbers of SCI papers in 1991-95 and 1996-2000 (annual averages), and corresponding percentages of world totals, for six countries.

Country	*Code*	*1991-95*	*1996-00*	*Ratio*	*1991-95*	*1996-00*	*Ratio*
World		515512	570756	1.11	*% / wld*	*% / wld*	
Austria	AT	3777	5327	1.41	0.7	0.9	1.27
Switzerland	CH	9029	11260	1.25	1.8	2.0	1.13
Germany	DE	40579	51185	1.26	7.9	9.0	1.14
Israel	IL	6131	7121	1.16	1.2	1.2	1.05
Sweden	SE	10225	12246	1.20	2.0	2.1	1.08
United Kingdom	UK	45212	51897	1.15	8.8	9.1	1.04

Within these totals, biomedical papers can be identified on the basis of words and contractions in their addresses (see Annex 1.1). The different countries show varying "commitments" to biomedicine: it is as high as 64% for Sweden and only 43% for Germany. Austrian output is at the high end of this scale at 57%.

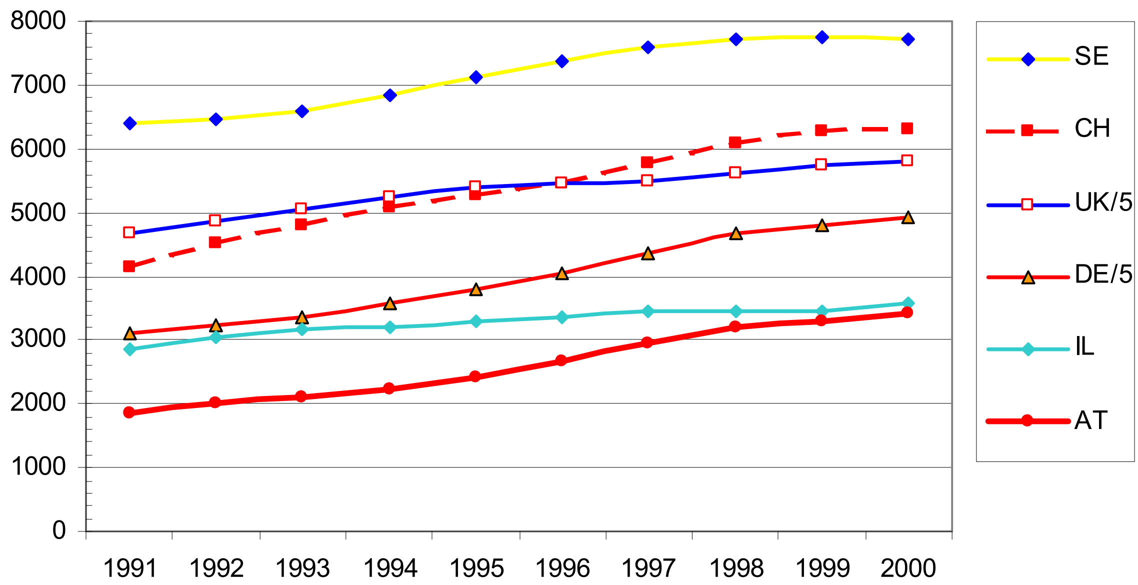

Figure 1.3 Outputs of biomedical papers from six countries in SCI, 1991-2000 (three-year moving averages)

This figure shows that Austrian biomedical output, while remaining the smallest of the six countries, has almost equalled that of Israel. Table 1.3 shows that, as in science, Austria shows the fastest increase in biomedical output of the six countries over the decade, with a growth in output of 7% per year compared with 2.4% for the world as a whole.

Table 1.3 Numbers of biomedical papers in SCI in 1991-95 and 1996-2000 (annual averages), and corresponding percentages of world totals, for six countries.

Country	*Code*	*91-95*	*96-00*	*Ratio*	*91-95*	*96-00*	*Ratio*	*% biom*
World		245657	276355	1.12	*% / wld*	*% / wld*		48.1
Austria	AT	2106	3111	1.48	0.9	1.1	1.31	57.3
Switzerland	CH	4773	5983	1.25	1.9	2.2	1.11	53.0
Germany	DE	16992	22825	1.34	6.9	8.3	1.19	43.4
Israel	IL	3116	3447	1.11	1.3	1.2	0.98	49.5
Sweden	SE	6668	7630	1.14	2.7	2.8	1.02	63.6
United Kingdom	UK	25229	28170	1.12	10.3	10.2	0.99	55.0

1.4 The Austrian biomedical database

This report is concerned with analysis of a specially-constructed database that includes papers in biomedicine both from the Science Citation Index and the Social Sciences Citation Index. The latter has a strong English-language bias, and since many papers in the social sciences are written primarily for a local or national readership, Austrian outputs are poorly represented in the SSCI and only 2.0% of the 26 757 papers in the composite database are covered in this source alone.

The SCI includes some papers in languages other than English and 3215 of the Austrian papers, or 12%, are in German. However the proportion of such papers has been steadily declining, from about 20% in 1991-2 down to 8% in 1999-2000. Nine journals (out of 107) account for over 60% of these papers, as shown in Table 1.4.

Table 1.4 Leading German-language journals used for Austrian biomedical research, 1991-2000

Journal	*N*	*Journal*	*N*	*Journal*	*N*
Wiener Klin Wochenschr	*810*	*Geburtshilfe und Frauenh*	*207*	*Hautarzt*	*99*
Acta Medica Austriaca	*245*	*Fortschr Gebiete Ron*	*117*	*Ultraschall in der Mediz*	*96*
Radiologe	*210*	*Chirurg*	*108*	*Deutsch Med Wochenschr*	*93*

By contrast the number of English-language journals is far higher and the dispersion of papers between them is greater. The leading journals are listed in Table 1.5.

Table 1.5 Leading English-language journals used for Austrian biomedical research, 1991-2000

Journal	*N*	*Journal*	*N*	*Journal*	*N*
Jl Biological Chemistry	313	*Journal of Immunology*	132	*Journal of Virology*	97
Wiener Klin Wochenschr	252	*Pr Nat Acad Scis USA*	125	*Ann NY Acad Sciences*	95
FEBS Letters	206	*Neuroscience Letters*	120	*Annals of Hematology*	95
Acta Anaesthesi Scandin	178	*Jl Investigve Dermatology*	115	*British Jl Cancer*	95
Blood	165	*European Jl Biochemistry*	104	*Brit Jl Haematology*	92
Transplantation Proceed	157	*Biochemical Journal*	103	*Electrophoresis*	92
Intl Arch Aller & Imm	155	*Journal of Urology*	100	*Naunyn Schmiedebergs*	92
Anticancer Research	146	*Bioch & Bioph Res Com*	99	*Nephrol Dialsisy Transp*	91
Anesthesia & Analgesia	132	*Lancet*	98	*Bone Marrow Transplant*	88

The nine leading English-language journals only account for 7% of the papers in English and the 27 leaders (listed here) for 15%. Altogether, Austrian papers in English were published in 1969 different journals (some journals, such as *Wiener Klinische Wochenschrift*, carried papers in both languages).

1.5 International co-operation

There has been a steady increase in the amount of international co-operation in science in recent years, fostered in part by international activities such as the European Union's (EU) Framework Programmes. For Austria, an analysis has been made of biomedical outputs with six countries or groups of countries, listed in Table 1.6. Data are shown as three-year moving averages for individual years during the decade (Figure 1.4) and, in Table 1.7, as numbers and percentages in each quinquennium. The groups are:

- Germany
- Other EU Member States (13)
- Other Western Europe (Switzerland = CH, Iceland = IS, Norway = NO)
- EU candidate countries (12)
- North America (Canada and the USA)

Papers co-authored internationally other than with any of the above are listed as "others".

Table 1.6 Lists of countries used for analysis of international co-authorship of Austrian papers

European Union member states				*EU candidate countries*			
Country	*Code*	*Country*	*Code*	*Country*	*Code*	*Country*	*Code*
Belgium	BE	Ireland	IE	Bulgaria	BG	Latvia	LV
Germany	DE	Italy	IT	Cyprus	CY	Malta	MT
Denmark	DK	Luxembourg	LU	Czech Rep.	CZ	Poland	PL
Spain	ES	Netherlands	NL	Estonia	EE	Romania	RO
Finland	FI	Portugal	PT	Hungary	HU	Slovenia	SI
France	FR	Sweden	SE	Lithuania	LT	Slovakia	SK
Greece	GR	United Kingd.	UK				

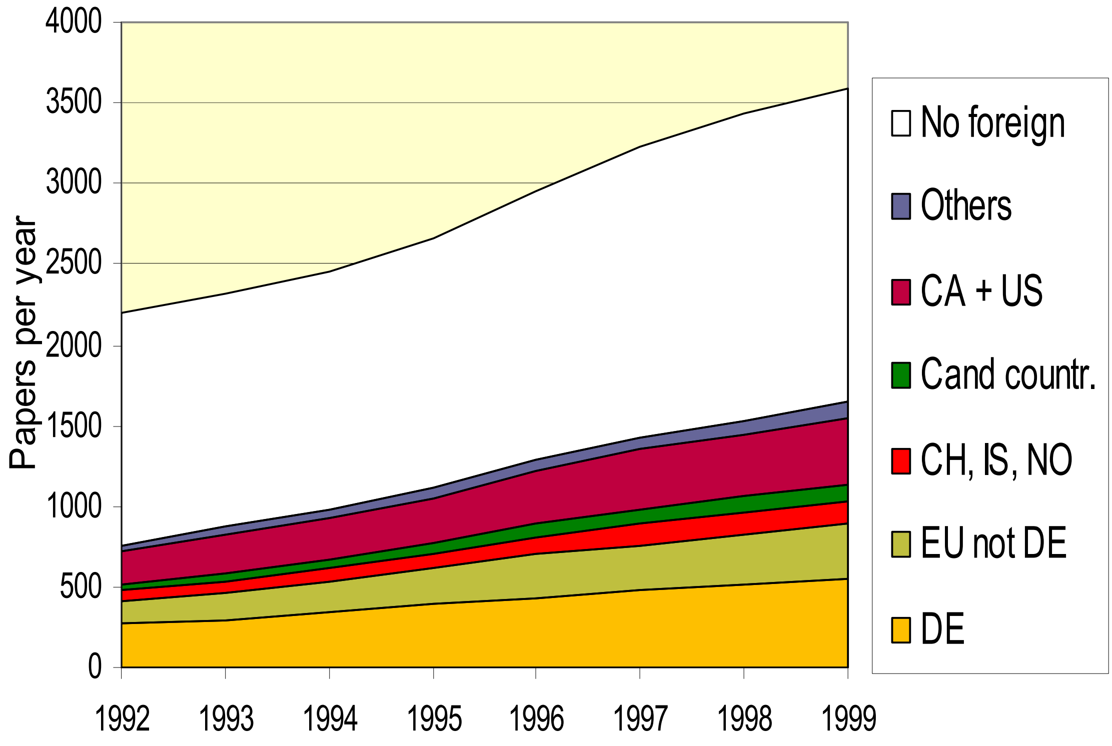

Figure 1.4 Austrian biomedical co-authorship with other countries, 1991-2000, three-year moving averages.

Table 1.7. International co-operation of Austrian biomedical researchers, 1991-95 and 1996-2000.

	91-95	*96-00*	*Ratio*	*91-95*	*96-00*	*Ratio*
All papers	11004	15753	1.43	*% of Austrian total*		
With Germany	1527	2529	1.66	13.9	16.1	1.16
With EU not Germany	820	1617	1.97	7.5	10.3	1.38
Other western Europe	367	626	1.71	3.3	4.0	1.19
Candidate countries	271	508	1.87	2.5	3.2	1.31
Canada + USA	1104	1953	1.77	10.0	12.4	1.24
Other countries	235	406	1.73	2.1	2.6	1.21
All foreign papers	3744	6411	1.71	34.0	40.7	1.20

Austria has co-authored papers with over 100 other countries: the leading individual countries are listed in Table 1.8.

Table 1.8. Countries with which Austria has co-authored most biomedical papers, 1991-2000

Country	*Code*	N	*Country*	*Code*	N	*Country*	*Code*	N
Germany	DE	4056	Sweden	SE	440	Hungary	HU	226
United States	US	2812	Canada	CA	369	Czech Republ.	CZ	195
United Kingdom	UK	1171	Belgium	BE	348	Finland	FI	184
Switzerland	CH	905	Spain	ES	306	Slovakia	SK	157
Italy	IT	819	Japan	JP	293	Israel	IL	154
France	FR	805	Australia	AU	241	Poland	PL	154
Netherlands	NL	688	Denmark	DK	240	Norway	NO	118

As can be seen from this table, geographical proximity is a major factor in the stimulation of international scientific co-operation, although traditional linguistic and cultural ties also count. It is possible to show Austria's biomedical links to other European countries in diagrammatic form, where the strengths of the links (numbers of co-authored papers) are presented as a non-dimensional "Salton Index" equal to the quotient of this number divided by the square root of the product of the outputs of the two countries. Thus for Germany, the annual total of 406 papers divided by sqrt(2676 x 19908) = 0.0556, or 5.6%. This diagram is shown in Figure 1.5.

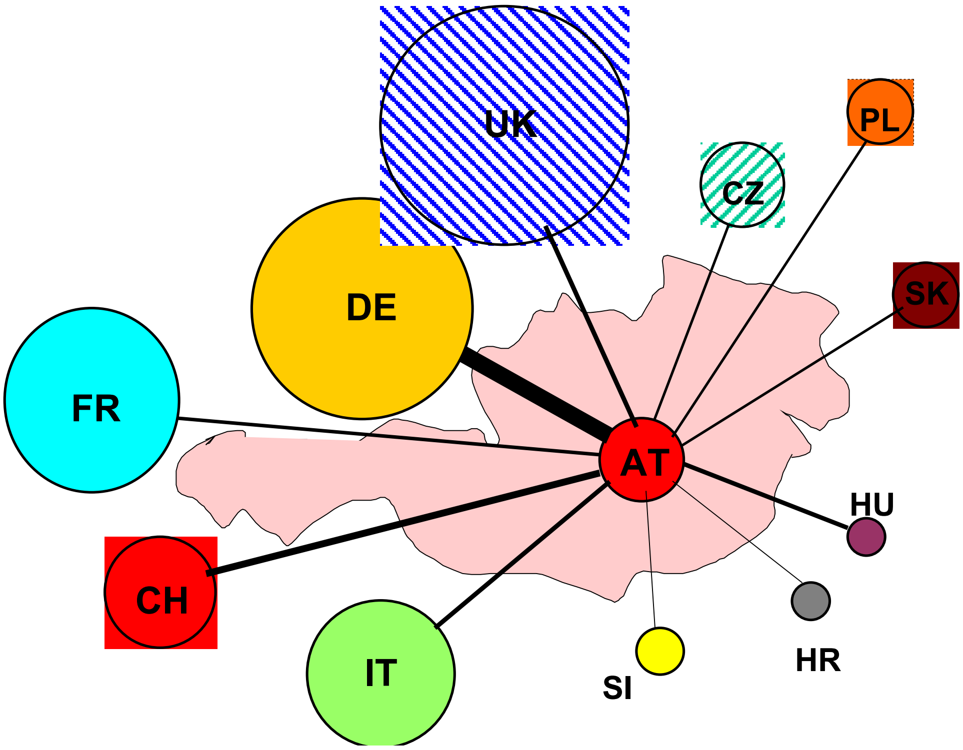

Figure 1.5 Diagram showing links from Austria to nearby countries in biomedical research publications. Circles have area proportional to annual output of biomedical papers in the SCI; links have thickness proportional to Salton Index of co-authorship with Austria.

1.6 Conclusions to chapter 1

The above analysis has shown the following:

- Austria is a modest supporter of biomedical research in comparison with some other advanced countries such as Switzerland, Germany, Israel, Sweden and the UK, devoting only about 0.9% of GDP to this purpose (compared to 2.2% for Sweden).
- Austrian scientific outputs currently account for about 1.0% of the world total, but are growing rapidly, as are those in biomedicine.
- Austrian biomedical production in the SCI/SSCI in year 2000 was approximately 3380 papers per year, of which 8% are in German, down from 20% in 1991.
- Currently, 42% of Austrian biomedical papers are co-authored internationally, up from 30% in 1991. Leading partners are Germany (15% of all Austrian papers), the USA (11%) and the UK (4%). Almost a quarter of Austria's papers are co-authored with other European Union Member States (including Germany); with the 12 candidate countries the percentage is 3% but both percentages are growing rapidly.

2 AUSTRIAN NATIONAL OUTPUTS AND PARAMETERS

2.1 Authorship analysis

Along with the recent increase in international collaboration has occurred a trend to larger teams of authors. To some extent this reflects the need for researchers to bring in additional sources of expertise in order to tackle difficult problems, and there are appreciable numbers of papers in the Austrian biomedical outputs database with large teams of authors, 20 or more. The distribution of authorship numbers (A) is shown in Figure 2.1. [Four papers had 255 authors, but this may be an artefact of the SCI database and they may actually have had many more authors than this.]

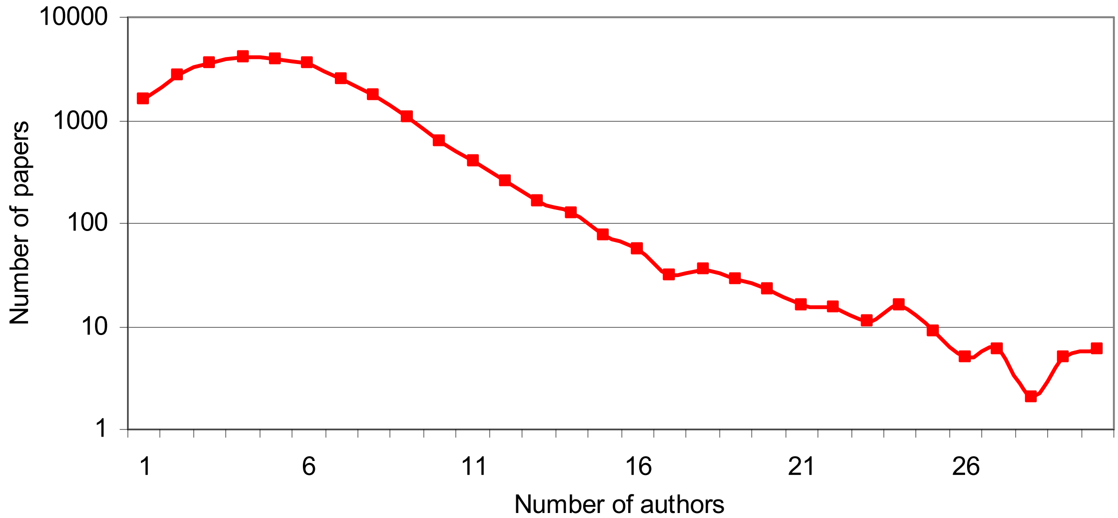

Figure 2.1. Distribution of authorship numbers on Austrian biomedical papers, 1991-2000 (log scale)

The peak occurs at A = 4 and the mean number of authors per paper is 5.40. The mean number has increased over the decade as is shown in Table 2.1.

Table 2.1 Numbers and percentages of Austrian biomedical papers with different numbers of authors.

A	*91-92*	*%*	*93-94*	*%*	*95-96*	*%*	*97-98*	*%*	*99-00*	%
1	330	8.1	331	7.4	268	5.1	340	5.5	315	4.7
2	546	13.5	504	11.3	566	10.8	534	8.6	601	8.9
3	668	16.5	659	14.7	737	14.0	810	13.0	770	11.4
4	679	16.7	719	16.1	797	15.2	954	15.3	951	14.1
5	603	14.9	621	13.9	776	14.8	907	14.6	959	14.2
6	451	11.1	570	12.7	676	12.9	885	14.2	970	14.4
7	316	7.8	402	9.0	489	9.3	609	9.8	708	10.5
8	176	4.3	266	5.9	343	6.5	406	6.5	530	7.8
9	126	3.1	157	3.5	198	3.8	275	4.4	301	4.5
10+	159	3.9	249	5.6	399	7.6	503	8.1	648	9.6
Total	4054		4478		5249		6223		6753	
Mean	*4.72*		*5.08*		*5.47*		*5.63*		*5.76*	

There has been a progressive shift to larger teams, with more papers with 6 or more authors and fewer with 4 or fewer authors. The mean team size has increased by just over one researcher over the decade. There is a striking difference, as would be expected, between the team sizes of Austrian domestic papers and those that are internationally co-authored, shown in Table 2.2.

Table 2.2. Average team size (mean A) for Austrian domestic and international papers, 1991-2000.

Paper type	*1991-92*	*1993-94*	*1995-96*	*1997-98*	*1999-2000*
Domestic	4.12	4.35	4.64	4.71	4.87
International	6.09	6.43	6.76	7.02	7.02

On average, working with foreign co-authors increases team size by about two researchers and the increment has itself been increasing.

2.2 Numbers of addresses

The numbers of addresses are, of course, lower than the numbers of authors. An "average" paper has 1.69 Austrian addresses and 0.96 foreign ones, although as mentioned above, 62% of all papers have no foreign co-author. The above graph shows that appreciable numbers of papers have many foreign addresses – 344 have 10 or more, compared with only 20 papers with 10 or more Austrian addresses.

As with authorship, the numbers of Austrian and foreign addresses per paper have been rising. Table 2.3 shows an analysis for three two-year periods in order to reveal the trends in these parameters. There has been an increase both in the numbers of Austrian and of foreign addresses, the latter being larger.

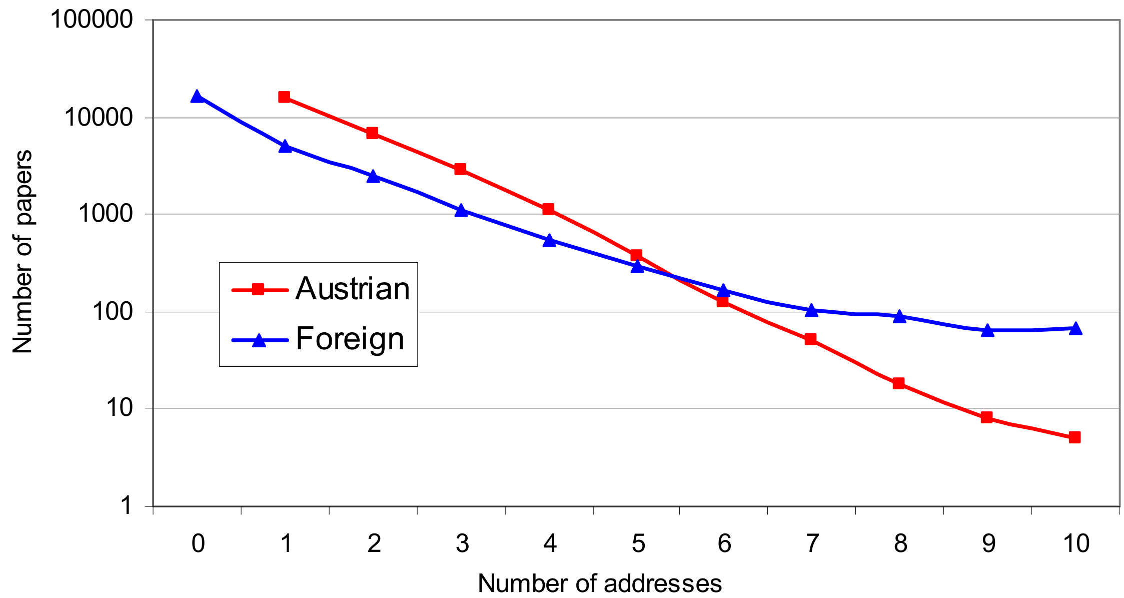

Figure 2.2 Distribution of address numbers on Austrian biomedical papers, 1991-2000 (log scale)

A similar analysis can be made of the numbers of addresses on each paper, with a distinction between the numbers of Austrian and non-Austrian addresses. Figure 2.2 shows the numbers of papers with given numbers of each type.

Table 2.3 Numbers and percentages of Austrian biomedical papers with different numbers of addresses (AT = Austrian, For = foreign).

	1991-92				*1995-96*				*1999-2000*			
D	*AT*	*%*	*For*	*%*	*AT*	*%*	*For*	*%*	*AT*	*%*	*For*	*%*
0			2832	69.9			3189	60.8			3940	58.3
1	2479	61.1	682	16.8	3042	58.0	1059	20.2	3769	55.8	1235	18.3
2	990	24.4	274	6.8	1315	25.1	502	9.6	1699	25.2	696	10.3
3	405	10.0	116	2.9	564	10.7	197	3.8	803	11.9	350	5.2
4	122	3.0	62	1.5	215	4.1	121	2.3	296	4.4	171	2.5
5	37	0.9	27	0.7	77	1.5	48	0.9	116	1.7	106	1.6
6+	21	0.5	61	1.5	36	0.7	133	2.5	70	1.0	255	3.8
Total	4054		4054		5249		5249		6753		6753	
Mean	*1.61*		*0.67*		*1.69*		*0.98*		*1.75*		*1.11*	

Of the papers with one or more foreign addresses, an analysis was made of those where the Austrian address was given first. [This is normally the "reprint" address, or address for correspondence; it is given in the SCI in slightly more detail than the others but it is not necessarily the address of the first author of the paper.] Of the 10 155 foreign co-authored papers, 4483 had an Austrian address in first place. However where there was only one foreign address (4963 papers), 3091 or 62% had an Austrian address first (*cf.* 50% expected) and where there were only two foreign addresses (2447 papers), 933 or 38% had an Austrian address first (*cf.* 33% expected). This shows that Austrian scientists are tending to take the lead in bilateral and trilateral research projects somewhat more often than expected. Of course, in many of these papers there would have been more than one Austrian address so the foreign contributions may have been less than one half or two thirds of the total effort. Thus where there was one foreign and one Austrian address (3313 papers) the Austrian was in the lead in only 1709 papers or 52% but when there were two or more Austrian addresses to one foreign one (1650 papers), an Austrian was in the lead in 1382, or 84%.

2.3 Biomedical sub-fields

One of the main themes of this report is the sub-division of "biomedicine", which comprises the two main scientific fields of clinical medicine and biomedical research, into component subject areas or sub-fields. Conventionally these have been defined solely by means of lists of journals but this is often unsatisfactory because many papers are published in general rather than specialist journals[3]. A better approach is to classify papers on the basis both of the journal in which they are published and words in their titles, which tend nowadays to be increasingly specific as authors are aware that their papers may well be selectively retrieved from electronic databases by this means.

In this study, 32 sub-fields were defined in this way, although for three of them it was not practical to use title words as there were so many that could occur and the sub-field boundaries were not very clear. For each sub-field, a "filter" was defined in consultation with an expert in the subject and then "calibrated" to determine its *precision* (how many papers retrieved were relevant) and its *recall* (how many relevant papers were retrieved). The ratio of these two factors gives the *calibration factor*, a number relating the estimated total number of papers in the sub-field to those actually identified by the filter.
The sub-fields are listed in Table 2.4, with their descriptions, a pentagraph code used subsequently in this report in the tables, charts and graphs, the name of the expert who defined the filter and the calibration factor. For the three journal-only sub-fields (anatomy, morphology & physiology; biochemistry & molecular biology; pharmacology & toxicology) the lists of specialist journals were taken from the classification system developed by CHI Research Inc. in the USA for the National Science Foundation's Science Indicators series.
Austrian outputs in each of the sub-fields are shown in Table 2.5. This lists the numbers of papers per year in each of the quinquennia and the change between them; then the total number of papers per year corrected for the calibration factor and expressed as a percentage of biomedicine (*i.e.*, of 2676 papers per year). This percentage is compared with that of world output in each sub-field, again for the decade 1991-2000, to show the Austrian presence (which would be expected to average 1.00% but may be higher or lower) and, coincidentally, Austria's relative commitment to the sub-field. The sub-fields are ranked in terms of this last indicator so as to show the relative importance of the subject to Austria.

This table shows that anaesthetics, followed by haematology; radiology, radiotherapy & nuclear medicine; mental health; and dermatology & venereology, are the strongest sub-

[3] Lewison G (1996) The definition of biomedical research sub-fields with title keywords and application to the analysis of research outputs. *Research Evaluation*, vol 6, pp 25-36.

fields; they are all clinical as would be expected (see section 1.1). By contrast the weakest sub-fields include genetics and anatomy, morphology & physiology, two rather basic subject areas, together with dentistry and, again as expected, tropical medicine.

Table 2.4. List of biomedical sub-fields used for the analysis, with their defining experts and calibration factors (CF = estimated/retrieved papers)

Code	**Description**	**Defining expert**	**C.F.**
ANAPH	anatomy, morphology & physiology	(none)	1.00
ANEST	anaesthesia	Prof R Jones, St Mary's, London	1.19
ARTHR	arthritis	Dr M Devey, Arthr Res Campaign	1.11
BCMBI	biochemistry & molecular biology	(none)	1.00
BIENG	bioengineering	Prof D Bader, QMW, U/London.	0.87
CARDI	cardiology	Dr M Phillips, Wellcome Trust	1.10
CHILD	paediatrics & neonatology	Prof K Casteloe, Barts, London	1.13
CYTHI	cell biology	Dr P Goodwin, Wellcome Trust	0.85
DENTA	dentistry	Dr J Clarkson, U/Dundee	1.12
DERMA	dermatology & venereology	Dr B Shergill, Royal London Hosp	0.95
ENDOC	endocrinology	Dr M McCarthy, Imp Coll Med S	0.96
GASTR	gastroenterology	Prof D Thompson, U/Manchester	0.95
GENET	genetics	Dr B Skene, Wellcome Trust	1.04
GERON	gerontology	Dr E Dickinson, Roy Coll Phys	1.09
HAEMA	haematology	Prof D Lane, Charing Cross Hosp	0.93
HUGEN	human genetics	Dr J Itzhaki, Wellcome Trust	1.00
IMMAL	immunology & allergology	Dr C Cross, Wellcome Trust	0.98
INFEC	infectious disease	Dr C Cross, Wellcome Trust	0.85
MENTH	mental health	Dr L Howard, Inst/Psychiatry	0.98
NEUSC	neuroscience	Dr P Sneddon, Wellcome Trust	1.01
OBSGY	obstetrics & gynaecology	Prof P Steer, Charing Cross Hosp	1.01
ONCOL	oncology	Dr L Davies, Cancer Res UK	1.06
OPHTH	ophthalmology	Dr S Thomas, Wellcome Trust	1.00
OTORH	otorhinolaryngology	Dr G Sandhu, Roy Nat TNE H'sp	1.15
PATHO	pathology	Dr M Sheaff, Barts, London	1.16
PHATO	pharmacology & toxicology	(none)	1.00
PUBEP	public health & epidemiology	Prof J Weinberg, City Univ.	1.11
RADIO	radiotherapy, radiology & nuclear med.	Dr E Aird, Mt Vernon Hospital	0.97
RENAL	renal medicine	Prof D Kerr, U/London	1.00
RESPI	respiratory	Prof P Barnes, Nat Ht & Lung In.	1.17
SURGE	surgery	Mr RG Carpenter, Barts, London	1.26
TROPM	tropical medicine	Dr C Davies, Wellcome Trust	1.19

Table 2.5 Ranking of 32 biomedical sub-fields by Austrian relative commitment. Listings are of papers per year, 1991-2000. Est AT = estimated mean Austrian production.

Code	*91-95*	*96-00*	*Ratio*	*CF*	*Est AT*	*% of biom*	*Est world*	*AT pres.*
ANEST	59	157	2.66	1.19	129	4.81	8011	1.61
HAEMA	215	291	1.35	0.93	235	8.79	16210	1.45
RADIO	73	130	1.77	0.97	98	3.68	7041	1.40
MENTH	67	114	1.70	0.98	89	3.32	6901	1.29
DERMA	105	134	1.28	0.95	114	4.24	9026	1.26
PATHO	183	252	1.37	1.16	252	9.43	20126	1.25
IMMAL	255	336	1.32	0.98	289	10.82	23143	1.25
HUGEN	8	19	2.37	1.00	14	0.52	1108	1.25
ONCOL	309	462	1.49	1.06	409	15.28	33431	1.22
BIENG	29	57	2.00	0.87	37	1.39	3154	1.18
RENAL	80	96	1.20	1.00	88	3.29	7479	1.18
CARDI	307	393	1.28	1.10	385	14.40	33037	1.17
SURGE	158	229	1.45	1.26	244	9.10	21034	1.16
OBSGY	163	191	1.18	1.01	179	6.68	15663	1.14
OTORH	39	80	2.05	1.15	69	2.57	6260	1.10
GERON	63	118	1.87	1.09	99	3.70	9553	1.04
CYTHI	72	123	1.71	0.85	83	3.09	8266	1.00
CHILD	131	196	1.50	1.13	185	6.91	18593	0.99
RESPI	92	151	1.63	1.17	142	5.31	14445	0.98
ARTHR	52	80	1.54	1.11	73	2.73	7772	0.94
ENDOC	265	379	1.43	0.96	309	11.55	33036	0.94
PUBEP	72	113	1.56	1.11	103	3.83	11537	0.89
GASTR	159	208	1.31	0.95	174	6.52	19676	0.89
OPHTH	44	63	1.43	1.00	54	2.01	6924	0.78
BCMBI	193	290	1.50	1.00	242	9.03	32590	0.74
PHATO	109	142	1.30	1.00	126	4.70	17600	0.71
NEUSC	155	227	1.46	1.01	193	7.22	27122	0.71
INFEC	221	306	1.38	0.85	224	8.38	32317	0.69
GENET	182	299	1.64	1.04	250	9.34	37358	0.67
ANAPH	39	49	1.25	1.00	44	1.66	6728	0.66
DENTA	17	37	2.16	1.12	30	1.14	4714	0.65
TROPM	15	29	1.93	1.19	26	0.97	5562	0.46

2.4 Research levels, clinical to basic

The papers in the database were classified as being at a particular research level, on a spectrum from clinical to basic, by reference to the journal in which they were published. The classification system has been developed by CHI Research Inc.[4] and is in four categories, shown in Table 2.6 with examples of journals in each category and the percentage of Austrian papers in each. It can be seen that there is a fairly even split of papers between the four categories of journals.

Table 2.6 Classification of journals by research level, and examples used by Austrian researchers

RL	*Description*	**Examples**	*% AT*
1	Clinical observation	*Wien Klin Wochenschr, Acta Med Austr, Geburtsh Frauenheilk*	22.0
2	Clinical mix	*Acta Anaesthesiol Scand, Anticancer Res, Anesth Analg*	23.5
3	Clinical investigation	*Blood, Transplant Proc, Int Arch Allergy Immunol*	27.0
4	Basic research	*J Biol Chem, FEBS Lett, Proc Nat Acad Sci USA*	25.4

In addition, 557 papers (2.1%) were in journals not classified by CHI Research – these would mainly have been social science journals for which their classification system does not cater. Over the decade there has been little shift in the proportions of papers in journals of different categories, although RL1 papers decreased from the first quinquennium to the second from 23.9% to 21.9% while RL2 papers increased from 20.6% to 24.7%.

The distribution of RL does, of course, vary greatly with the sub-field, some being rather clinical and others quite basic. Figure 2.3 shows the distribution of papers for those sub-fields with 1000 or more papers over the decade; in this chart papers in unclassified journals have been omitted. The sub-fields have been ordered by the "mean" research level category – not strictly a valid indicator as the RL values are categorical rather than continuous variables, but useful visually. Surgery; radiology, radiotherapy & nuclear medicine and anaesthesia are the most clinical, and biochemistry & molecular biology; neuroscience and genetics are the most basic.

[4] Narin F, Pinski G and Gee HH (1976) Structure of the biomedical literature. *Journal of the American Society for Information Science*, vol 27, pp 25-45.

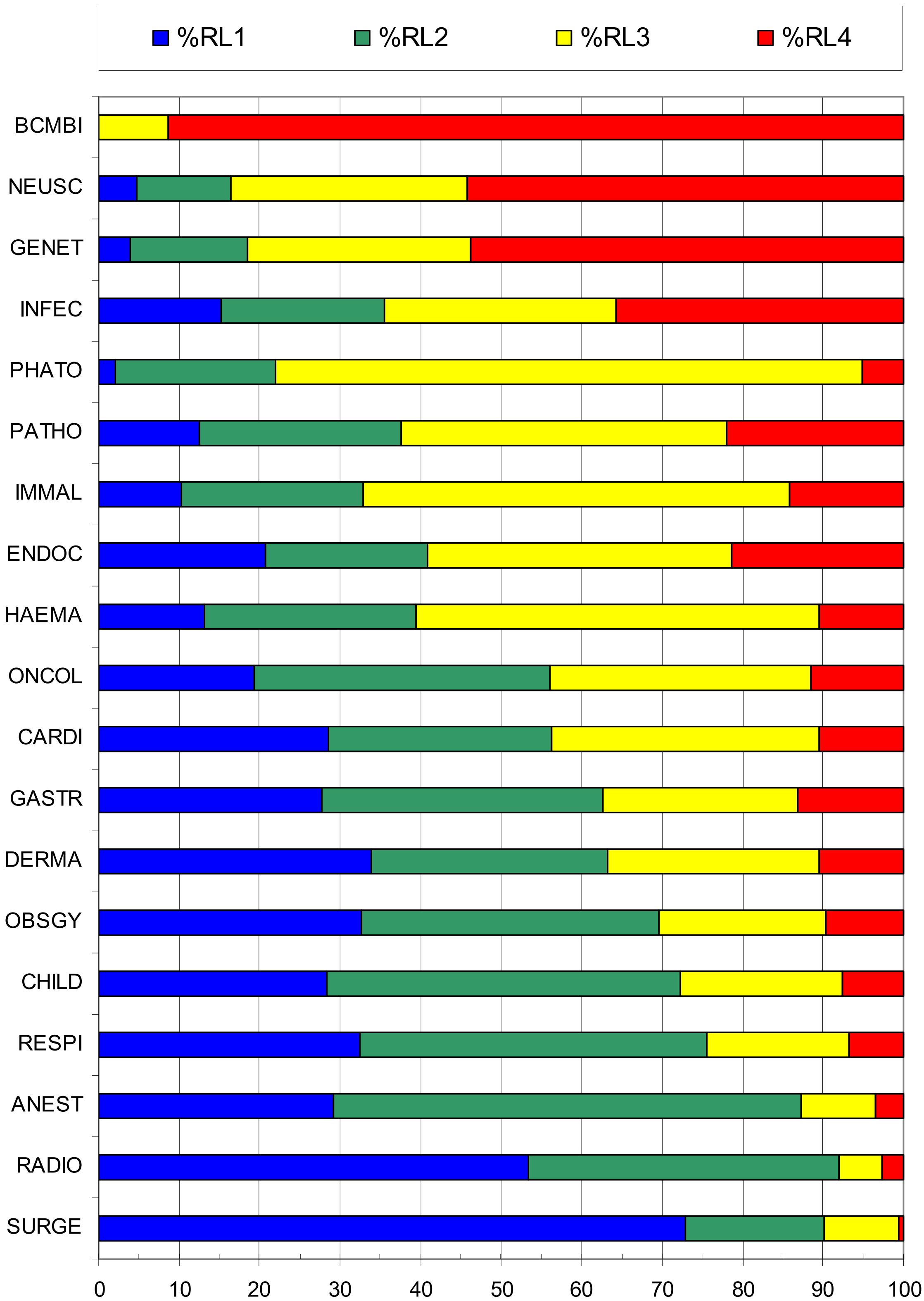

Figure 2.3 Distribution by research level (RL; 1 = clinical, 4 = basic) of Austrian papers in 19 sub-fields with > 1000 papers, 1991-2000

It appears from this figure and from Table 2.5 above that Austria's relative commitment is much stronger in the clinical sub-fields than in the basic ones, as was suggested in the opening section of this report. This relationship is shown in Figure 2.4, where relative commitment is plotted as a function of mean research level.

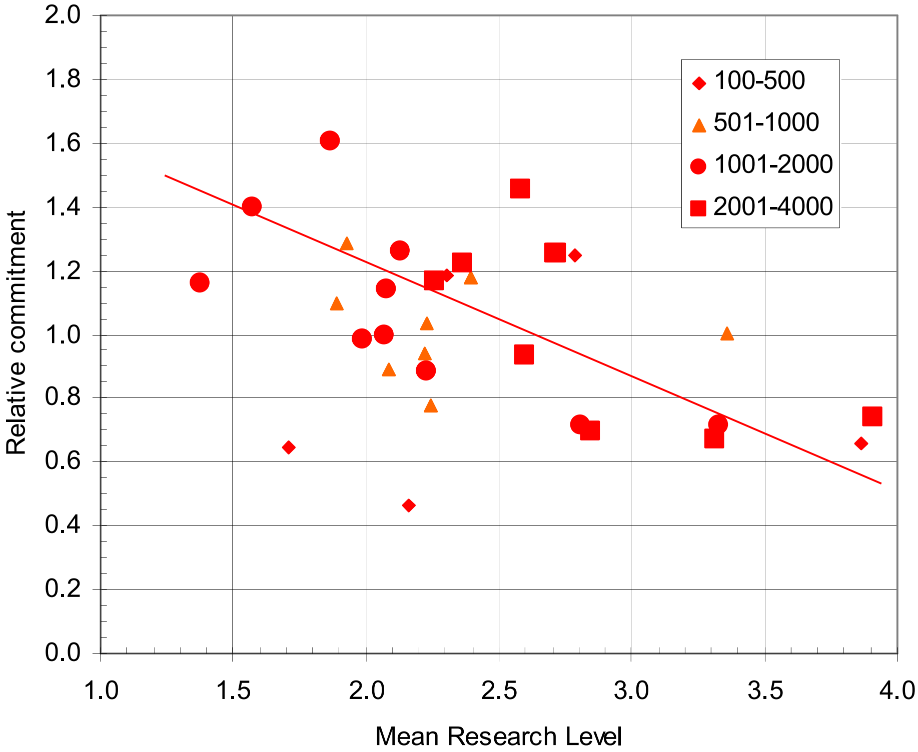

Figure 2.4 Relationship between Austrian relative commitment to 32 biomedical sub-fields and the "mean" research level (1 = clinical, 4 = basic) of papers in the subject. The symbols show the numbers of papers in each sub-field

2.5 Potential impact of research

One of the goals of research evaluation is to determine the "quality" of the research that is undertaken. This is a somewhat subjective indicator, but several surrogate quantitative indicators have been developed that measure the likely impact of the research on other researchers. One of these is the numbers of citations of a paper made by other researchers in a given time period: this is explored further in the next section. A second such indicator, and one that is simpler to determine and also quicker and cheaper, is the impact factor of the journal in which a paper is published. This can be measured in several ways but in the present study it has been calculated as the mean number of citations received by papers in a given journal in their year of publication and four subsequent years, designated $C_{0\text{-}4}$. Although this is not the conventional impact factor published annually by the Institute for Scientific Information, it has two notable advantages:

- it covers a longer time period which normally includes the peak year for citations to a research paper; and
- the $C_{0\text{-}4}$ journal citation score can be directly compared with the citations received by the paper.

Citations to a group of papers in a given journal are distributed around the mean for that journal[5], although a high quality group of papers may achieve a higher average score, and *vice versa*. However this comparison of observed and expected citation rates is not necessarily a good indicator in itself as it may reflect the publication policy of the researchers concerned. If they are ambitious and try mainly to publish papers in high-impact journals, they may have a lower observed-to-expected citation ratio, even though their papers attract more citations than if they sought to publish primarily in low-impact journals.

In effect, the impact factors of the journals in which a group of papers are published represent a different indicator of the likely quality of the research than that presented by citation scores, but one that is also valid and useful.

Although the impact factor for a journal, $C_{0\text{-}4}$, can be calculated to two decimal places (or more), it is hardly reliable to this degree for several reasons, including that it changes with time. There is, in fact, a tendency for mean impact factors to rise with time[6] as more highly-cited journals will tend to expand and less cited ones to contract, or even merge or close. For many purposes it is sufficient to categorize journals into four groups (potential impact category, PIC) on the basis of their $C_{0\text{-}4}$ values. The intention is that overall in biomedicine about 10% of papers should be in the top category (PIC = 4), 20% in the next (PIC = 3), 30% in the third (PIC = 2) and the remaining 40% in the bottom category (PIC = 1). For this purpose, the critical $C_{0\text{-}4}$ values are as shown in Table 2.7.

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[5] Lewison G (2001) The quantity and quality of female researchers: a bibliometric study of Iceland. *Scientometrics*, vol 52 no 1, pp 29-43. See Figure 7.

[6] Lewison G and Devey ME. (1999) Bibliometric methods for the evaluation of arthritis research. *Rheumatology*, vol 38, pp 13-20. See Figure 2.

Table 2.7 Classification of journals by potential impact category (PIC), and examples used by Austrian researchers

PIC	C_{0-4} *values*	**Examples**	*% AT*
1	Below 6	*Wien Klin Wochenschr, Acta Med Austr, Geburtsh Frauenheilk*	43.2
2	From 6 to 11	*Int Arch Allergy Immunol, Anesth Analg, Neurosci Lett, J Urol*	28.8
3	From 11 to 20	*FEBS Lett, J Invest Dermatol, Eur J Biochem, Biochem J*	17.2
4	20 and above	*J Biol Chem, Blood, J Immunol, Proc Nat Acad Sci USA, Lancet*	10.8

As can be seen, Austrian biomedical papers fall approximately into the percentages listed above for each category though PIC1 journals are over-represented, in part because so many papers are in *Wiener Klinische Wochenschrift*.

The distribution of papers by PIC for each sub-field follows a rather similar pattern to that for research level shown in Figure 2.3, and is presented in Figure 2.5 for the 19 sub-fields with 1000 or more Austrian papers.

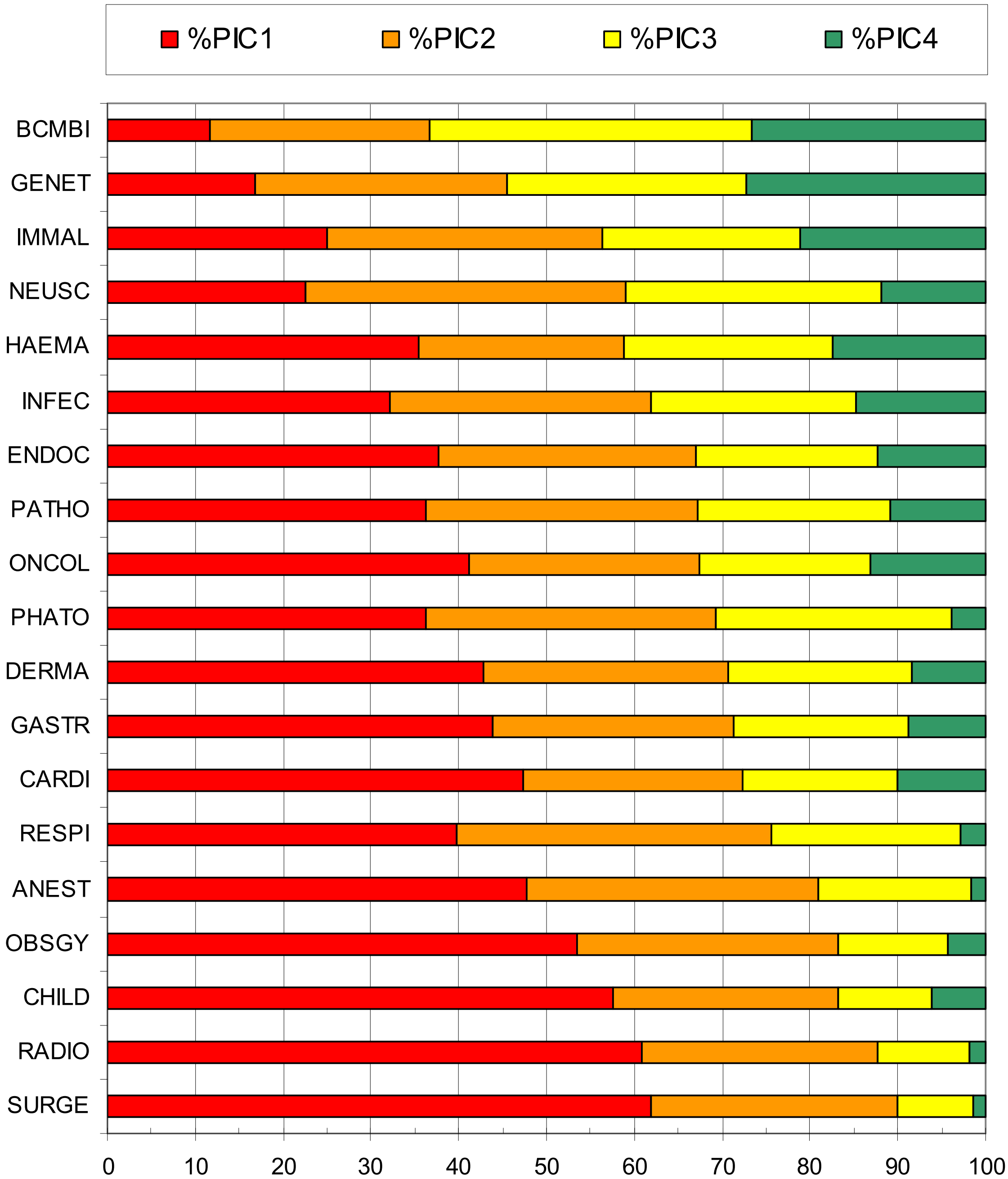

Figure 2.5 Distribution by potential impact category (PIC; 1 = low, 4 = high) of Austrian papers in 19 sub-fields with > 1000 papers, 1991-2000

It is no coincidence that the sub-fields with the most basic research, such as biochemistry & molecular biology (BCMBI) and genetics (GENET), are also the ones where papers are in the highest impact journals: basic research journals tend to have higher citation rates than do clinical journals. The relationship for Austrian papers between the "mean" RL and "mean" PIC is shown in Figure 2.6, and demonstrates a close correlation between the two.

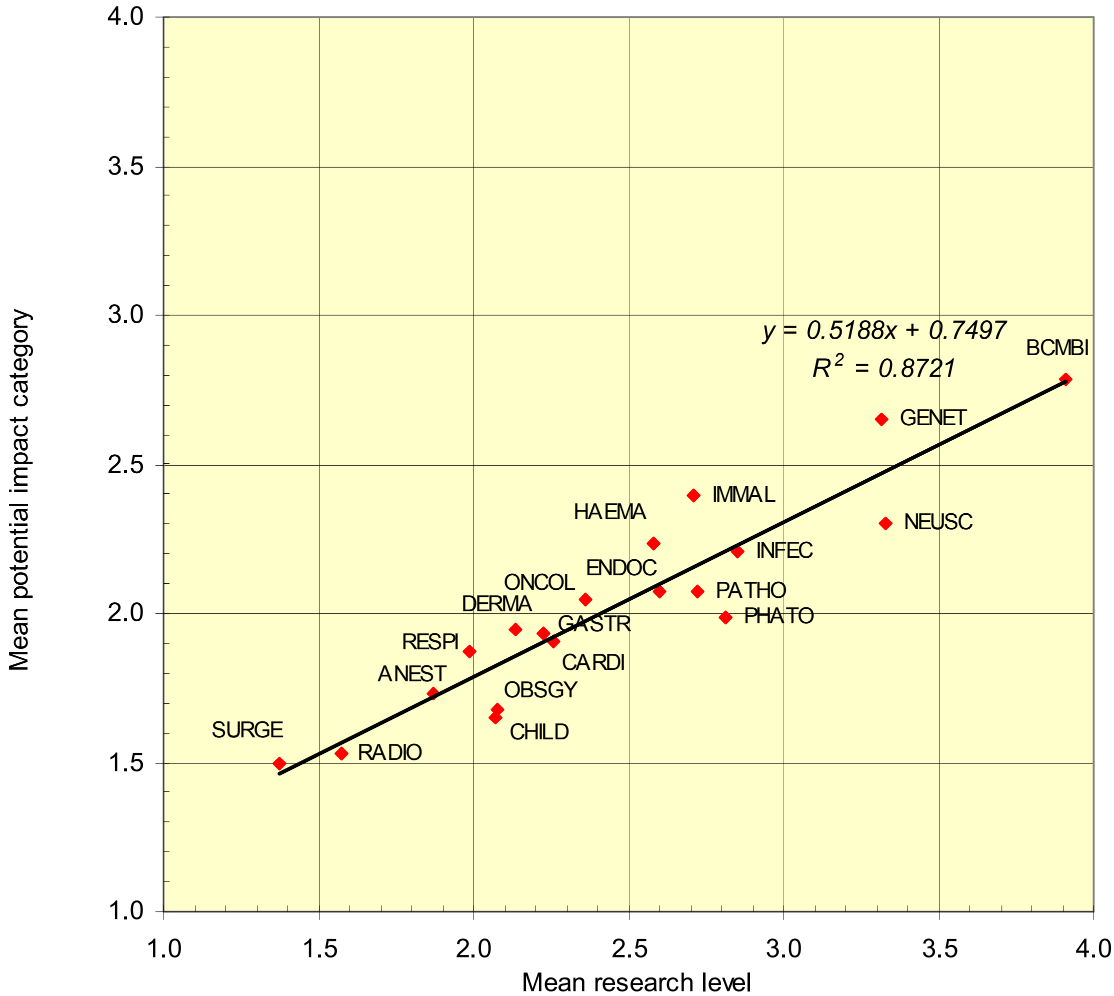

Figure 2.6 "Mean" potential impact category PIC (1 = low, 4 = high) plotted against "mean" research level RL (1 = clinical, 4 = basic) for Austrian papers in 19 sub-fields with > 1000 papers in 1991-2000.

2.6 Citation scores

The numbers of citations to Austrian papers were determined for each citing year through 2001 under sub-contract to the Institute for Scientific Information (ISI) in Philadelphia. Since it was considered desirable to allow citations to cumulate for five years in order for them to include the peak year (typically the third after publication), these determinations were made for papers published from 1991-97 (n = 16 815) and not for those from 1998-2000. Citation numbers are distributed in a manner that has interested mathematicians who have attempted to write equations to describe it[7],[8],[9]. The pattern is approximately logarithmic, and Figure 2.7 shows the distributions of citations to Austrian papers in three contrasting sub-fields where the ordinate or y-axis represents the numbers of citations in five years and the abscissa or x-axis represents the centile within the group.

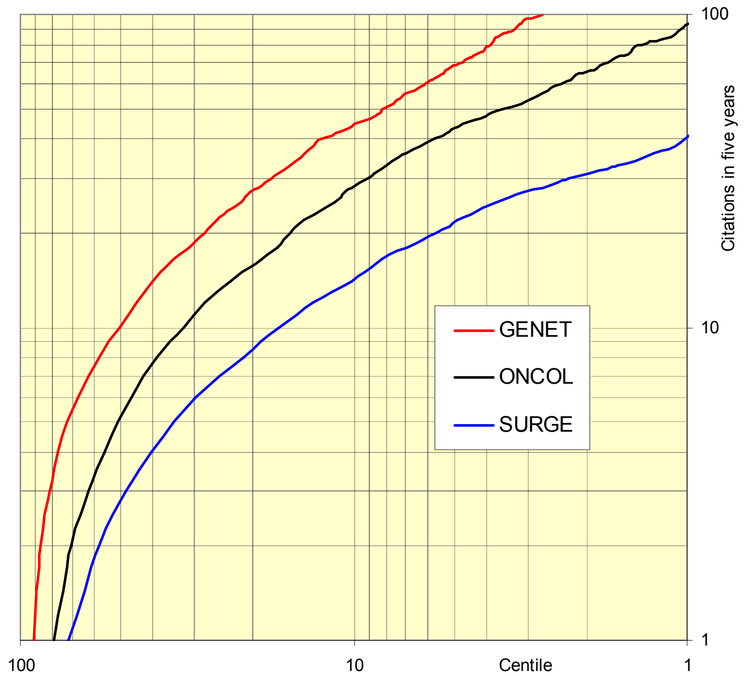

Figure 2.7 Distribution of numbers of citations over five years to Austrian papers 1991-97 in three sub-fields: genetics, oncology and surgery.

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[7] Gupta BM (1997) Analysis of distribution of the age of citations in theoretical population genetics. *Scientometrics*, vol 40, no 1, pp 139-162

[8] Saam NJ and Rewiter L. (1999) Lotka's law reconsidered – the evolution of publication and citation distributions in scientific fields. *Scientometrics*, vol 44 no 2, pp 135-155.

[9] Egghe L. (2000) A heuristic study of the first citation distribution. *Scientometrics*, vol 48 no 3, pp 345-359.

The graph shows that for an Austrian genetics paper to be in the top 10% of its group (*i.e.*, 143rd out of 1432 papers) it needs to receive 44 citations. An oncology paper in the top 10% (238th out of 2377 papers) needs 28 citations and a surgery paper in the top 10% needs only 14 citations. Alternatively, one can determine the numbers of papers in each sub-field receiving given numbers of citations, *e.g.*, 28% of genetics papers obtain 20 cites or more, as do 15% of oncology papers but only 6% of surgery papers. The latter system allows a statistical comparison between groups of papers and Figure 2.8 shows the percentages of papers with zero, 1-5, 6-10, 11-20, 21-39, 40-79 and 80 or more cites in those 17 sub-fields with at least 700 papers whose citation counts were determined.

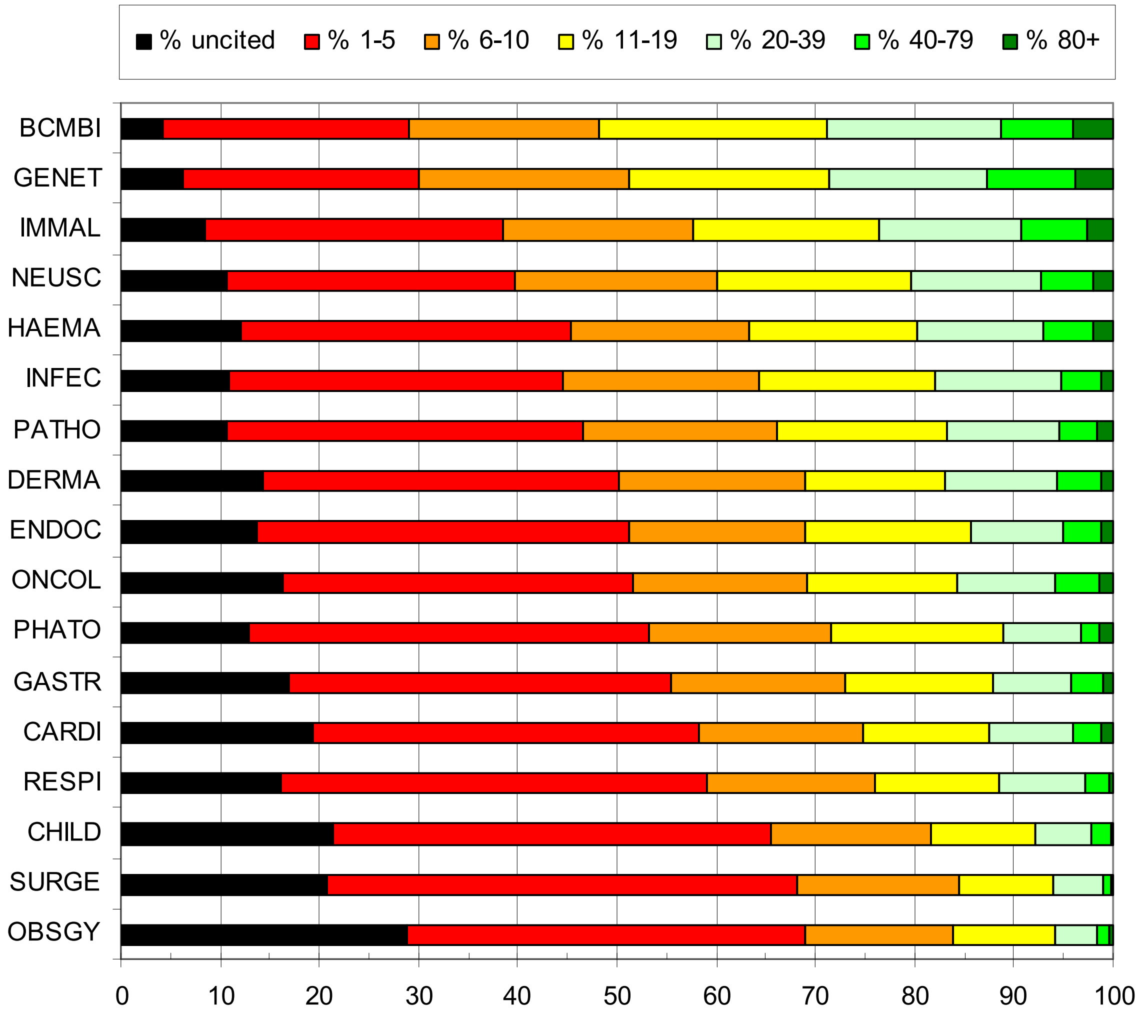

Figure 2.8 Distribution by citation category of Austrian papers in 17 sub-fields with > 700 papers, 1991-97

Comparison of Figures 2.5 and 2.8 shows that PIC values are a fair predictor of the relative position of a sub-field in terms of citations, and the same sub-fields appear at the top and bottom of each chart. If a composite "mean citecount category" is calculated, based on papers with citations in the range 1-5 counting as 1, ones with 6-10 as 2, 11-19 as 3, etc., then this can be plotted against "mean PIC" to show how well the latter can predict the former. The result is shown in Figure 2.9. It is evident that the association is very close and the citation performance of each sub-field can be closely predicted from a knowledge of its PIC distribution. The exceptions are dermatology & venereology (DERMA), surgery (SURGE) and pathology (PATHO) (somewhat more highly cited than expected) and obstetrics & gynaecology (OBSGY) (somewhat less cited).

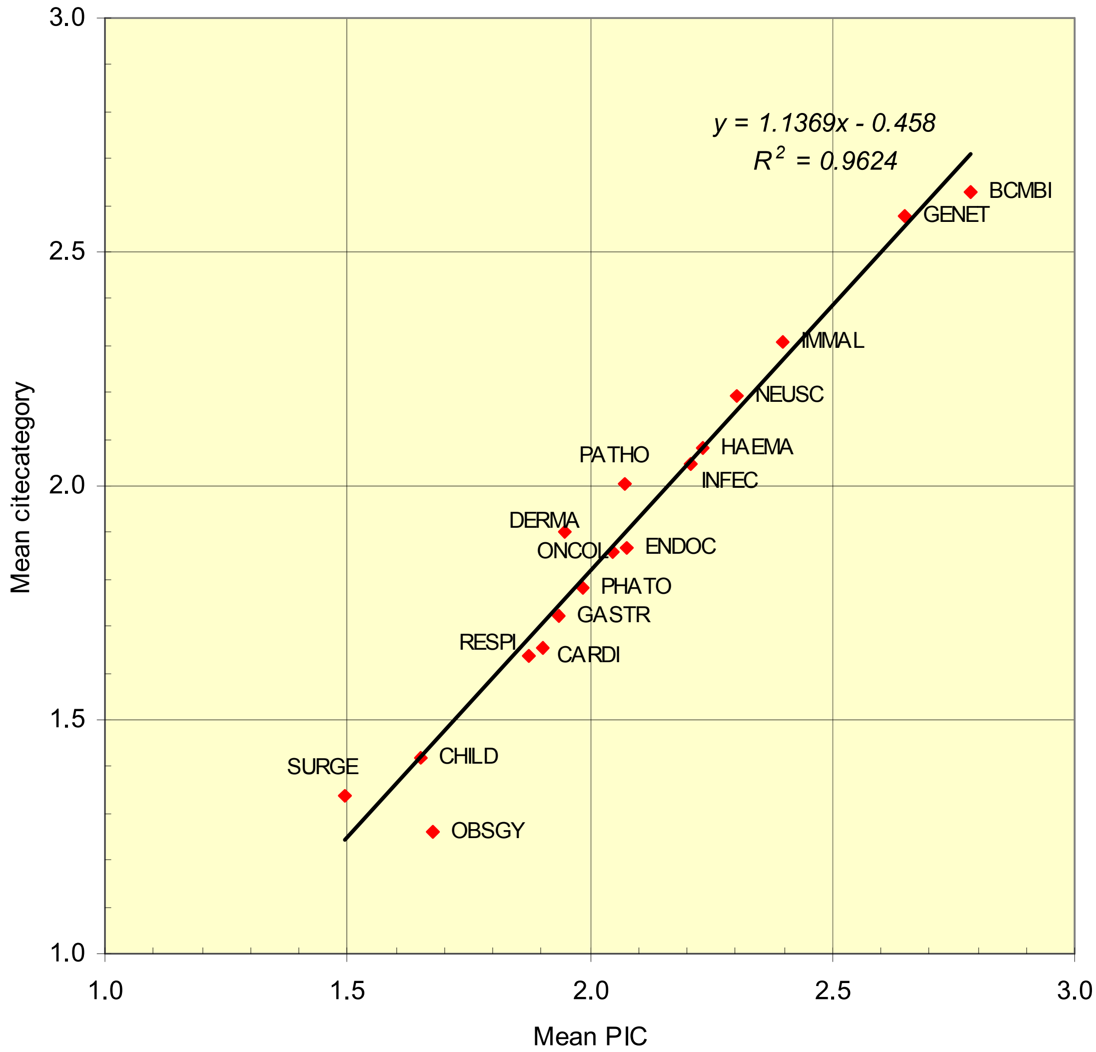

Figure 2.9 Scatter plot of "mean citation category" against "mean PIC" for 17 Austrian sub-fields with > 700 papers, 1991-97

Citation scores have tended to rise with time[10], as shown in Figure 2.10. The difference between alternate years is statistically significant (p ~ 0.1%) except between 1995 and 1997. One reason for the improved performance is the reduction in the proportion of German-language papers, which tend to receive far fewer citations than the English-language ones, see Figure 2.11. This figure also shows that reviews, which account for 3.8% of Austrian papers, are the most highly cited, followed by articles and then by notes – the latter were amalgamated with articles in 1996 by the SCI and the SSCI. The differences in citations between notes and articles, and between articles and reviews, are both very highly statistically significant (p < 0.01%).

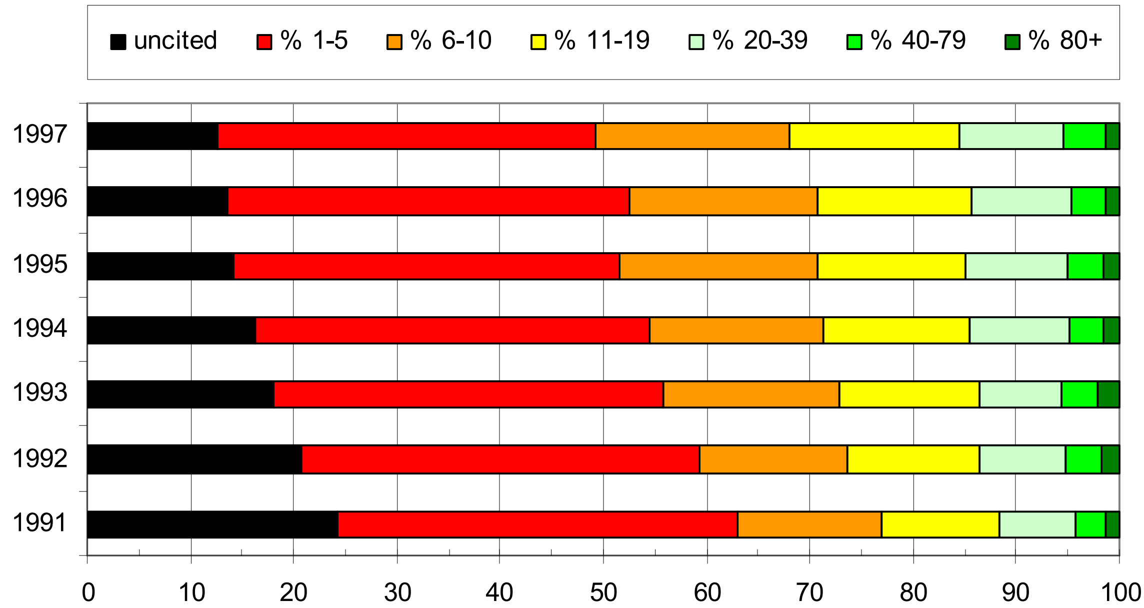

Figure 2.10 Distribution of five-year citation scores for Austrian biomedical papers from different years, 1991-97.

[10] Bienenstock J, Huttunen J, af Malmborg C and Rodriguez-Farre E. (1996) *Report of the evaluation panel on the research of the Göteborg University Faculty of Medicine.* Göteborg University, Sweden: ISBN 91-88856-08-9. See Figure 5, p 69.

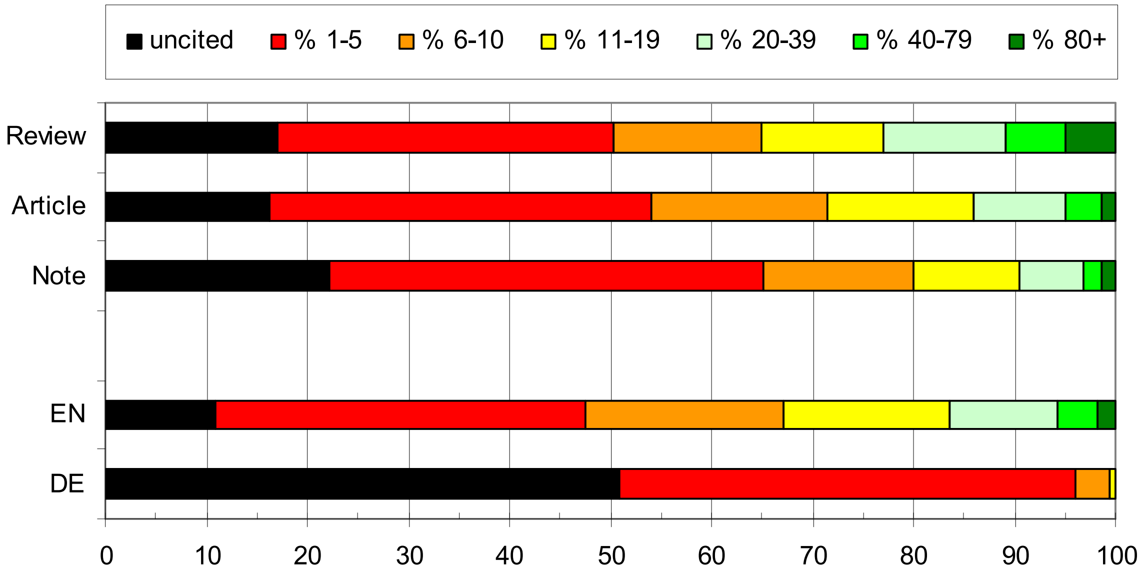

Figure 2.11 Distribution of five-year citation scores for Austrian biomedical papers of different document types and in English (EN) and German (DE), 1991-97

The effect of numbers of authors on citation scores is also positive, as is shown in Figure 2.12. Figure 2.13 examines the effect of international co-authorship and it appears that this has a positive effect, as has been reported elsewhere[11]. However since papers with one or more foreign addresses also tend to have more authors and are more likely to be written in English, this conclusion is not firm, and needs to be investigated in more detail, see Chapter 6.

[11] Narin F, Stevens K and Whitlow ES. (1991) Scientific co-operation in Europe and the citation of multinationally authored papers. *Scientometrics*, vol 21 no 3, pp 313-324.

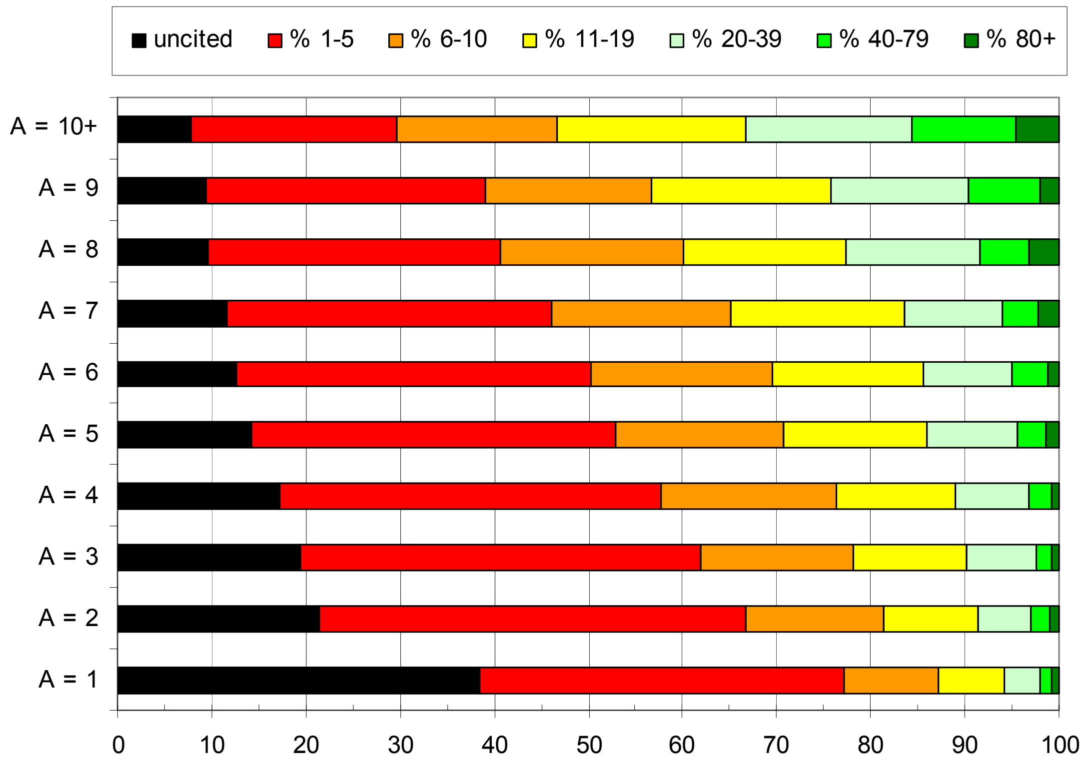

Figure 2.12. Distribution of five-year citation scores for Austrian biomedical papers with different numbers of authors (A), 1991-97

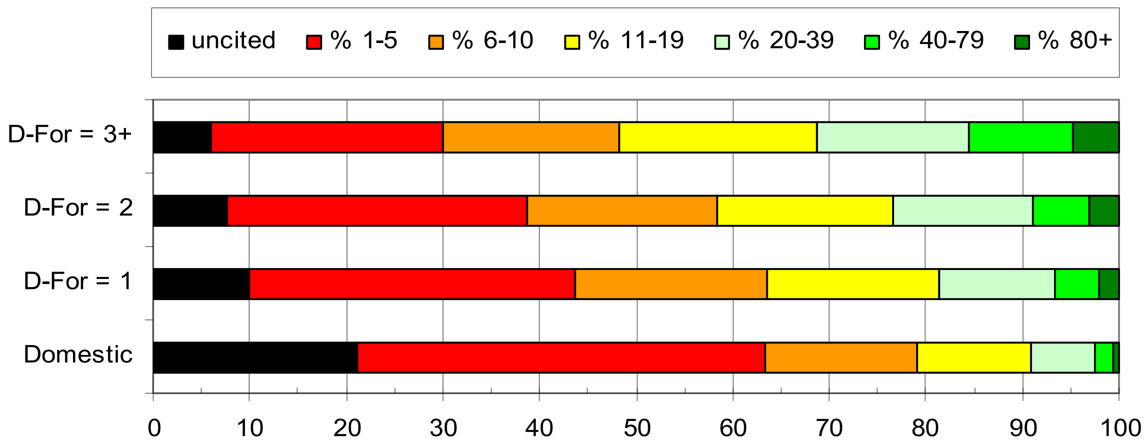

Figure 2.13. Distribution of five-year citation scores for Austrian biomedical papers with different numbers of foreign addresses (D-For), 1991-97

Most of the differences in the above charts between papers in different groups, even if adjacent, are statistically significant.

2.7 Conclusions to Chapter 2

The above analysis has shown the following:

- Austrian biomedical papers typically have four or five authors, about 1.7 Austrian addresses and 1.0 foreign addresses. All three parameters have been rising steadily in the 1990s as co-operative working has increased.

- Papers in each of 32 biomedical sub-fields were identified by means of journal names and title words that comprised "filters", each defined in association with an expert in the subject. Estimated annual Austrian outputs ranged from 409 in oncology and 385 in cardiology down to 26 in tropical medicine and 14 in human genetics.

- Austrian relative commitment, based on the ratio of its share of world output in a sub-field to that in biomedicine, is greatest in anaesthesia research (160%), haematology (145%) and radiology & radiotherapy & nuclear medicine (140%). It is least in dentistry (65%) and tropical medicine (46%).

- The sub-fields were classified by research level, RL, based on a categorization of journals from clinical to basic. Austrian relative commitments tended to be higher in clinical sub-fields such as surgery, radiology and anaesthesia and lower in basic ones such as biochemistry & molecular biology, neuroscience and genetics.

- The sub-fields were also classified by the potential impact category (PIC) of the journals as measured by mean citation scores over five years. The basic sub-fields scored more highly than the clinical ones because basic research journals tend to receive more citations than clinical ones.

- Five-year citation scores to the Austrian papers published from 1991-97 were determined and showed a very close association with PIC values for the larger sub-fields ($r^2 = 0.96$), indicating that the latter indicator is an excellent predictor of citation performance, with minor exceptions.

- Biochemistry & molecular biology and genetics are the most highly-cited sub-fields for Austrian biomedical research papers, and obstetrics & gynaecology, surgery and paediatrics the least.

- Citation scores have tended to rise with time; they are much higher for English-language than for German-language papers; and they are higher for papers with more authors and one or more foreign addresses.

3 COMPARISONS OF AUSTRIA WITH FIVE OTHER COUNTRIES

3.1 Outputs and relative commitment

This chapter examines Austrian biomedical outputs in the context of the five other countries selected for comparison: Switzerland (CH), Germany (DE), Israel (IL), Sweden (SE) and the United Kingdom (UK). Their main characteristics were listed in Table 1.1.

The first comparison is in terms of how much research is taking place in each of the 32 sub-fields in relation to each country's total biomedical output. Since the sub-fields vary greatly in size, they have been grouped in eight sets of four, and the charts (Figures A2.1 to A2.8) in Annex 2 show the amount of research in each sub-field as a percentage of biomedicine for each country, with account taken of the calibration factors in Table 2.4. Austrian outputs are shown in red, Swiss in orange, Germany in yellow and black, Israel in blue, Sweden in yellow and blue, the UK in red and white and the world in black. Relative commitments are tabulated in Table 3.1, with those higher than 2 boxed in dark green, those higher than 1.4 boxed in light green, those lower than 0.7 boxed in pink, and those below 0.5 boxed in red.

The charts tell a similar story to the figures of relative commitment in Table 3.1, but make some points more clearly. For example, the first chart (Figure A2.1) shows that Austrian genetics output is quite low but its outputs in oncology and cardiology are high; Sweden is particularly strong in endocrinology and Germany in genetics. The second chart shows the low output of Austria in neuroscience and the third, its strong performance in surgery and pathology. Israel is shown to be very active in paediatrics, and, from the fourth chart, also in obstetrics & gynaecology. This chart shows Austria's relatively large output in haematology. Chart five reveals the Swedish strength in public health & epidemiology and chart six Austrian strengths in anaesthesia and radiology, radiotherapy & nuclear medicine. Chart seven shows Israeli strength in mental health, together with Britain, and chart eight shows the large outputs in tropical medicine from Switzerland and the UK, and in dentistry from Sweden.

Table 3.1 Relative commitment of the six countries to research in each of 32 biomedical sub-fields, 1991-2000

Code	**Sub-field**	*AT*	*CH*	*DE*	*IL*	*SE*	*UK*
ANAPH	anatomy, morphology & physiology	0.66	0.78	0.88	0.69	1.18	0.85
ANEST	anaesthesia	1.61	0.91	1.08	0.87	1.21	1.20
ARTHR	arthritis	0.94	1.14	0.89	1.50	1.14	1.28
BCMBI	biochemistry & molecular biology	0.74	1.11	1.13	1.01	0.91	0.89
BIENG	bioengineering	1.18	0.99	0.92	1.14	1.28	0.87
CARDI	cardiology	1.17	0.90	1.10	0.95	0.93	0.86
CHILD	paediatrics & neonatology	0.99	0.80	0.76	1.49	1.05	1.12
CYTHI	cell biology	1.00	1.24	1.20	0.93	0.80	0.91
DENTA	dentistry	0.65	0.77	0.56	1.48	1.98	1.27
DERMA	dermatology & venereology	1.26	1.07	1.22	1.10	0.89	1.04
ENDOC	endocrinology	0.94	0.87	0.90	1.07	1.25	0.89
GASTR	gastroenterology	0.89	0.88	1.02	0.80	1.07	0.90
GENET	genetics	0.67	1.00	1.09	0.90	0.86	0.97
GERON	gerontology	1.04	0.79	0.77	1.01	1.23	0.99
HAEMA	haematology	1.45	0.99	1.14	1.22	0.96	0.92
HUGEN	human genetics	1.25	0.94	1.00	0.95	1.21	1.55
IMMAL	immunology & allergology	1.25	1.39	1.12	1.12	1.13	0.96
INFEC	infectious disease	0.69	1.05	0.98	0.92	0.86	1.06
MENTH	mental health	1.29	1.11	1.50	2.05	1.43	1.78
NEUSC	neuroscience	0.71	0.95	1.05	0.93	1.12	0.85
OBSGY	obstetrics & gynaecology	1.14	0.58	0.86	1.73	1.02	1.05
ONCOL	oncology	1.22	0.88	1.08	0.99	0.92	0.87
OPHTH	ophthalmology	0.78	1.16	1.35	1.15	0.68	1.05
OTORH	otorhinolaryngology	1.10	0.70	0.81	1.24	1.08	1.07
PATHO	pathology	1.26	0.86	0.99	0.81	0.96	0.94
PHATO	pharmacology & toxicology	0.71	0.88	0.89	0.63	0.86	0.97
PUBEP	public health & epidemiology	0.89	0.92	0.73	1.25	1.64	1.36
RADIO	radiotherapy, radiology & nuclear medicine	1.40	0.71	1.15	0.68	0.91	0.78
RENAL	renal medicine	1.18	0.93	1.18	0.93	1.00	0.78
RESPI	respiratory	0.98	0.96	0.79	0.76	1.01	1.11
SURGE	surgery	1.16	0.72	0.78	0.92	1.02	0.71
TROPM	tropical medicine	0.46	1.53	0.60	0.82	0.72	1.44

3.2 Research levels

Annex 3 provides detailed data on the distribution of the papers of the six countries by research level, divided up into the outputs from the two quinquennia 1991-95 and 1996-2000: these are labelled 1 and 2 in the 32 charts. The countries are ordered so that the one with the most basic research is at the top of each chart (based on the whole decade) and one with the most clinical work at the bottom. Although there are some exceptions (*e.g.*, pharmacology & toxicology, public health & epidemiology), in most sub-fields Austria is at or close to the bottom of the charts, *i.e.*, its output is more clinical and less basic than that of the other five countries.

Although overall Austria's output has changed little over the decade in terms of research level, the charts in Annex 3 suggest that there have been some changes in both directions in some of the sub-fields. Six have become noticeably more basic: dermatology & venereology, respiratory medicine, paediatrics & neonatology, neuroscience, anaesthesia and pathology; and two have become more clinical: dentistry and genetics.

3.3 Potential impact categories

Charts of the outputs of the six countries distributed by potential impact category (PIC) in the two quinquennia are in Annex 4. Although its outputs are nearly all relatively clinical, Austria fares better in terms of its mean ranking among the six countries than would be expected. Its "average" ranking is slightly below fourth place, compared with below fifth place in terms of research level. Its most highly rated sub-field, in which it ranks first overall, is dermatology & venereology. It was easily top in 1996-2000 and just behind the UK in second place in 1991-95. In genetics and infection, Austria was placed second overall, behind Switzerland. It was in third place in eight other sub-fields: biochemistry & molecular biology, gerontology, haematology, immunology & allergology, pathology, pharmacology & toxicology, renal medicine and surgery. Several of these sub-fields are quite basic, so even though Austria's output tends to be more in the clinical sub-fields, it is still publishing some of its basic work in high-impact journals.

There is a small but positive correlation between Austria's ranking on PIC and its ranking on RL, but there are several notable exceptions, notably the three sub-fields in which Austrian papers have the best PIC ranking (dermatology & venereology, genetics and infection). In all of these it was doing the most clinical work of the six countries.

3.4 Citation scores

The charts in Annex 5 show the results for all seven years, 1991-97, together. It should be noted that although citations were determined to all the Austrian papers, they were only found for samples of 200 for the other five countries in order to save costs. Although they are likely to be quite representative, fewer differences between countries will be statistically significant, although some are. Overall, Austrian rankings are rather similar to those for PIC rankings, and the "average" ranking is about fourth. Once again, dermatology & venereology is outstanding. Three sub-fields (biochemistry & molecular biology, cell biology and human genetics) have Austria in second place, and seven (genetics, immunology & allergology, infection, oncology, pathology, pharmacology & toxicology, and tropical medicine) show it in third place.

The ranking of Austria in terms of citation category is positively associated with its overall ranking on PIC, see Figure 3.1.

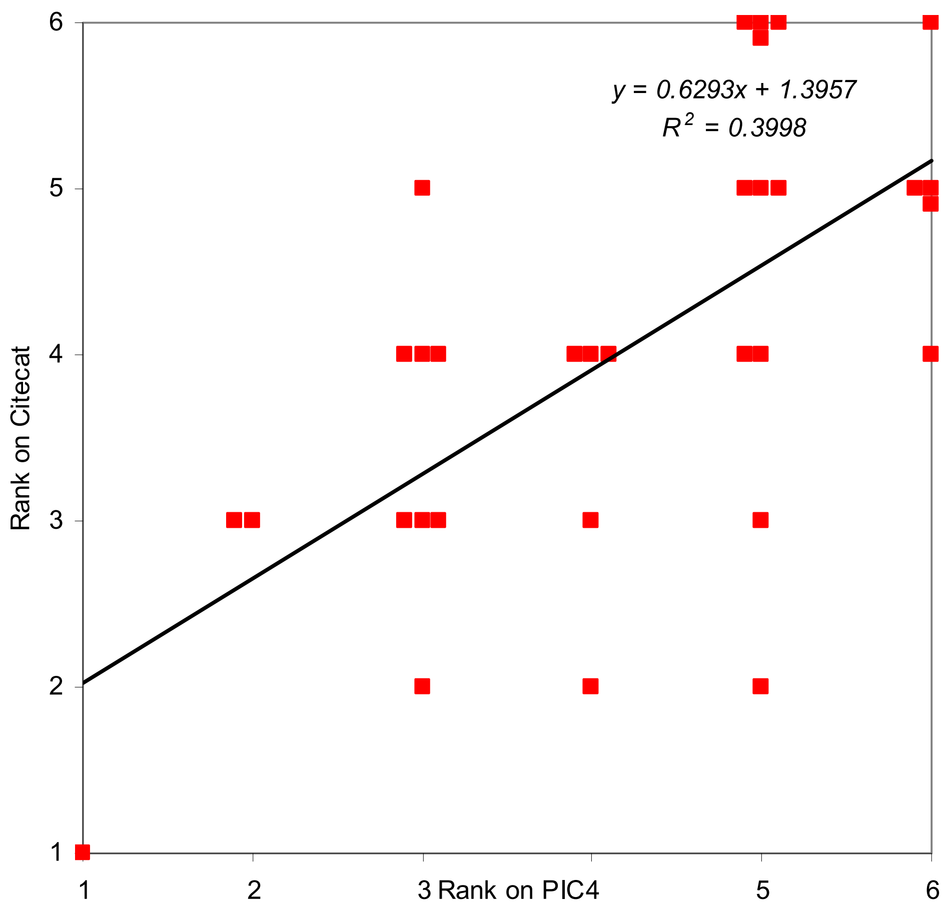

Figure 3.1 Correlation between Austria's ranking among six countries in 32 biomedical sub-fields on citation category (citecat) for 1991-97 papers and on potential impact

category of journals (PIC) for 1991-2000 papers. Each spot represents the result for one sub-field.

3.5 Statistical comparison of Austria and other countries

The results presented above show the ranking of Austria on three criteria but it is necessary to examine how robust the findings are. If two groups of papers have different distributions of a parameter, *e.g.*, PIC, how likely is it that they could be samples from the same population? The χ^2 test, with three or five degrees of freedom, can be applied to the distributions of papers by PIC, and of citation categories (with all citations over 40 being combined into one category). The main interest here is in whether the Austrian ranking in PIC or citation category, relative to its immediate rivals above and below, is in fact significant.

Table 3.2 Comparison of Austrian rankings on PIC and tests of statistical significance with adjacent countries. Degree of significance: n.s. = not significant (> 5%); 1 = < 5%, 2 = < 1%, 3 = < 0.1%, 4 = < 0.01%.

Code	*Rank*	*Higher*	*Sign*	*Lower*	*Sign*	*Code*	*Rank*	*Higher*	*Sign*	*Lower*	*Sign*
ANAPH	6	SE	4			IMMAL	3	UK	4	DE	4
ANEST	5	SE	n.s.	DE	4	INFEC	2	CH	4	DE	4
ARTHR	5	IL	4	DE	2	MENTH	4	IL	n.s.	CH	2
BCMBI	3	IL	4	DE	1	NEUSC	6	SE	4		
BIENG	6	IL	n.s.			OBSGY	5	IL	4	DE	4
CARDI	5	IL	4	DE	2	ONCOL	5	IL	3	DE	4
CHILD	5	IL	4	DE	n.s.	OPHTH	6	CH	3		
CYTHI	4	UK	3	DE	n.s.	OTORH	6	IL	1		
DENTA	5	IL	2	UK	2	PATHO	3	SE	4	UK	4
DERMA	1			UK	4	PHATO	3	CH	n.s.	IL	3
ENDOC	5	IL	4	DE	3	PUBEP	4	SE	4	IL	n.s.
GASTR	4	SE	4	DE	4	RADIO	5	SE	n.s.	DE	3
GENET	2	CH	4	UK	1	RENAL	3	UK	4	DE	n.s.
GERON	3	SE	3	CH	4	RESPI	5	IL	4	DE	4
HAEMA	3	UK	4	IL	n.s.	SURGE	3	UK	4	DE	4
HUGEN	5	SE	2	DE	1	TROPM	4	UK	1	IL	2

For most of the PIC rankings, the differences between Austrian and adjacent countries are highly statistically significant. For example, in arthritis research (ARTHR), Austria is ranked fifth, above Germany ($p < 1\%$) and below Israel ($p < 0.01\%$). However the differences in citation categories are mostly not significant because only samples of 200 papers from the other countries have been taken. Usually, there is a significant difference between the countries at either end of the tables but not between adjacent ones. Thus in immunology & allergology, Austria's citation performance is not significantly different from that of the UK (higher), or Germany and Sweden (lower), but it is inferior to that of Switzerland ($p < 0.01\%$ or degree 4 in the above table) and superior to that of Israel ($p < 1\%$ or degree 2). In dermatology & venereology, Austria's sub-field of highest relative impact, it has a citation performance significantly superior to that of Germany ($p < 5\%$ or degree 1) and Israel ($p < 0.01\%$ or degree 4).

3.6 Conclusions to chapter 3

The above analysis has shown the following:

- Austrian biomedical outputs are more polarised in terms of numbers of papers than those of the five comparator countries: Switzerland, Germany, Israel, Sweden and the UK. Of 32 sub-fields, Austria shows relatively the highest commitment to eight and the least to six others.

- Austrian biomedical research is very clinical. Of the six countries it publishes the most clinical work in 19 of the sub-fields and the next most clinical work in a further eight.

- The potential impact of Austrian research is somewhat higher ranked than its clinical character would suggest, averaging fourth place. In dermatology & venereology Austria is ranked first and its standing is improving with time. It is ranked second in genetics and infection research.

- Rankings based on citations to Austrian research and to samples of papers from the five comparator countries are somewhat similar to those based on the potential impact category analysis. Again, Austria is placed first in dermatology & venereology but the sample sizes of the other countries were not large enough to confirm that this result was statistically significant. Austria lies in second place in terms of citations in biochemistry & molecular biology, cell biology and human genetics.

4 AUSTRIAN BIOMEDICAL RESEARCH INSTITUTIONS

4.1 Methodology and classification of institutions

The work of classification of all the Austrian addresses was carried out by the BMBWK in Vienna as they had specialist knowledge of the different types of institution. For some papers, with rather sparse addresses, it was necessary for them to examine the list of authors in order to identify the individual institution, particularly for some university departments. The addresses were coded in up to five parts, see Annex 1.2. The first part indicated the main sector, of which there were six:

- Austrian Academy of Sciences
- Companies (big pharma, startup, other)
- Hospitals (Länder, city, private, religious, insurance)
- Ludwig Boltzmann Society (academic host, hospital host, other host)
- Universities (13, but only nine had significant output)
- Other institutions

The second part of the code designated one of the nine Länder (or the university), and the third part was usually the sub-category of institution, shown in parentheses above, or the type of faculty (medicine, science) in a university. The fourth part of the code normally identified the individual institution and the fifth part was used for different purposes. All the codes were concatenated so that they could be filtered and papers identified that emanated from each of the sectors or institutions selected for analysis.

4.2 Outputs of main sectors, Länder, universities and hospitals

The analysis of outputs in the two quinquennia by sector is shown in Table 4.1. The sectors have been partially sub-divided and the percentages of all Austrian papers for the quinquennium are shown. The outputs of the six sectors, year-by-year (shown as three-year moving averages) are presented graphically in Figure 4.1. Table 4.2 gives the results analysed by Länder (including the university outputs) and Table 4.3 gives the outputs of individual universities. The leading hospitals have been identified and they and their outputs are listed in Table 4.4.

Table 4.1 Outputs of Austrian biomedical papers from main sectors and sub-sectors, 1991-95 and 1996-2000 (integer counts).

Sector	*Total*	*91-95*	*%*	*96-00*	*%*	*Ratio*
All papers	**26757**	**11004**	***100.0***	**15753**	***100.0***	**1.43**
Universities	22220	8931	*81.2*	13289	*84.4*	1.49
Medical faculties	17451	7030	*63.9*	10421	*66.2*	1.48
Science faculties	3771	1506	*13.7*	2265	*14.4*	1.50
Hospitals	4054	1813	*16.5*	2241	*14.2*	1.24
City	1957	878	*8.0*	1079	*6.8*	1.23
Länder	1098	488	*4.4*	610	*3.9*	1.25
Religious	554	248	*2.3*	306	*1.9*	1.23
Private	499	196	*1.8*	303	*1.9*	1.55
Insurance	431	215	*2.0*	216	*1.4*	1.00
Companies	1780	859	*7.8*	921	*5.8*	1.07
Big pharma	1559	787	*7.2*	772	*4.9*	0.98
Start-ups/biotech	106	34	*0.3*	72	*0.5*	2.12
Medical technology	45	11	*0.1*	34	*0.2*	3.09
Other	90	35	*0.3*	55	*0.3*	1.57
Ludwig Boltzmann Society	1749	719	*6.5*	1030	*6.5*	1.43
Academic hosts	977	397	*3.6*	580	*3.7*	1.46
Hospital hosts	684	290	*2.6*	394	*2.5*	1.36
Other	110	46	*0.4*	64	*0.4*	1.39
Austrian Academy of Sciences	697	299	*2.7*	398	*2.5*	1.33
Other institutions	970	391	*3.6*	579	*3.7*	1.48

This table shows that universities have not only been the main contributors to Austrian biomedical research outputs, but that their contribution has grown over time. That of hospitals has grown modestly, but that of companies has remained almost static, especially the output of big pharmaceutical companies. The outputs of the Ludwig Boltzmann Society, those of the Austrian Academy of Sciences, and other research institutions, have approximately kept pace with the overall expansion of Austrian biomedical research. The dominance of the universities is shown graphically in Figure 4.1.

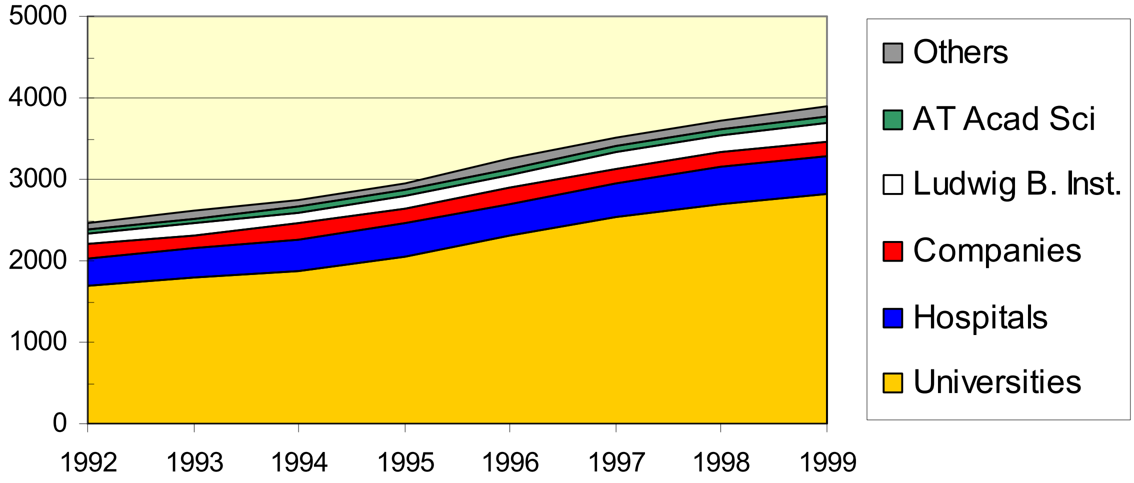

Figure 4.1 Main Austrian sectors contributing to Austrian biomedical research outputs, 1991-2000 (three-year running means).

Table 4.2 Contributions of the nine Länder to Austrian biomedicine (integer counts), 1991-2000.

Land	*Total*	*91-95*	*%*	*96-00*	*%*	*Ratio*
Wien	16136	6563	*59.6*	9573	*60.8*	1.46
Tyrol	4949	2053	*18.7*	2896	*18.4*	1.41
Styria	4554	1865	*16.9*	2689	*17.1*	1.44
Salzburg	1284	512	*4.7*	772	*4.9*	1.51
Upper Austria	889	412	*3.7*	477	*3.0*	1.16
Lower Austria	583	246	*2.2*	337	*2.1*	1.37
Carinthia	370	148	*1.3*	222	*1.4*	1.50
Voralberg	166	73	*0.7*	93	*0.6*	1.27
Burgenland	45	22	*0.2*	23	*0.1*	1.05

The table above (4.2) shows the contributions of the nine Länder and that Vienna dominates Austrian biomedical production. With the two other medical schools in Innsbruck and Graz, it accounts for about 85% of total production. There are not great differences between the Länder in the expansion of their outputs, although Burgenland and Upper Austria have increased their outputs the least and Salzburg and Carinthia, the most. Table 4.3 lists the universities and faculties with their outputs in each quinquennium.

Table 4.3 Outputs of Austrian biomedical papers from its universities, 1991-95 and 1996-2000 (integer counts).

University and faculty	*Total*	*91-95*	*%*	*96-00*	*%*	*Ratio*
Vienna University	11935	4699	*42.7*	7236	*45.9*	1.54
Medical faculty	10437	4096	*37.2*	6341	*40.3*	1.55
Science faculty	1703	654	*5.9*	1049	*6.7*	1.60
Other	19	7	*0.1*	12	*0.1*	1.71
University Innsbruck	4778	2001	*18.2*	2777	*17.6*	1.39
Medical faculty	4259	1778	*16.2*	2481	*15.7*	1.40
Science faculty	586	255	*2.3*	331	*2.1*	1.30
Other	12	5	*0.0*	7	*0.0*	1.40
University Graz	4113	1696	*15.4*	2417	*15.3*	1.43
Medical faculty	3258	1335	*12.1*	1923	*12.2*	1.44
Science faculty	1026	423	*3.8*	603	*3.8*	1.43
Other	40	9	*0.1*	31	*0.2*	3.44
Univ of Agricultural Sciences, Vienna	593	203	*1.8*	390	*2.5*	1.92
Graz Univ of Technology	561	221	*2.0*	340	*2.2*	1.54
Univ of Salzburg	544	208	*1.9*	336	*2.1*	1.62
Univ of Veterinary Medicine, Vienna	417	119	*1.1*	298	*1.9*	2.50
Vienna Univ of Technology	365	165	*1.5*	200	*1.3*	1.21
Univ of Linz	176	72	*0.7*	104	*0.7*	1.44
Univ of Klagenfurt	19	14	*0.1*	5	*0.0*	0.36
Leoben Univ of Mining + Metallurgy	8	1	*0.0*	7	*0.0*	7.00
Vienna Univ of Econ. + Bus. Admin.	6	1	*0.0*	5	*0.0*	5.00

The last table in this section (4.4) lists the 11 leading hospitals with their outputs in the two quinquennia. Evidently, there is significant variation in how much their output has changed, some publishing fewer papers in the second quinquennium and some many more.

Table 4.4 Leading Austrian hospitals and their biomedical research production, 1991-2000, integer counts.

Hospital	*Total*	*91-95*	*%*	*96-00*	*%*	*Ratio*
LKH Salzburg (St Johanns Spital)	454	182	1.65	272	1.73	1.49
KH der Stadt Wien Lainz	438	220	2.00	218	1.38	0.99
St Anna Kinderspital	386	152	1.38	234	1.49	1.54
Krankenanstalt der Stadt Wien Rudolfsstiftung	292	137	1.25	155	0.98	1.13
Wilhelminenspital der Stadt Wien	283	116	1.05	167	1.06	1.44
Hanusch-KH Wien	190	105	0.95	85	0.54	0.81
Donauspital im SMZ-Ost der Stadt Wien	182	57	0.52	125	0.79	2.19
Kaiser-Franz-Josef-Spital der Stadt Wien	166	79	0.72	87	0.55	1.10
A.ö. LKH Klagenfurt	146	53	0.48	93	0.59	1.75
A.ö. KH der Stadt Linz	142	77	0.70	65	0.41	0.84
A.ö. KH der barmh. Schwestern vom heiligen Kreuz Wels	104	44	0.40	60	0.38	1.36

4.3 Main sectors and medical schools: international collaboration

In section 1.5, Austrian international collaboration was examined. It is of interest to see which types of institution are undertaking this activity.

Table 4.5 Austrian biomedical papers from different sectors and propensity to collaborate internationally, 1991-95 and 1996-2000.

Sector	*91-95*	*Int'l*	*%*	*96-00*	*Int'l*	*%*
All papers	11004	3744	*34*	15753	6411	*41*
Univ. medical faculties	7030	2090	*30*	10421	3782	*36*
Univ. science faculties	1506	561	*37*	2265	1050	*46*
Hospitals	1813	370	*20*	2241	655	*29*
Companies	859	481	*56*	921	507	*55*
Ludwig Boltzmann Society	719	202	*28*	1030	366	*36*
Austrian Academy of Sciences	29	143	*48*	398	182	*46*
Other institutions	391	150	*38*	579	264	*46*

The companies are the most likely to collaborate internationally, followed by the Austrian Academy of Sciences, although for both the rate has slightly declined which contrasts with the situation of the other sectors where it has increased substantially. Collaboration appears to be more likely in scientific topics than in clinical ones.

Maps can be made of the amount of collaboration with nearby countries by the three universities with medical schools: Graz, Innsbruck and Vienna. These are shown in Figures 4.2, 4.3 and 4.4 respectively. The circles have area proportional to the annual outputs of papers and the connecting lines have width proportional to the Salton Index of co-operation (see section 1.5).

It is clear that all three universities collaborate much more with Germany than with any other country, followed by Switzerland. There is some evidence of preferential collaboration with countries in close proximity[12]. Thus the university working most with the Czech Republic (CZ) and with Hungary (HU) is Vienna; Graz works most closely with Slovenia (SI) and Croatia (HR); and Innsbruck leads in collaboration with Italy (IT).

[12] Bordons M, Gomez I, Fernandez MT, Zulueta MA and Mendez A (1996) Local, domestic and international scientific collaboration in biomedical research *Scientometrics*, vol 37 no 2, pp 279-295.

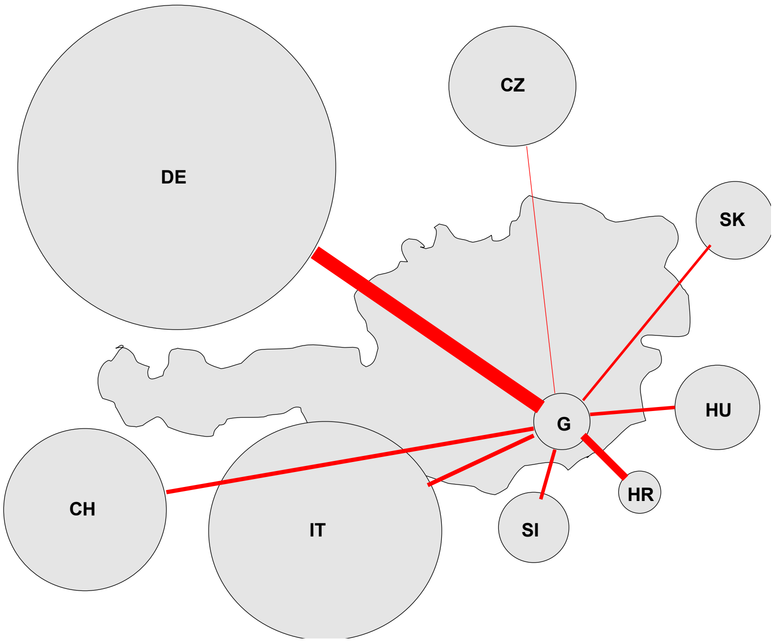

Figure 4.2 International collaboration of the University of Graz with neighbouring countries in biomedical research, 1991-2000

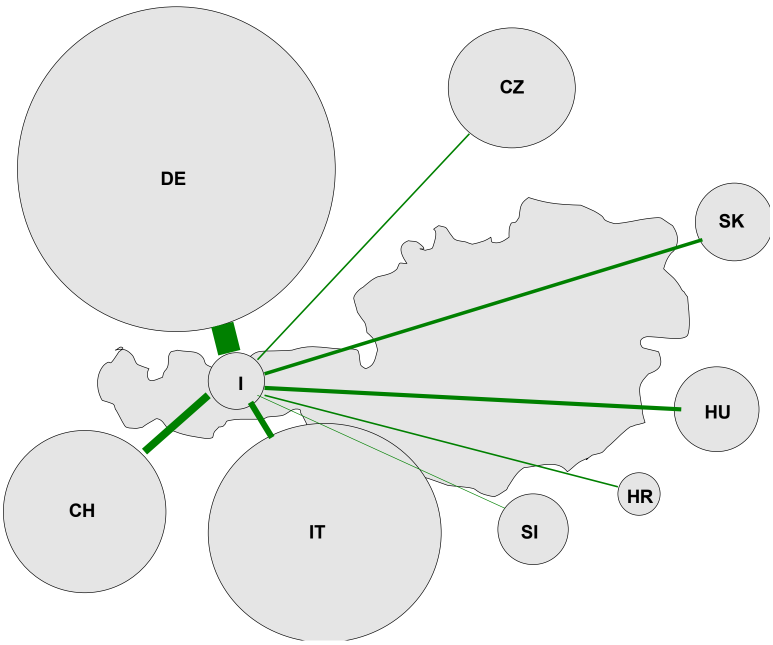

Figure 4.3 International collaboration of the University of Innsbruck with neighbouring countries in biomedical research, 1991-2000

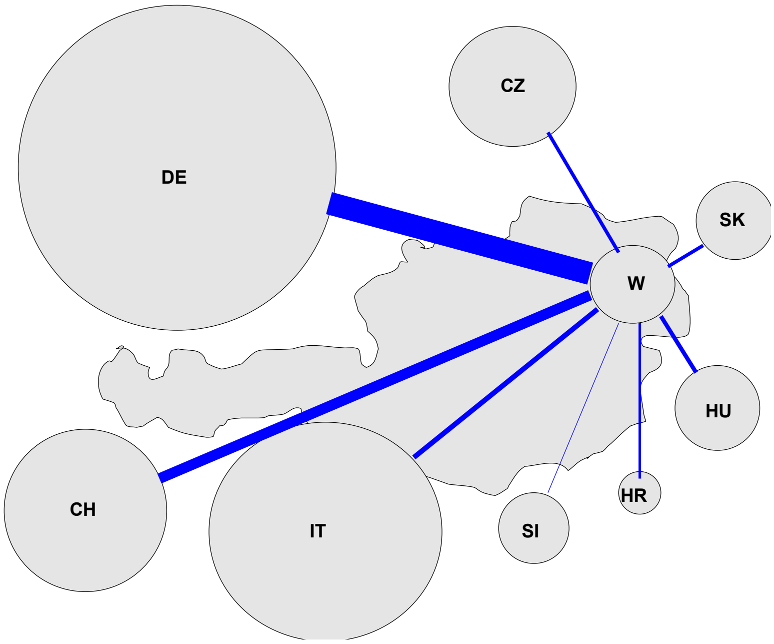

Figure 4.4 International collaboration of the University of Vienna with neighbouring countries in biomedical research, 1991-2000

4.4 Sectoral participation in individual biomedical sub-fields

The outputs in each quinquennium are tabulated in Tables A2.9 and A2.10 of Annex 2. The outputs of eight sectors (including three groups of faculties: medicine, science and others at universities) are shown in chart form, with correction factors for each sub-field applied, in Figures A2.9, A2.10, A2.11 and A2.12 for four groups of eight sub-fields. It is very clear that the output in all the sub-fields is dominated by that of the medical faculties. However some other types of institution show strengths in certain sub-fields. Tables 4.6 and 4.7 show the 12 leading sub-fields for the university faculties & hospitals; and for companies, the Ludwig Boltzmann Society, the Austrian Academy of Sciences and other institutions, respectively.

Table 4.6 Biomedical sub-fields of primary concern to Austrian medical faculties, science faculties, other university faculties and hospitals, 1991-2000

Medical fac's	%	*Science fac's*	%	*Other fac's*	%	*Hospitals*	%
DENTA	88.2	BCMBI	33.4	INFEC	10.3	ARTHR	29.8
ANEST	87.1	PHATO	27.3	BIENG	9.5	SURGE	27.3
RENAL	84.7	ANAPH	23.0	BCMBI	8.8	ONCOL	26.2
OPHTH	82.7	GENET	19.4	GENET	5.6	CHILD	26.1
OTORH	82.4	NEUSC	18.8	TROPM	3.2	RADIO	25.9
CHILD	82.0	CYTHI	17.4	ANAPH	2.7	PUBEP	24.5
PUBEP	81.7	HUGEN	13.8	NEUSC	1.6	GERON	23.7
SURGE	81.4	INFEC	13.6	MENTH	1.3	HAEMA	23.3
OBSGY	81.3	PATHO	9.7	DERMA	1.0	RESPI	22.9
TROPM	81.1	ENDOC	9.7	GERON	0.7	GASTR	22.5
RADIO	80.6	BIENG	9.3	CYTHI	0.6	OTORH	21.7
GASTR	79.7	TROPM	7.8	PUBEP	0.3	OBSGY	19.8

Table 4.7 Biomedical sub-fields of primary concern to Austrian companies, the Ludwig Boltzmann Society (LBS), the Austrian Academy of Science (AAS) and other institutions, 1991-2000

Companies	%	*L B S*	%	*A A S*	%	*Others*	%
GENET	15.9	ARTHR	21.5	CYTHI	6.6	PUBEP	6.6
CYTHI	15.6	GERON	13.8	GERON	6.1	RADIO	6.6
IMMAL	15.4	BIENG	12.9	BCMBI	5.5	PHATO	6.2
BCMBI	15.3	ANEST	9.8	PATHO	5.1	MENTH	6.1
INFEC	12.4	INFEC	9.4	IMMAL	4.8	TROPM	5.5
HAEMA	11.1	RADIO	9.2	ENDOC	4.4	BIENG	4.1
PHATO	9.4	MENTH	8.6	CARDI	4.0	INFEC	3.9
HUGEN	8.0	NEUSC	8.4	HUGEN	3.6	GENET	3.3
ARTHR	7.8	RESPI	8.1	OBSGY	3.6	RESPI	3.1
DERMA	7.3	IMMAL	7.9	NEUSC	3.5	DERMA	3.1
ONCOL	6.8	ENDOC	7.7	GENET	2.7	OBSGY	2.9
RESPI	4.2	HAEMA	7.6	INFEC	1.9	HUGEN	2.9

4.5 Research levels of papers from different sectors

The above tables suggest that the different sectors will be doing rather different levels of research, some quite basic and some mostly clinical. Figure 4.5 shows that this is so. The most basic work is being done by the four science faculties (Graz, Innsbruck, Salzburg and Vienna). Next comes the work by companies and from the Austrian Academy of Sciences, then "others", the Ludwig Boltzmann Society, the three medical schools and finally the hospitals, most of whose work is clinical as would be expected. For most institution types, as for Austria as a whole, there has been little difference in the distribution of research levels between the two quinquennia, but there are two exceptions: the Ludwig Boltzmann Society and hospitals, both of whose output has become significantly more basic (for both, $p < 0.01\%$).

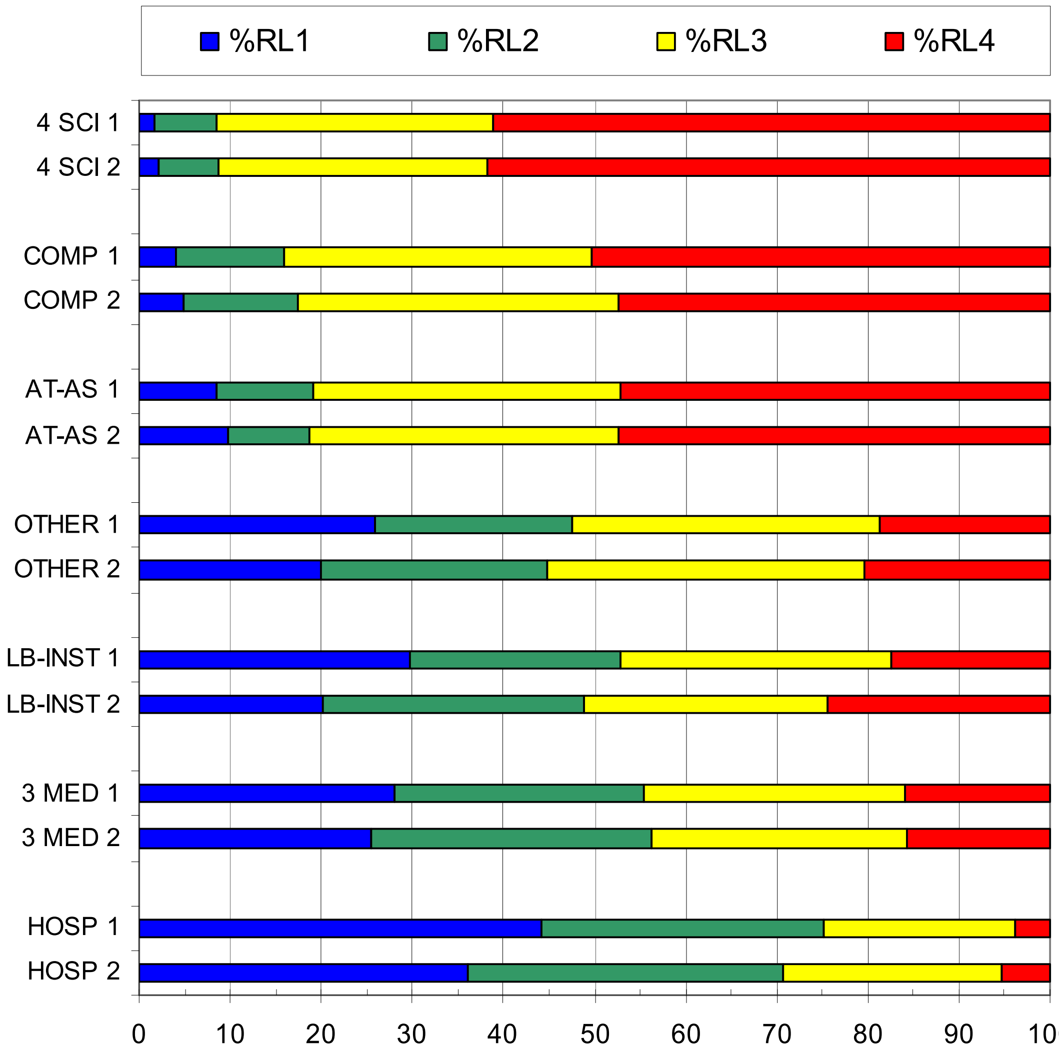

Figure 4.5 Distribution of Austrian biomedical papers by research level (RL: 1 = clinical, 4 = basic) for different types of institution: 1 = 1991-95, 2 = 1996-2000.

However the grouping of all three medical schools together conceals substantial differences between Graz and Vienna, which tend to do rather clinical work, and Innsbruck, whose output is much more basic, see Figure 4.6. The work at Innsbruck is becoming somewhat more clinical ($p < 0.1\%$) while that in Vienna is becoming more basic ($p < 0.01\%$).

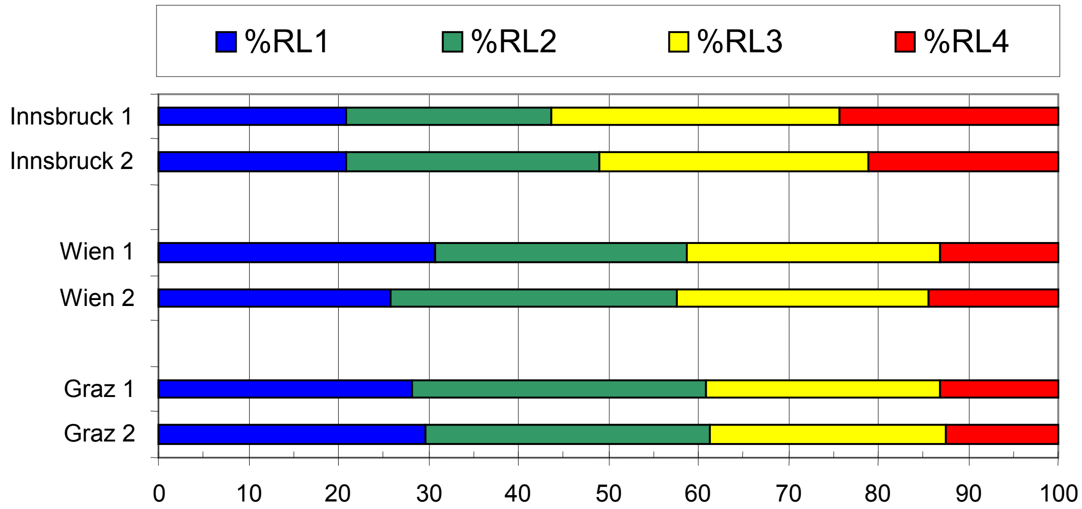

Figure 4.6 Distribution by research level of papers from Austrian medical schools.

4.6 Potential impact categories of papers from different sectors

Figure 4.7 shows the comparable data on PIC for the different types of institution as Figure 4.5 for research levels.

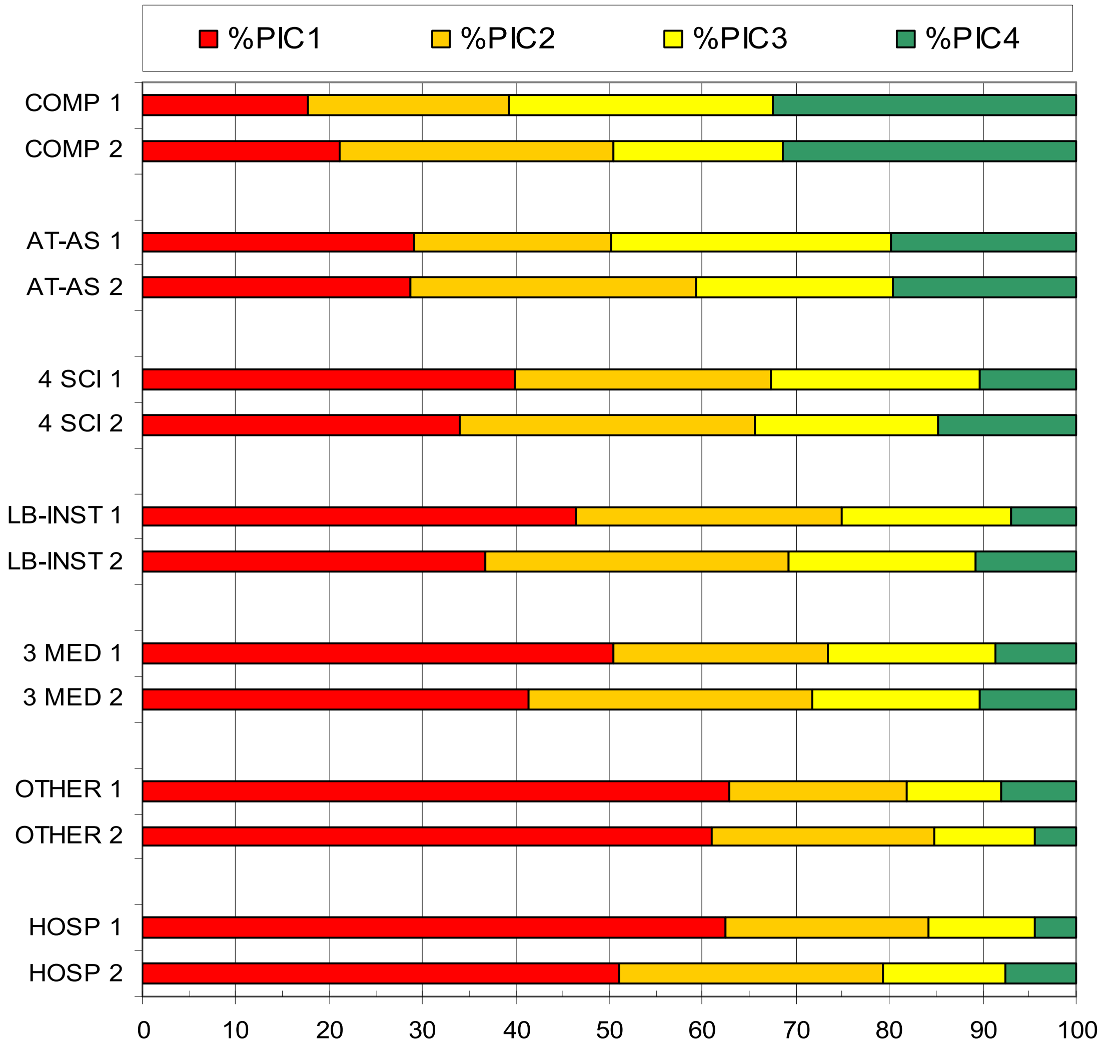

Figure 4.7 Distribution of Austrian biomedical papers by potential impact category (PIC: 1 = low, 4 = high) for different types of institution: 1 = 1991-95, 2 = 1996-2000

The ranking of the institutions has some resemblance to that of Figure 4.5, but companies are seen to publish papers in journals of the highest impact, and the work of the four scientific faculties is in lower-rated journals. All the differences in PIC distribution between adjacent institutions are statistically significant, most of them highly so ($p << 0.01\%$). There has been a notable, and statistically highly significant, improvement in PIC values for all types of institutions except companies, whose output has declined in potential impact ($p < 0.001\%$).

As with the RL distributions, the grouping of universities conceals big differences between them in terms of the PICs of their papers. Figure 4.8 shows these for the 12 individual faculties.

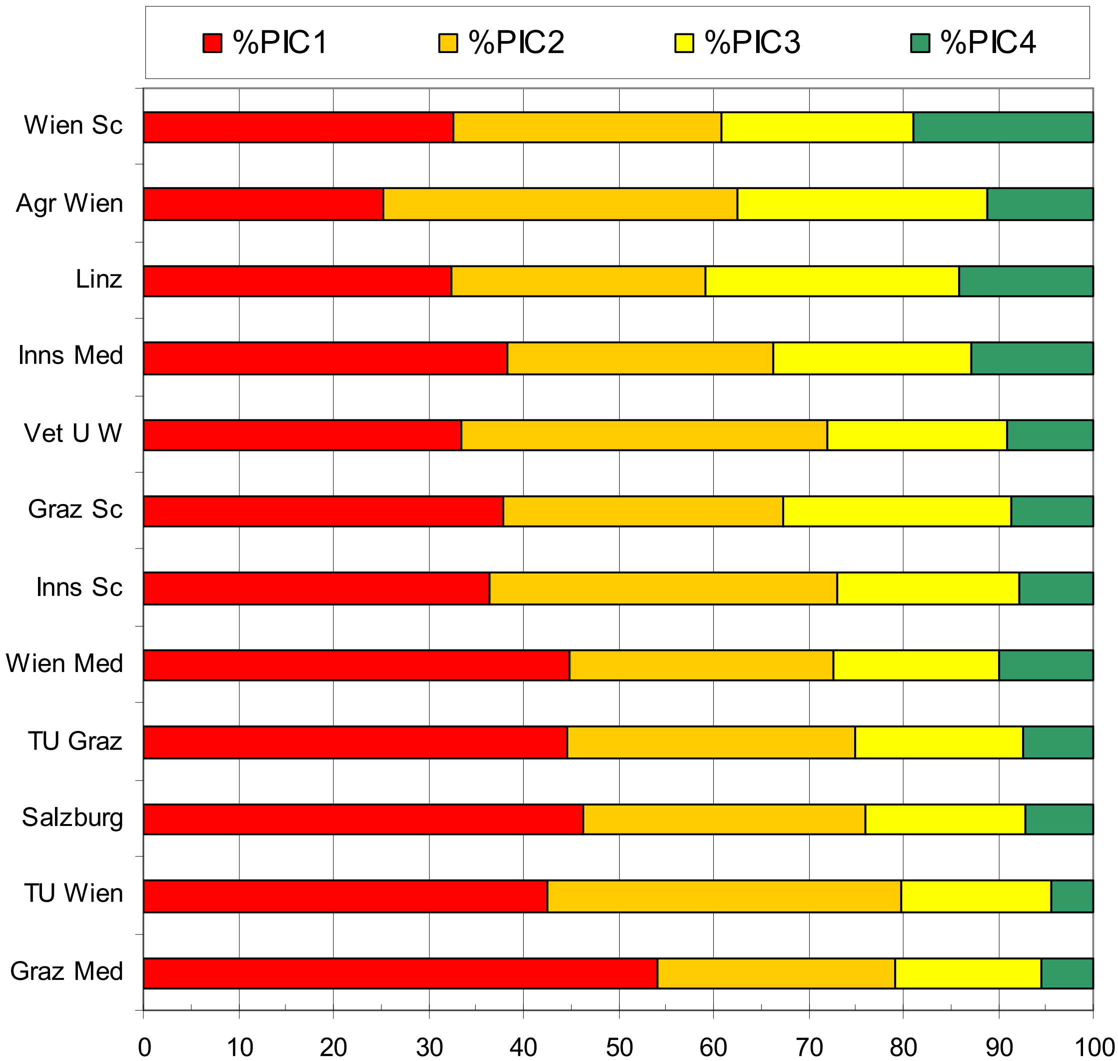

Figure 4.8 Distribution of potential impact category (PIC: 1 = low, 4 = high) for papers from the 12 Austrian university faculties: 1 = 1991-95, 2 = 1996-2000

Many of the differences in PIC distribution between the universities are statistically significant. Thus, among the medical schools, Innsbruck ranks higher than Vienna which is in turn higher than Graz; both differences are highly significant ($p << 0.01\%$). Among the science faculties, Vienna is decidedly in first position, followed by Innsbruck, which is only a little ahead of Graz, with Salzburg in fourth place.

There has been an improvement in potential impact for virtually all the faculties, most notably the Veterinary University of Vienna (p < 1%). The small decline in the potential impact of papers from the Graz science faculty is not significant, but the improvements in PIC of all three medical schools are highly significant (p < 0.1%). The reasons for these increases in PIC will be discussed in the next two chapters.

4.7 Citations to papers from different sectors

Figure 4.9 shows the distribution of papers (1991-97 only) between citation categories (see section 2.6 and Figure 2.8) for the different types of Austrian institution.

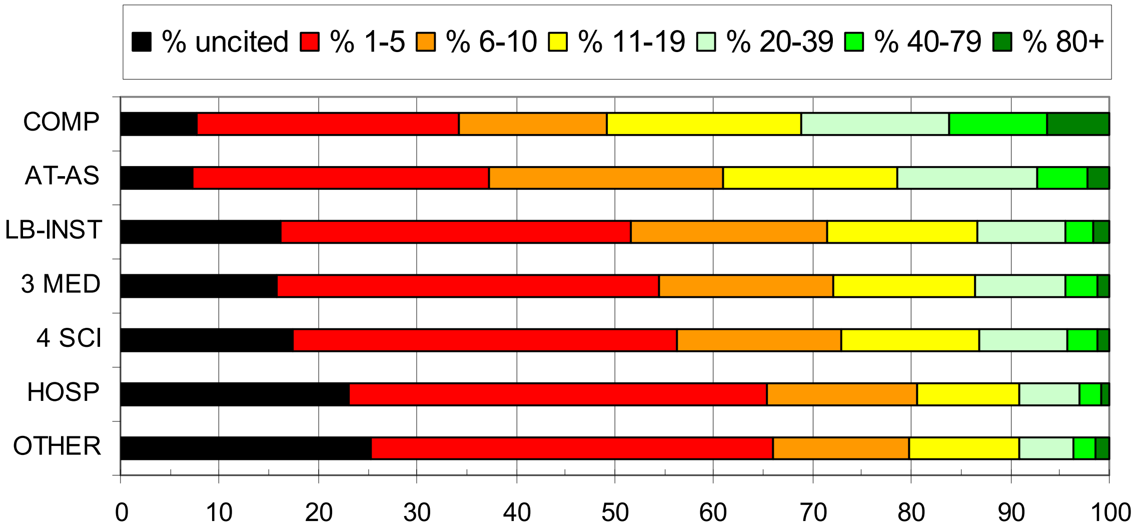

Figure 4.9 Distribution of Austrian biomedical papers 1991-97 by citation category (5-year counts) for different types of institution.

Comparison of this figure with Figure 4.7 shows that companies are again ranked highest, followed by the Austrian Academy of Sciences. However the four science faculties receive fewer citations for their papers than do the three medical faculties, contrary to what would have been expected from the journals in which they are published. The difference in citation category distributions is statistically significant (p < 2%).

There is, in fact, a very close association between these two indicators, which is explored in Figure 4.10. This plots "mean citecat", or citation category (see section 2.6 and Figure 2.9) against "mean PIC". Once again the correlation is excellent, as it was for the different sub-fields. This figure shows that the science faculties lie below the trendline, and the Ludwig Boltzmann Society, with the medical faculties, lies slightly above it.

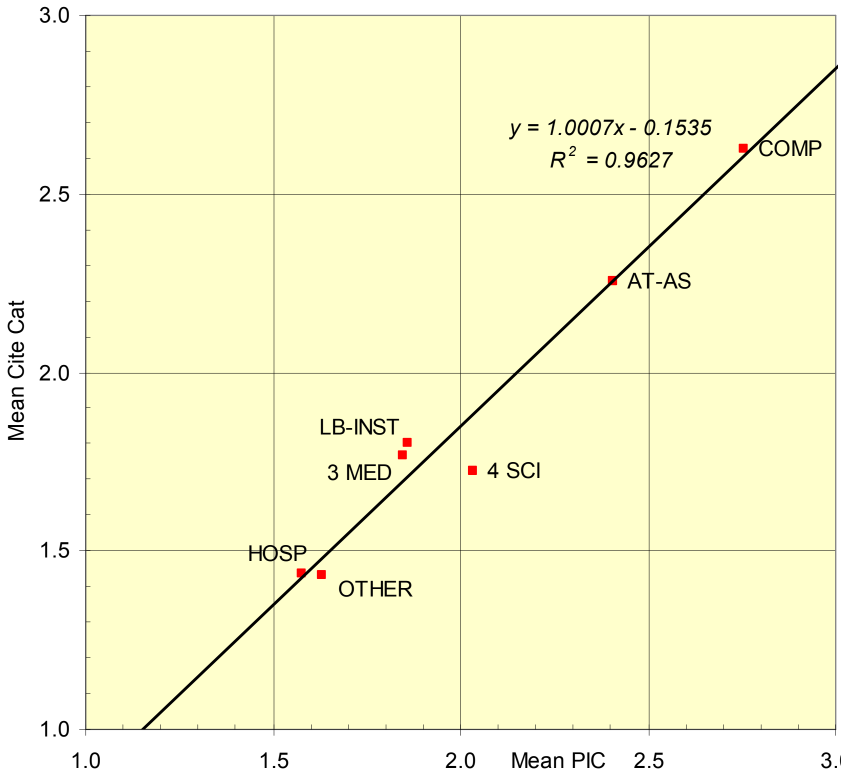

Figure 4.10 Scatter plot of "mean citation category" against "mean PIC" for different types of Austrian research institutions, 1991-97

The citation standing of the individual university faculties is shown in Figure 4.11. The ranking of the three medical faculties is clear: Innsbruck is ahead of Vienna which is ahead of Graz, the differences both being highly significant ($p << 0.01\%$). However the ranking of the science faculties is less definitive. Although Graz is statistically differentiated from the second-ranked faculty, Vienna ($p < 0.1\%$), the latter is only slightly ahead of Salzburg ($p < 5\%$) and this in turn is not significantly ahead of Innsbruck. So the three universities with both medical and science faculties rank in reverse order for their outputs in terms of citation categories.

There is an association between PIC and citation category for the universities, but it is less strong than for the different types of institution, see Figure 4.12. Some faculties are above the trend line, notably the Graz science faculty and the Technical University at

Graz, indicating that their papers receive more citations than would be expected from the journals in which they publish. Conversely, some are below the trend line and receive fewer citations than expected, *e.g.*, the Technical University in Vienna and the Innsbruck science faculty.

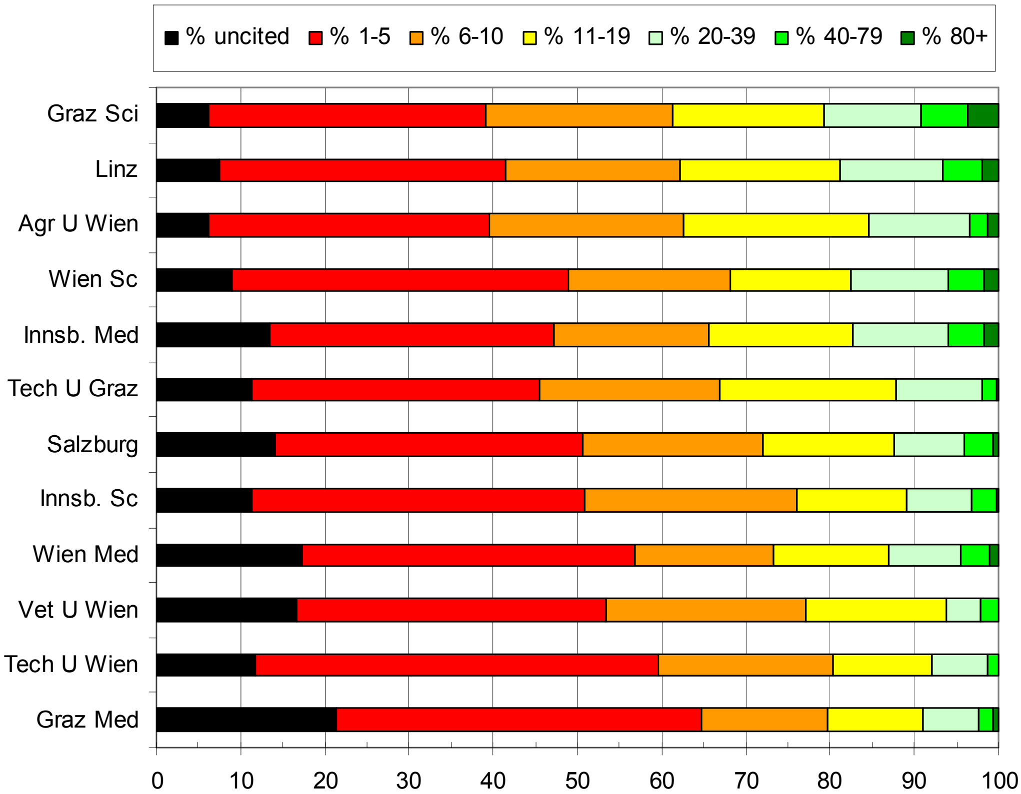

Figure 4.11 Distribution of Austrian biomedical papers 1991-97 by citation category (5-year counts) for different university faculties.

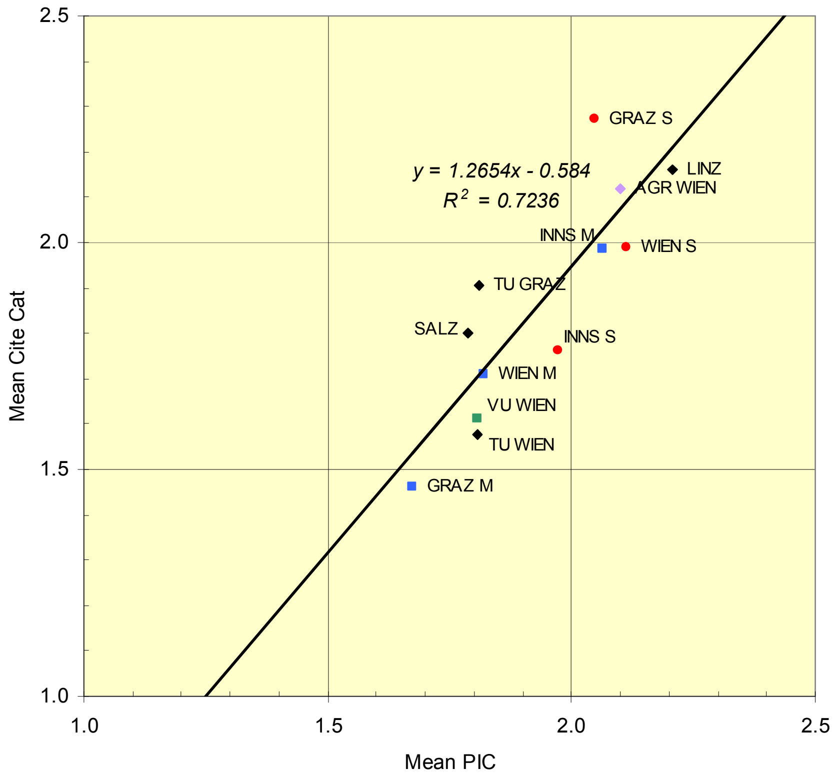

Figure 4.12 Scatter plot of "mean citecat" against "mean PIC" for different faculties, 1991-97

4.8 Summary of chapter 4

The above analysis has shown the following:

- Austrian biomedical output is dominated by that of the three medical faculties (Graz, Innsbruck and Vienna) who publish almost two thirds of all the papers and whose overall presence has increased. Science faculties and hospitals each account for about one seventh of the total; companies and the Ludwig Boltzmann Society publish about 7% each.

- Among the nine Länder, Vienna dominates with 60% of Austrian output, followed by Tyrol (18%) and Styria (17%). Most Länder have increased their output at similar rates over the decade, with a 43% increase between 1991-95 and 1996-2000.

- Among the medical faculties, Vienna has the most output (nearly 40% of the Austrian total), followed by Innsbruck (16%) and Graz (12%). Its science faculty is also the largest in biomedical output with 6% of the total, compared with 4% at Graz, and 2% at Innsbruck and Salzburg. The leading hospitals were St Johanns Spital in Salzburg and KH der Stadt Wien Lainz, each with about 1.7% of the Austrian total. Among company papers, those from "big pharma" decreased, while outputs from startups and biomedical companies, although few, expanded rapidly over the decade.

- The three leading universities collaborate internationally mostly with Germany but there are also relatively strong links with nearby countries: Graz with Slovenia and Croatia, Innsbruck with Italy and Vienna with the Czech Republic and Hungary. Companies are the institutions most likely to collaborate internationally, but the proportion of their output so co-authored has declined slightly whereas that of most other institutions has increased.

- The different institutions concentrate their efforts on different biomedical sub-fields. The medical faculties lead in dentistry and anaesthesia; the science faculties in biochemistry & molecular biology, and pharmacology & toxicology; and other faculties in infection and bioengineering. Hospitals concentrate most on arthritis, surgery, oncology and paediatrics. Companies work primarily on genetics, cell biology, immunology & allergology and biochemistry & molecular biology.

- The research of the science faculties, companies and the Austrian Academy of Sciences (AAS) is the most basic, and that of the hospitals the most clinical. Among the medical faculties, the work of Innsbruck is more basic than that of Graz and Vienna. The work of hospitals and the Ludwig Boltzmann Society is becoming somewhat more basic.
- The institutions publishing work in journals of the highest impact are companies, followed by the AAS and the science faculties. Hospitals' work is in the lowest impact journals. Among university faculties, science at Vienna is ranked highest and the Graz medical faculty the lowest.
- Citation scores of the different institutions are predicted rather well by their PIC distributions, with again companies, followed by the AAS, ranked highest, and other institutions and hospitals the lowest. However the highest-ranked university faculty was the science faculty at Graz, followed by Linz, and the lowest-ranked was the Graz medical faculty, followed by the Technical and Veterinary universities in Vienna. Innsbruck medical faculty papers were the most cited among those of medical schools.

5 THE FUNDING OF AUSTRIAN BIOMEDICAL RESEARCH

5.1 Methodology and classification of funding bodies

The Austrian biomedical papers were all looked up in London libraries to determine their funding, as given in their acknowledgements, or, for government and company laboratories, from their addresses. Funding bodies with many acknowledgements were given individual "trigraph" codes, *e.g.*, FFW = Austrian Science Foundation, OAW = Austrian Academy of Sciences, WHO = World Health Organization; others were given "generic" codes that connoted a country and an organisation category, such as government, private-non-profit, or a company.

The analysis covered both the number of funding bodies, F (which was often zero for work in hospitals and universities, it being assumed that such work was not explicitly funded by a research grant or contract), and their sector and identity. Five main sectors were used for the funding analysis:

- Austrian governmental: this includes ministries, agencies, Länder and cities, and the Austrian Academy of Sciences;
- Austrian private-non-profit: this includes collecting charities, endowed foundations, hospital own funds, academic own funds and other non-profit bodies, and the Ludwig Boltzmann Society;
- Industrial: this includes both pharmaceutical and non-pharmaceutical companies from all countries, and start-ups (mostly biotech companies);
- International: *e.g.*, the World Health Organization, the European Union and the International Atomic Energy Agency;
- Other: this includes foreign governmental and non-profit sources.

In addition, an analysis was made of papers with no funding acknowledgement.

Out of the 26 757 papers in the database, 25 969 were found and inspected (97%) and their funding sources entered to the database. Of these papers, 11 576 (45%) had no funding acknowledgement: this is rather higher than the corresponding figure (about 33%) for the UK's Research Outputs Database covering the same years[13].

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[13] Dawson G, Lucocq B, Cottrell R and Lewison G. (1998) *Mapping the Landscape: National Biomedical Research Outputs 1988-95*. The Wellcome Trust, London: ISBN 1869835-95-6.

5.2 Numbers of funding bodies

During the decade, the percentage of papers with one or more funding acknowledgements rose from 51% to 58%. The average number of funding bodies also increased, as shown in Table 5.1.

Table 5.1 Numbers of funding bodies acknowledged on Austrian biomedical research papers, 1991-2000.

F	*91-92*	*%*	*93-94*	*%*	*95-96*	*%*	*97-98*	*%*	*99-00*	*%*
0	1937	49.0	2001	46.2	2211	43.5	2667	44.0	2760	42.3
1	1083	27.4	1143	26.4	1326	26.1	1495	24.6	1629	25.0
2	483	12.2	635	14.7	743	14.6	888	14.6	970	14.9
3	242	6.1	279	6.4	407	8.0	500	8.2	528	8.1
4	99	2.5	146	3.4	214	4.2	237	3.9	296	4.5
5	58	1.5	63	1.5	94	1.8	128	2.1	177	2.7
6	34	0.9	31	0.7	43	0.8	69	1.1	76	1.2
7	4	0.1	20	0.5	23	0.5	31	0.5	43	0.7
8	4	0.1	6	0.1	13	0.3	17	0.3	17	0.3
9	5	0.1	8	0.2	5	0.1	17	0.3	12	0.2
10+	7	0.2	2	0.0	9	0.2	17	0.3	17	0.3
Total	3956		4334		5088		6066		6525	
Mean	*0.988*		*1.070*		*1.187*		*1.243*		*1.288*	

There is a big difference in funding acknowledgements between German-language and English-language papers. The former had funding acknowledgments on only 18.7%, or barely one paper in six, and the mean number of acknowledgments was only 0.23 per paper. This strongly suggests that the main funding bodies expect that the results of the research they fund will be published in English rather than German.

There is also, as would be expected, a difference between domestic and international papers, with the latter having a larger number of funders per paper (a mean of 2.03) and only 22% of papers without funding acknowledgements. These indicators are almost invariant with time. Domestic papers do show an increase in numbers of funders: for papers with just one Austrian address, this rises from 0.49 to 0.62, and for papers with two or more Austrian addresses, it rises from 0.68 to 0.80 funding acknowledgements per paper. It seems that a part of the increase in mean numbers of funding acknowledgements seen in Table 5.1 is due to the growing practice of collaboration, both nationally and internationally.

5.3 Analysis of main funding sectors

The numbers of papers in five two-year periods that acknowledged support from each sector, and from some leading funders within each sector, are shown in Table 5.2. This also gives the ratio of papers from 1996-2000 divided by those from 1991-95.

Table 5.2 Outputs of Austrian biomedical papers funded by main sectors and by leading funders within each one, 1991-2000, and ratio of 1996-2000 to 1991-95 papers.

Funding sector	*91-2*	*93-4*	*95-6*	*97-8*	*99-0*	Total	%	Ratio
All inspected papers	3956	4334	5088	6066	6525	25969	100.0	1.43
Austrian government	1050	1247	1624	1839	1933	7693	29.6	1.52
Austrian Fund for Sci Res	767	901	1162	1311	1336	5477	21.1	1.47
Austrian National Bank	148	185	238	383	506	1460	5.6	2.36
Ministry for Science	82	117	186	232	240	857	3.3	2.00
Austrian Academy of Sci	140	142	169	190	218	859	3.3	1.43
Vienna Mayor's Fund	77	88	121	102	99	487	1.9	1.22
Austrian private non profit	459	571	606	741	825	3202	12.3	1.44
Ludwig Boltzmann Society	311	330	349	437	500	1927	7.4	1.44
Industry	574	642	791	938	1003	3948	15.2	1.44
International organisations	76	103	189	330	484	1182	4.6	3.55
European Union	15	38	111	228	349	741	2.9	6.41
Other funders (foreign)	724	866	1129	1383	1584	5686	21.9	1.71
No funding acknowledged	1937	2001	2211	2667	2760	11576	44.6	1.32

During the decade the biggest changes in funding have been in the international component, especially the European Union, whose output has increased from 0.4% in 1991-92 to over 5% in the last two years. The Austrian National Bank and the Ministry for Science have also substantially increased their portfolios of research. Meanwhile, the percentage of papers without funding acknowledgements has fallen from 49% in 1991-92 to 42% in 1999-2000.

Data for the UK Research Outputs Database for the same decade show that the UK government supported 32% of papers, the UK private-non-profit sector 30%, industry 16%, international organisations 6% and other, foreign, sources, 18%, with 35% of papers not acknowledging any funding. By comparison, Austrian papers show a slightly lower government component, a much lower private-non-profit component, but a similarly-sized industrial sector in terms of support for biomedical research.

5.4 Variation of funding with sub-field and other input variables

Do the various funders of Austrian biomedical research concentrate on different subject areas or different research levels? Figure 5.1 shows the distribution of research levels for the main funding sectors and leading funding bodies identified in Table 5.2.

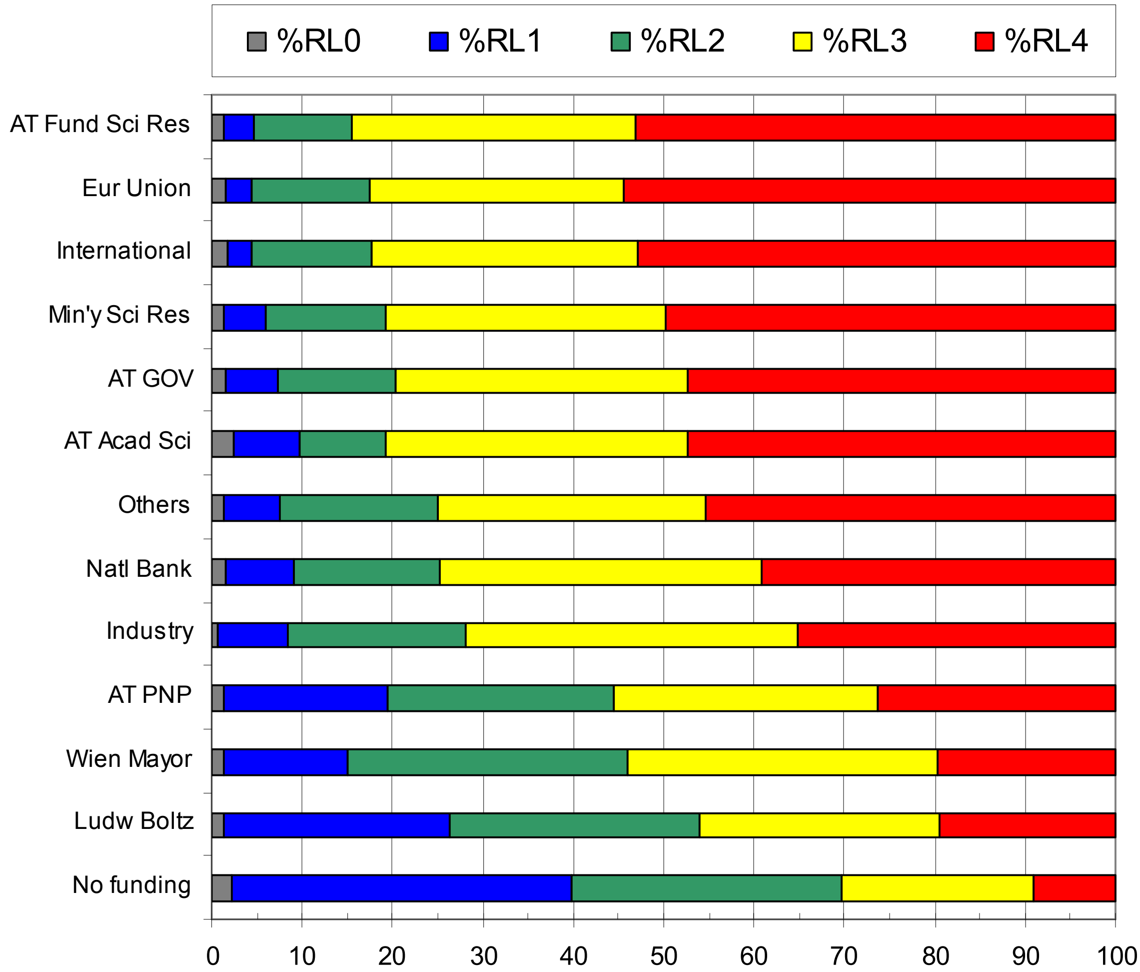

Figure 5.1 Distribution of research levels (1 = clinical, 4 = basic; 0 = not available) for Austrian biomedical papers funded by different sectors and sources, 1991-2000.

This shows that there is a marked difference between funders in the type of research they support. At one end of the spectrum is "unfunded" research, with 70% clinical (RL = 1 or 2), and at the other end is the work of the Austrian Fund for Scientific Research, with only 14% in these two categories. Research funded by industry is more clinical than that done intramurally by companies in Austria (see Figure 4.5). This work includes two additional groups of papers: work in universities and hospitals funded extramurally, and intramural work in companies whose addresses are outside Austria. This work is evidently much more clinical than the Austrian companies' intramural work.

The numbers of papers in each of the 32 sub-fields and acknowledging funding from each sector, the seven leading individual funders and no funding source, are given in Annex 2, Tables A2.11 to A2.14. The latter three tables show the relative commitments of each funder to the different sub-fields. For example, the Austrian government supported 214 papers in anatomy, physiology & morphology (ANAPH) out of 436 in the sub-field that were inspected (49.1%); this compares with its share of 7536 out of the overall total of 25 969 papers (29.6%). Thus its relative commitment to this sub-field was 49.1% / 29.6% = 1.66. Table A2.12 shows that this sub-field was in fact third in terms of its relative priorities, biochemistry & molecular biology (BCMBI) and cell biology (CYTHI) ranking higher. By contrast, in radiology, radiotherapy & nuclear medicine (RADIO) and surgery (SURGE) it supported fewer than one quarter of the number of papers that its overall funding might have suggested.

There is a clear distinction between the sub-fields preferentially supported by the agencies of the Austrian federal government and those supported by the Vienna Mayor's Fund, the latter being much more patient-oriented such as obstetrics & gynaecology (OBSGY), dentistry (DENTA) and oncology (ONCOL). This difference is also evident from Figure 5.1, above, where the work supported by the Vienna Mayor's Fund is seen to be relatively clinical.

Work on arthritis (ARTHR), and on radiology, radiotherapy & nuclear medicine (RADIO), which gets little support from the Austrian government, are major interests of the Ludwig Boltzmann Society (Table A2.13). It also works a lot on bioengineering (BIENG), as do the researchers supported by the Austrian National Bank. Work supported by international organisations is focussed on tropical medicine (TROPM), as is work with other, foreign, sources of support: these include the World Health Organization, the World Bank and the United Nations Development Program as well as the Thai Government and Thai universities.

Research without explicit funding is dominated by surgery (SURGE) and dentistry (DENTA), followed by ophthalmology (OPHTH) and otorhinolaryngology (OTORH). In these four sub-fields, fewer than 30% of papers acknowledge any funding sources. By contrast, biochemistry & molecular biology has funding for 87% of research papers, and human genetics (HUGEN) for 82% of papers. This variation in explicit funding support is shown graphically in Figure 5.2.

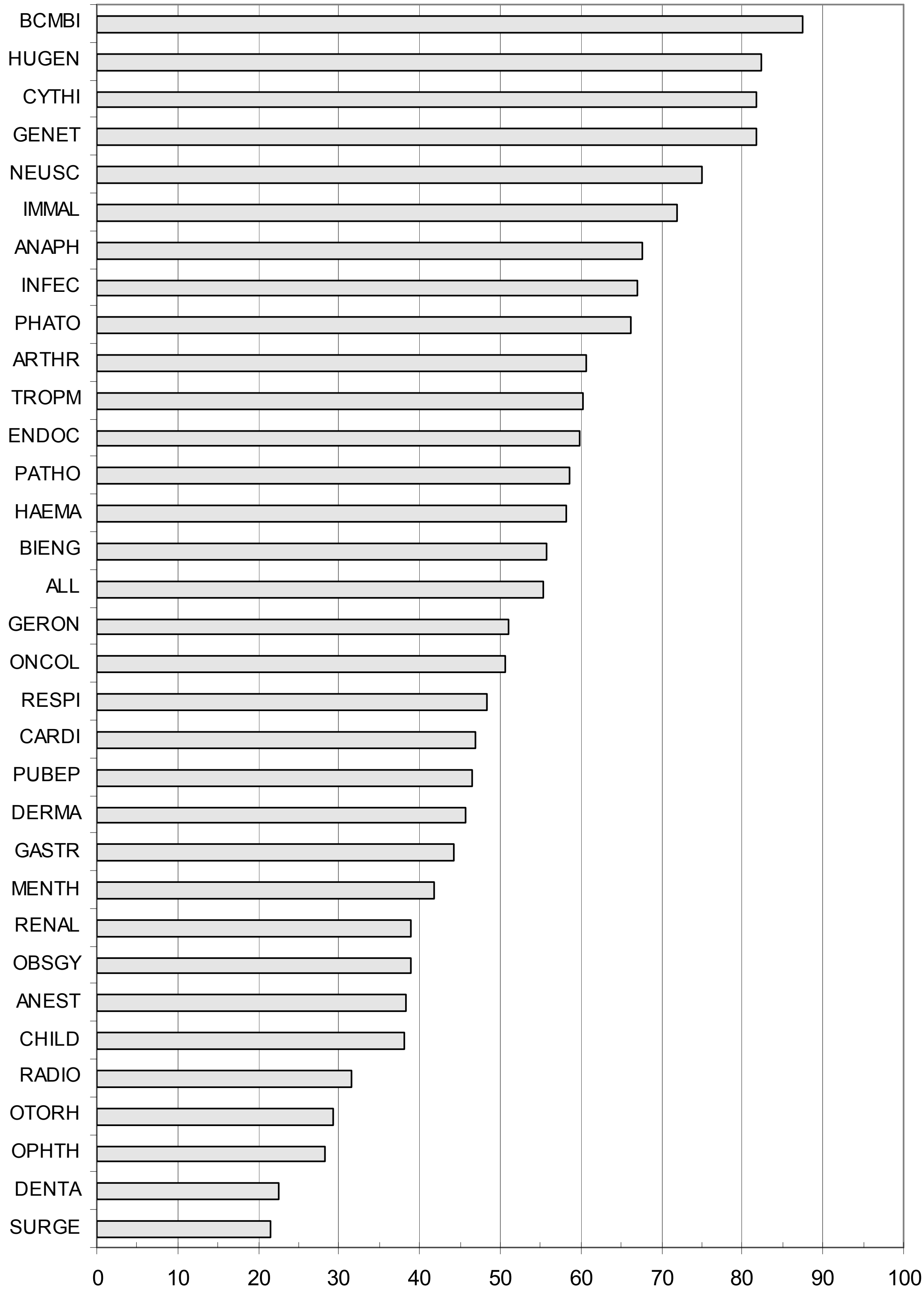

Figure 5.2   Percentage of Austrian biomedical papers in each of 32 sub-fields with explicitly acknowledged funding, 1991-2000.

5.5 Activities of funding sectors in different institutions

This section focusses on the funding obtained by the three medical schools, the four science faculties and the hospitals, who may be presumed to be competing for research grants from the sources described above. Table A2.15 in Annex 2 lists the numbers of papers funded by the different sectors and agencies, and without explicit funding, from the different institutions, and Table 5.3, below, shows the percentages of each group of papers with funding from the given source.

Table 5.3 Papers from Austrian medical and science faculties, and hospitals, funded from different sources, 1991-2000, percent of total outputs.

Institution:	*Gov*	*FFW*	*ANB*	*MSR*	*AAS*	*WIE*	*PNP*	*LBS*	*IND*	*INT*	*EU*	*OTH*	*None*
Med. schools	26.9	19.1	6.2	2.4	2.3	2.4	12.0	6.1	11.6	3.0	2.1	18.1	51.9
Graz	25.1	19.1	6.8	2.4	1.5	0.2	8.3	1.9	8.2	1.9	1.5	14.3	59.0
Innsbruck	34.7	28.2	7.0	3.2	4.2	0.2	11.0	4.1	12.8	3.4	2.6	23.7	45.0
Wien	24.5	15.5	5.7	2.2	1.9	4.0	13.8	8.4	12.3	3.2	2.1	16.7	52.1
Sci. faculties	55.7	46.4	8.8	5.5	2.8	1.1	10.1	5.0	13.8	6.2	4.3	30.1	24.1
Graz	55.6	48.0	9.8	2.8	1.6	0.2	6.7	0.7	14.4	3.9	2.8	32.3	22.0
Innsbruck	51.1	37.1	7.2	9.3	1.9	0.2	3.7	1.2	12.7	6.2	5.1	25.5	27.1
Salzburg	54.9	43.6	11.7	4.2	6.9	0.4	9.4	3.3	10.2	6.3	4.0	29.0	24.8
Wien	57.9	49.4	8.1	6.1	2.5	2.2	14.9	9.2	14.9	7.5	5.0	30.2	24.2
Hospitals	14.2	6.4	4.1	1.4	2.0	2.5	18.3	12.5	8.7	1.8	1.4	10.5	60.2

Gov = Austrian government; FFW = Austrian Fund of Scientific Research; ANB = Austrian National Bank; MSR = Ministry of Science and Research; AAS = Austrian Academy of Sciences; WIE = Vienna Mayor's Fund; PNP = Austrian private-non-profit; LBS = Ludwig Boltzmann Society; IND = industry; INT = international organizations; EU = European Union; OTH = others (foreign governmental and private-non-profit).

This table reveals some interesting patterns. Science faculties have the highest level of funding (an average of 76% of papers being explicitly funded), Graz having the most (78%) and Innsbruck the least (73%). This accords with their respective ranking on PIC and citations. Medical schools have about 48% of their papers funded, with Innsbruck the most (55%) and Graz the least (41%). Again, this is in agreement with the PIC and citation rankings of the three schools, and suggests that funding is correlated with potential and actual impact. Hospitals receive even less funding (40%), and indeed, of their 2137 papers not co-published with an Austrian university, only 36% have funding acknowledgements. They receive very little explicit funding from the Austrian government but rather more from Austrian private-non-profit organisations, especially the Ludwig Boltzmann Society, many of whose units are located in hospitals.

Funding from international and "other" bodies is usually awarded on a very competitive basis and its receipt may be taken as an indicator of superior quality research proposals. The ranking order is again science faculties first, then medical schools and finally hospitals. If the funding from both international and other foreign sources is added, then Innsbruck ranks first among the medical schools with 27%, followed by Vienna with 20% and Graz with 16%; among science faculties Vienna is highest with 38%, Graz has 36%, Salzburg 35% and Innsbruck 32%. So the ordering of the medical schools and faculties is repeated almost exactly as before on this indicator.

5.5 Multiple funding and its effects on impact

It is by now well-established in the literature that research supported through peer-reviewed competitive grants tends to be of superior quality and impact[14]. In practical terms, papers with multiple funding acknowledgements are published in higher impact category journals than papers with only a single one or none. This situation also prevails in Austria, as witness Figure 5.3, which shows the PIC distribution of papers acknowledging different numbers of funders, F.

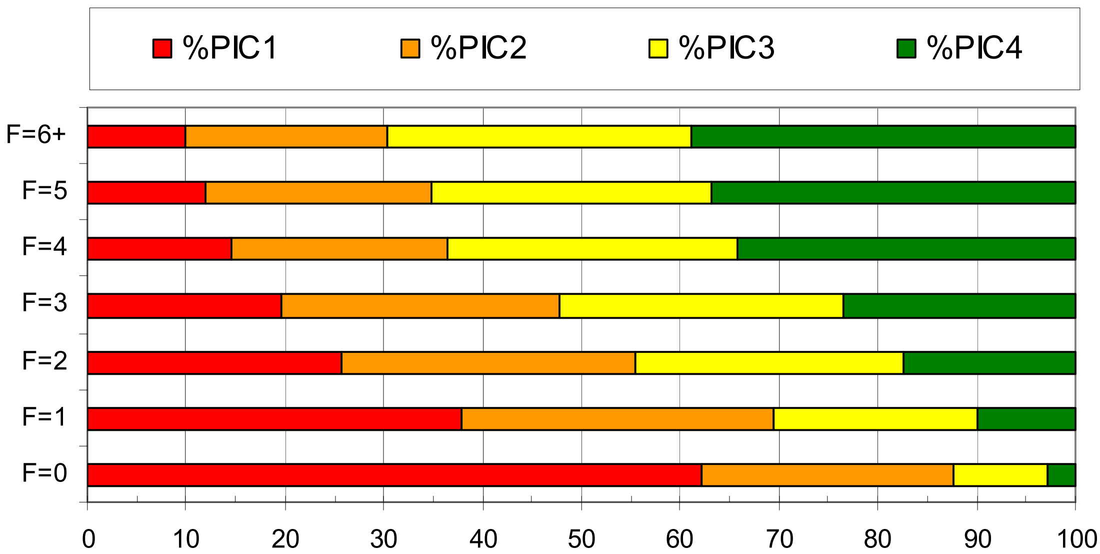

Figure 5.3. Potential impact category distribution (PIC: 1 = low, 4 = high) of Austrian biomedical papers with different numbers of funding acknowledgements (F), 1991-2000.

[14] Lewison G and Dawson G (1998) The effect of funding on the outputs of biomedical research *Scientometrics* vol 41, pp 17-27.

A similar situation also occurs if citation categories, as previously defined, are shown for the papers classified in terms of F. The resulting chart is shown as Figure 5.4. There is a smooth progression towards more citations as the number of funding bodies acknowledged on a paper increases from zero to six or more.

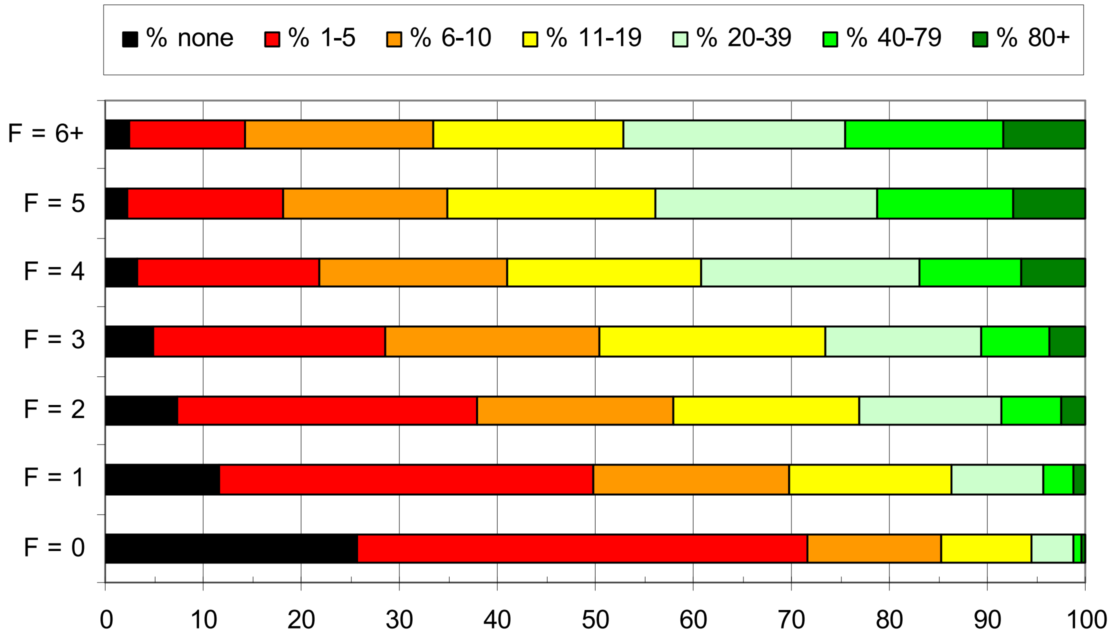

Figure 5.4. Citation category distribution in five-year period of Austrian biomedical papers with different numbers of funding acknowledgements (F), 1991-97.

5.6 Summary of chapter 5

The above analysis has shown the following:

- From the funding acknowledgments on Austrian biomedical papers, about 30% are supported by governmental agencies (including Länder), of which the Austrian Fund for Scientific Research accounts for nearly three quarters. Industry supported 15% of papers, the private-non-profit sector (including the Ludwig Boltzmann Society) 12% and international and foreign funders 26%. About 45% of papers, many more than in the corresponding set for the UK, had no funding acknowledgements.
- During the 1991-2000 decade, funding acknowledgements have increased modestly in numbers per paper with time. International funders, and especially the European Union which currently supports 5% of Austrian biomedicine, have greatly increased their presence. German-language papers are much less likely than English ones to carry funding acknowledgements; domestic papers also acknowledge funding less frequently than do international papers.

- There are differences between the funders in the sub-fields that they favour, and the research levels of their papers. The Austrian Fund for Scientific Research and the European Union tend to support basic sub-fields such as biochemistry & molecular biology. By contrast, Länder, such as the Vienna Mayor's Fund, support patient-oriented sub-fields such as obstetrics and cancer. Very clinical sub-fields such as surgery and dentistry have fewer than 25% of papers with funding acknowledgements, whereas over 80% of basic ones such as biochemistry & molecular biology and human genetics acknowledge funding.
- Science faculties in Austrian universities acknowledge more funding (and especially from foreign sources) on their papers (76%) than do medical schools (48%) and hospitals (40%). Graz, the highest-rated science faculty in terms of potential impact and citations, acknowledges more funding (78%) than Innsbruck, the lowest rated (73%); however Innsbruck medical school acknowledges more than Graz (55%, *cf.* 41%), also in keeping with its citation ratings.
- Papers with funding acknowledgements are published in higher impact journals (higher PIC) and receive more citations than unfunded ones, and the effect is clear and progressive at least up to six funding acknowledgements and more.

6 PARAMETRIC ANALYSIS OF INPUTS AND OUTPUTS

6.1 Methodology, input and output variables

The analysis so far has examined Austrian biomedical research papers and has categorized them in a number of ways – by sub-field, by research level, by institutional address, by numbers of authors, by number and identity of funding bodies – and has found some rather clear patterns. However it is already evident that these "input variables" to the research are highly correlated so that certain institutions such as hospitals work in clinical sub-fields; do work that is classified as clinical rather than basic; have relatively few addresses, especially international ones; and receive little external funding. It is not therefore surprising if their papers turn out to be in low impact journals (low PIC) and relatively poorly cited, given that each of these "output variables" seems to be positively linked to basic work with many authors and addresses and multiple funding.

The correlation between the input variables of different types of institution makes it difficult to evaluate their work on a fair basis. To do this, it is theoretically necessary to examine how output impact varies across institutions, with all other input variables held constant. This is what occurs in epidemiological analysis, where the factors that truly are associated with a disease need to be identified despite the confounding effects of others that frequently co-occur. Thus poor people often smoke, eat a bad diet, take little exercise and live in polluted areas, and suffer high disease rates. Which of these factors is most closely correlated with the incidence of a particular disease?

To isolate the effects of these various confounding input variables, a reduced file was prepared with only selected input variables listed, either categorical (*e.g.*, number of authors – limited to 10) or Boolean (*e.g.*, in the CARDI sub-field – yes or no – or from a particular institution). The categorical variables of author number (A), address number (D), funding number (F) and research level (RL) were also provided as squares and, for research level, as cubes. The purpose of this was to allow for a non-linear variation of the output variable as the input variable increased. For example, this appears to be occurring in Figures 5.3 and 5.4, where the change from F = 0 to F = 1 has a much bigger effect on PIC and citation category than the change from F = 5 to F = 6+.

The analysis was performed with the SPSS computer program, and linear regression of the output or dependent variables (PIC or citation category) on each of the input or independent variables, most of which were categorical (1 or 0), determined as a coefficient.

6.2 Authorship, co-operation, funding, and sub-field effects on PIC

Table 6.1. Regression equation coefficients for potential impact category (PIC), with and without funding data (F), for different input variables (A = authors, D = addresses, F = funders) for Austrian biomedical papers, 1991-2000.

Parameter	*No F*		*With F*		*Parameter*	*No F*		*With F*	
R^2	0.338		0.368		R^2	0.338		0.368	
	Coeff	*Sign.*	*Coeff*	*Sign.*		*Coeff*	*Sign.*	*Coeff*	*Sign.*
DE (lang)	-0.526	0.0%	-0.508	0.0%	INFEC	0.089	0.0%	0.080	0.0%
A	0.035	0.0%	0.027	0.5%	NEUSC	0.161	0.0%	0.138	0.0%
A^2	0.002	0.3%	0.002	0.6%	ONCOL	0.069	0.0%	0.068	0.0%
D	-0.041	0.3%	-0.062	0.0%	OPHTH	-0.103	0.5%	-0.106	0.4%
D^2	0.005	0.2%	0.006	0.1%	OTORH	-0.242	0.0%	-0.215	0.0%
F			0.229	0.0%	PATHO	-0.045	2.4%	-0.031	n.s.
F^2			-0.016	0.0%	PHATO	0.056	2.7%	0.033	n.s.
YEAR	0.007	0.0%	0.005	0.7%	RENAL	0.089	0.2%	0.110	0.0%
ANAPH	-0.435	0.0%	-0.457	0.0%	RESPI	0.092	0.0%	0.095	0.0%
BCMBI	0.449	0.0%	0.403	0.0%	SURGE	-0.121	0.0%	-0.077	0.0%
BIENG	-0.173	0.0%	-0.190	0.0%	DE (address)	-0.077	0.0%	-0.014	n.s.
CARDI	0.088	0.0%	0.101	0.0%	EU (address)	0.167	0.0%	0.054	0.8%
CHILD	-0.154	0.0%	-0.142	0.0%	CC (address)	-0.352	0.0%	-0.384	0.0%
CYTHI	0.380	0.0%	0.312	0.0%	US (address)	0.345	0.0%	0.215	0.0%
DENTA	-0.182	0.0%	-0.167	0.1%	COMP (addr)	0.355	0.0%	0.271	0.0%
DERMA	0.053	3.8%	0.073	0.4%	LBS (addr)	0.027	n.s.	-0.165	0.0%
ENDOC	0.096	0.0%	0.081	0.0%	AAS (addr)	0.197	0.0%	-0.032	n.s.
GASTR	0.102	0.0%	0.115	0.0%	OTHER (add)	-0.218	0.0%	-0.240	0.0%
GENET	0.343	0.0%	0.301	0.0%	SALZ-S	-0.313	0.8%	-0.298	0.9%
HAEMA	0.132	0.0%	0.146	0.0%	G-MED	-0.083	2.5%	-0.049	n.s.
IMMAL	0.257	0.0%	0.216	0.0%					

DE (lang) = German language; DE (address) = German address; CC (address) = candidate countries; SALZ-S = University of Salzburg science faculty; G-MED = University of Graz medical school.

Because the data file contains almost 27 000 papers, it has sufficient statistical power to show the effects, if any, of a large number of input variables on the output variable PIC. Table 6.1 shows the results of the analysis in the form of coefficients of the variable, where they are statistically significant at $p < 5\%$.

This table is in two halves, with the left-hand columns showing the situation that would be found in the absence of funding information (No F), and the right-hand columns showing the effects of including such data (With F). [It would also be possible to show the effects of including information on individual funding bodies or sectors, but in practice these data make almost no difference to the coefficients of the independent variables. The coefficients for the funders themselves are presented later in this section.] It is clear that, for most of the independent variables, the coefficients are not very sensitive to the presence or absence of funding data, though there are some exceptions. The most notable are the coefficients for the presence of the Ludwig Boltzmann Society (LBS) or the Austrian Academy of Sciences (AAS) in the address field. Because all their papers are assumed to have specific intramural funding, this has the effect of making their presence much less of a positive influence on PIC. When this imputed funding is taken into account, the LBS is seen to have a negative effect on potential impact, and the apparently positive effect of the AAS disappears.

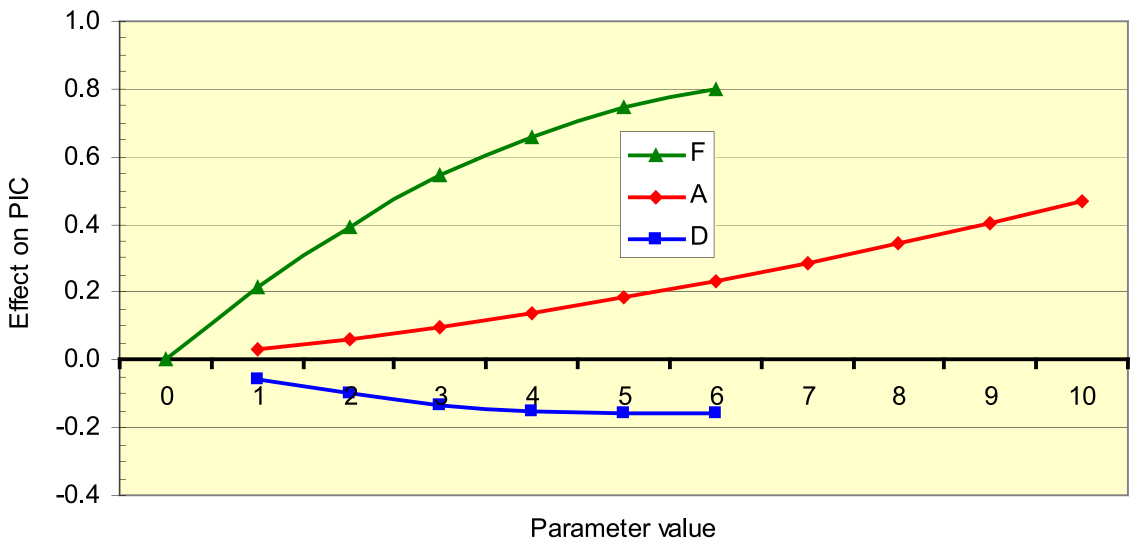

Figure 6.1 Effects of funding (F), authorship (A) and addresses (D) on potential impact category of journals in which Austrian biomedical papers are published, 1991-2000

The effects of author numbers, addresses, funding and year on PIC can be represented by the following equation, and is shown in Figure 6.1:

$$PIC = 0.03\ A + 0.002\ A^2 - 0.06\ D + 0.006\ D^2 + 0.23\ F - 0.016\ F^2 + 0.005\ YR \quad (1)$$

This means that author number, A, has a positive effect on PIC and the effect actually increases with A (up to 10 authors). Inter-lab co-operation (D) *per se* has a negative effect. The reason that it often seems to lead to papers of higher potential or actual impact is that such papers tend to have more authors and, particularly, more funding acknowledgements. The effect of funding is large: the best fit quadratic equation leads to a maximum effect on PIC of over 0.8 (at F = 7). Finally, this equation shows that there is a steady tendency for PIC values to increase with time; the effect is small but it is statistically quite significant ($p < 1\%$). However it is smaller when account is taken of the tendency of funder numbers to increase with time (see section 5.2).

The effects of the individual sub-fields on PIC take account of their research levels and other factors such as the tendency for some to receive more explicit funding (see Figure 5.2). Only 23 of the 32 have coefficients significantly different from zero, or 21 when account is taken of funding. The following table shows them ranked by coefficient: all the values are significant at $p < 1\%$. These are not necessarily sub-fields in which Austrian research is of higher potential impact than that of other countries. The table reflects rather the overall frequency with which Austrian papers in the sub-fields are published in high-impact journals, when differences in their research levels have been taken into account.

Table 6.2. Biomedical sub-fields in which Austrian research is in journals of higher (coeff > 0) or lower (coeff < 0) than average potential impact, PIC: 1991-2000.

Code	*Sub-field*	*Coeff*	*Code*	Sub-field	*Coeff*
BCMBI	biochem & mol. biology	0.403	SURGE	surgery	-0.077
CYTHI	cell biology	0.312	TROPM	tropical medicine	-0.092
GENET	genetics	0.301	OPHTH	ophthalmology	-0.106
IMMAL	immunology & allergology	0.216	CHILD	paediatrics & neonatology	-0.142
HAEMA	haematology	0.146	DENTA	dentistry	-0.167
NEUSC	neuroscience	0.138	BIENG	bioengineering	-0.190
GASTR	gastroenterology	0.115	OTORH	otorhinolaryngology	-0.215
RENAL	renal medicine	0.110	ANAPH	anat., morphol. & physiology	-0.457
CARDI	cardiology	0.101			
RESPI	respiratory	0.095			
ENDOC	endocrinology	0.081			
INFEC	infectious disease	0.080			
DERMA	dermatology & venereology	0.073			
ONCOL	oncology	0.068			

Research level naturally has a big influence on the PIC of the journals in which papers will be published, and the PIC values corresponding to each RL are shown in Table 6.3.

Table 6.3. Potential impact category (PIC) of journals in which Austrian biomedical papers at different research levels (RL) tend to be published, after allowance for different sub-fields and other input parameters, 1991-2000.

Analysis	*RL = 1 (clinical)*	*RL = 2*	*RL = 3*	*RL = 4 (basic)*
Without funding data	1.74	1.87	2.08	2.35
With funding data	1.73	1.84	1.99	2.21

Table 6.1 also shows the effects of language (papers in German are published in journals of PIC about 0.5 lower than for English papers), and of the institutions undertaking the research. The effect of co-operation with Germany, Austria's leading partner, is not significant, but co-operation within the EU has a small positive effect (PIC = +0.05). Co-authorship with the USA is seen to be beneficial (+ 0.22), whereas co-operation with the EU candidate countries of eastern Europe hinders publication in high impact journals (-0.38). Companies are producing high impact research (+0.27), but "other" Austrian institutions have a negative effect (-0.24).

In the earlier sections, it was shown that there was a hierarchy of medical schools and science faculties which appeared to be consistent in PIC, in citations and in funding. However it now appears that this was merely a statistical artefact, because of the inter-connections between the various input parameters. The only faculty whose performance, at least in terms of PIC, is significantly different from the norm is the Salzburg science faculty, which has a negative effect (-0.30) whether or not account is taken of funding data.

The analysis also covered the effects of individual funding bodies and sectors. The results are shown in Table 6.4, in descending order of positive influence. There is clearly a big difference between the funding activities of the Austrian Fund for Scientific Research and the Vienna Mayor's Fund, possibly because of greater competition for the support of the former. The presence of international funding normally has a negative effect, except for that of the EU, whose research contracts are awarded after an international evaluation.

Table 6.4. Regression equation coefficients for potential impact category (PIC), for different funding bodies and sectors for Austrian biomedical papers, 1991-2000.

Code	*Funder*	*Coeff.*	*Sign.*
FFW	Austrian Fund for Scientific Research	0.218	0.0%
EUF	European Union funding	0.111	2.5%
OTH	Other (foreign) funding	0.078	0.1%
ONJ	Austrian National Bank	0.006	n.s.
PNP	Austrian private-non-profit sector	-0.079	0.2%
INTL	International funding	-0.085	4.2%
IND	Industrial sector	-0.088	0.0%
ATM	Austrian Ministry for Science	-0.119	0.0%
WIE	Vienna Mayor's Fund	-0.134	0.1%

6.3 The effects of input parameters on citation categories

This analysis was performed separately because it involved only papers published from 1991-97, and it was limited to the papers for which funding data had been determined (n = 16 336). Analyses were performed: with and without funding data, and with and without PIC being regarded as an independent variable that could have an influence on the numbers of citations that a paper would receive. The latter turned out to be very important: the r^2 value of the resulting regression increased from 0.304 to 0.454 when PIC was introduced as an input factor, whereas funding data had a rather minor influence on this coefficient.

Table 6.5 shows the results of the analysis with funding data included, but without and with PIC as an "input" or explanatory variable. In effect, the latter analysis examines how well the papers are cited in relation to the impact factors of the journals in which they are published, whereas the former analysis treats citations as separate from PIC. The table shows that almost all the coefficients are smaller (either less positive or less negative, and with less significance) when PIC is introduced as an explanatory variable. In its absence, the equation for citation category is as follows, and the values are plotted in Figure 6.2:

$$\text{Citcat} = 0.035\,A + 0.005\,A^2 - 0.175\,D + 0.02\,D^2 + 0.31\,F - 0.02\,F^2 + 0.013\,YR \qquad (2)$$

which is very similar in both form and in its coefficients to equation (1) for PIC, except that citation category attains higher values (its maximum is 6 rather than 4). The only major difference between the two equations is that the negative coefficient of D is now much larger.

Table 6.5. Coefficients of the effect of significant input variables on citation category (0 = uncited, 6 = 80+ cites in five years) for Austrian biomedical papers 1991-97, with account taken of funding per paper (F) and without and with journal potential impact (PIC) as an "independent" or explanatory variable.

	Without PIC		*With PIC*			*Without PIC*		*With PIC*	
Parameter	*Coeff*	*Sign.*	*Coeff*	*Sign.*	*Parameter*	*Coeff*	*Sign.*	*Coeff*	*Sign.*
DE (lang)	-0.804	0.0%	-0.466	0.0%	HUGEN	0.273	n.s.	0.318	1.6%
A	0.035	4.6%	0.016	n.s.	IMMAL	0.205	0.0%	0.056	4.9%
AA	0.005	0.4%	0.003	2.6%	NEUSC	0.153	0.0%	0.027	n.s.
D	-0.175	0.0%	-0.117	0.0%	OBSGY	-0.157	0.0%	-0.155	0.0%
DD	0.020	0.0%	0.015	0.0%	OPHTH	-0.268	0.0%	-0.145	1.9%
F	0.308	0.0%	0.145	0.0%	PATHO	0.103	0.4%	0.096	0.2%
FF	-0.020	0.0%	-0.009	0.0%	PHATO	-0.044	n.s.	-0.083	4.0%
PIC			0.700	0.0%	EU (address)	0.166	0.0%	0.125	0.0%
YR	0.013	0.5%	0.005	n.s.	CC (address)	-0.388	0.0%	-0.147	0.5%
ANAPH	-0.365	0.0%	-0.081	n.s.	US (address)	0.375	0.0%	0.207	0.0%
BCMBI	0.332	0.0%	0.022	n.s.	MED SCH	-0.118	n.s.	-0.139	3.6%
CHILD	-0.125	0.2%	-0.013	n.s.	COMP (addr)	0.289	0.0%	0.067	n.s.
CYTHI	0.494	0.0%	0.270	0.0%	LBS (addr.)	-0.158	0.0%	-0.051	n.s.
DERMA	0.211	0.0%	0.156	0.0%	OTHER (ad.)	-0.217	0.0%	-0.082	n.s.
GENET	0.299	0.0%	0.064	4.3%	W-MED	0.191	0.7%	0.124	4.6%
GERON	0.140	1.4%	0.124	1.5%	I-MED	0.232	0.1%	0.147	1.8%
HAEMA	0.124	0.0%	0.027	n.s.	SALZ-S	-0.399	4.0%	-0.168	n.s.

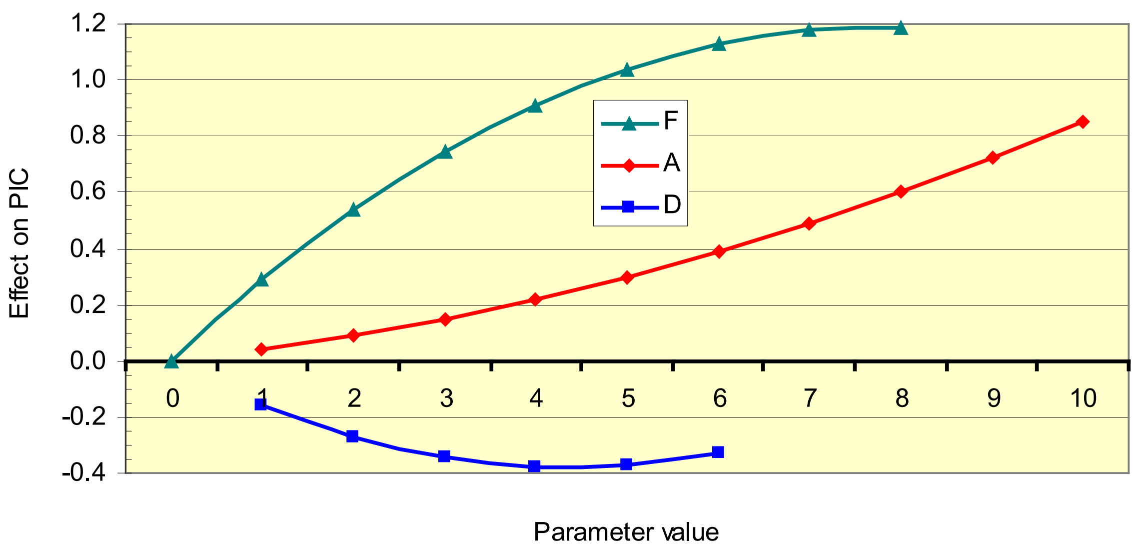

Figure 6.2 Effects of funding (F), authorship (A) and addresses (D) on citation category of Austrian biomedical papers, 1991-97

This shows that inter-lab co-operation, with everything else held constant, has a more adverse effect on citations received by a paper than on the impact factor of the journal in which it is likely to be published. The effect of time is again positive, showing that citation numbers are steadily increasing, although this is almost all attributable to papers appearing in higher impact journals.

The effects of international collaboration are seen to be similar to those of Table 6.1, with EU and US co-authors helping to raise impact, but ones from the candidate countries of eastern Europe lowering it. Again, the individual medical schools and science faculties do not seem to have much effect on citation performance, except that the Innsbruck medical school has more citations that would have been expected (+0.15). However medical schools collectively seem to score relatively poorly on citations so that the Innsbruck medical school is barely above the overall Austrian average, although it is so when citations are analysed without PIC. The Salzburg science faculty showed to disadvantage (-0.40) when citation category was analysed without taking account of PIC, but this disappeared when PIC was included. This means that, although it published its biomedical papers in rather low impact journals, they were reasonably well cited for those journals (but still relatively poorly). On the other hand, the Vienna medical school did well in citations (+0.19) and the Innsbruck medical school even better (+0.23). Companies performed well (+0.29) but the LBS poorly (-0.16) when citation categories were analysed without reference to PIC. Since citations and PIC are considered to be relatively independent indicators of research quality, this may be a better method of research evaluation, even though PIC clearly has a strong influence on citations.

The sub-fields with a positive and a negative effect on citation category are shown in Table 6.6. Comparison of this table with Table 6.2 shows that many of the same sub-fields are at the top of the first division or the bottom of the second division.

Table 6.6 Biomedical sub-fields in which Austrian research is cited significantly more or less highly, when controlling for other input parameters but not for PIC, 1991-97.

Code	*Sub-field*	*Coeff*	*Code*	Sub-field	*Coeff*
CYTHI	cell biology	0.494	ANEST	anaesthesia	-0.110
BCMBI	biochem & molec biology	0.332	CHILD	paediatrics & neonatology	-0.125
GENET	genetics	0.299	OTORH	otorhinolaryngology	-0.143
DERMA	dermatology & venereology	0.211	OBSGY	obstetrics & gynaecology	-0.157
IMMAL	immunology & allergology	0.205	OPHTH	ophthalmology	-0.268
NEUSC	neuroscience	0.153	ANAPH	anatomy, morphol & physiol	-0.365
GERON	gerontology	0.140			
HAEMA	haematology	0.124			
PATHO	pathology	0.103			
GASTR	gastroenterology	0.074			

The effects of research level on citation category are shown in Table 6.7.

Table 6.7. Citation category of Austrian biomedical papers at different research levels (RL), after allowance for different sub-fields and other input parameters, 1991-97.

Analysis	*RL = 1 (clinical)*	*RL = 2*	*RL = 3*	*RL = 4 (basic)*
Without PIC as variable	1.97	2.02	2.08	2.24
With PIC as variable	0.80	0.77	0.72	0.73

Even without controlling for PIC, the citation scores of Austrian biomedical papers are not very sensitive to research level – much less so than their PIC values are – except that basic papers (RL = 4) are more cited than the others. The effect of controlling for PIC is to make citation scores virtually invariant with research level.

Table 6.8 shows the effects of individual funding bodies and sectors on the citation category of papers acknowledging their support. The order of merit of the funders is similar, whether or not PIC is kept constant, but now the presence of European Union funding is seen to have the greatest positive effect on citations. Although funding from the Vienna Mayor's Fund had a negative effect on PIC values its effect on citation categories was insignificant.

Table 6.8. Regression equation coefficients for citation category, for different funding bodies and sectors for Austrian biomedical papers, 1991-97.

		Without PIC		*With PIC*	
Code	*Funder*	*Coeff.*	*Sign.*	*Coeff.*	*Sign.*
EUF	European Union funding	0.306	0.4%	0.217	2.3%
OAW	Austrian Academy of Sciences	0.296	1.5%	0.206	n.s.
FFW	Austrian Fund for Scientific Research	0.284	0.0%	0.142	0.0%
OTH	Other (foreign) funding	0.173	0.0%	0.095	1.3%
PNP	Austrian private-non-profit sector	-0.097	4.1%	-0.049	n.s.

6.4 Summary of chapter 6

The above analysis has shown the following:

- A regression analysis of the Austrian biomedical papers, with input variables of authorship, address and funding numbers, and categorical variables for the presence or absence of sub-fields, institutions, countries and funders, allows their individual effects on potential journal impact (PIC) and citation scores to be determined while controlling for the other input parameters.

- The effects on both PIC and citation category are positive for papers with more authors (A) and more funders (F), but negative for papers with more addresses (D) or written in German.

- Sub-fields of high potential and actual impact include biochemistry & molecular biology, cell biology and genetics. However otorhinolaryngology and anatomy morphology & physiology papers are in low impact journals and poorly cited.

- European Union funding, and co-authorship with other EU member states, both have a positive effect on the PIC of journals and papers' citations, after controlling for all other input parameters. Co-authorship with the USA is also beneficial but with the EU's candidate countries it reduces both PIC and citations.

- The rather decisive ranking of medical schools and science faculties seen on the basis of PIC, citations and funding almost disappears when account is taken of the full range of input parameters to the research. However there is some evidence that Innsbruck remains the medical school with the highest-impact papers, and Salzburg the science faculty with the lowest impact.

7 REFERENCES

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ANNEX 1 METHODOLOGY

A1.1 The construction of the database

The method employed for the identification and retrieval of relevant records was similar to that employed for the UK Research Outputs Database. Like it, the Austrian biomedical database consisted of articles, notes and reviews taken from the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI), CD-ROM version without abstracts © The Institute for Scientific Information (ISI). This was chosen because it is multi-disciplinary and records all the addresses of each publication. Records were taken with a publication date from 1991-2000, and included late publications recorded on the CD-ROM for the first quarter of 2001.

All the journals whose papers appeared on the SCI and SSCI were classified as either "biomedical", "fringe" or "irrelevant". CHI Research Inc. classify all journals processed by the ISI into one of about nine major fields for their production of science indicators biennially for the US National Science Foundation. Papers in all journals so classified as "clinical medicine" or "biomedical research" were deemed to be relevant to the Austrian database, with the important exception of the multi-disciplinary journals such as *Nature* and *Science*. These were deemed to be "fringe", along with many others in biology, organic chemistry and the like. Journals in fields as remote from biomedicine as astronomy, inorganic chemistry, geology and physics were deemed to be "irrelevant".

The database was constructed to include all papers with at least one Austrian address in the "biomedical" journals, plus ones in "fringe" journals that also satisfied a "biomedical address filter", *i.e.*, their address(es) indicated that one or more of the participating research institutions was concerned with biomedicine. The biomedical address filter contained about 600 individual search statements with three types of address word (or contraction), where an asterisk is recognised as a wildcard – any character(s) or none – by the SCI retrieval software:

- generic, such as A*-CANC*, B*-DENT*, C*-HOSP*, D*-MED*, ….
- biomedical, such as ANAT, BIOMED, CANC, DIABET,…
- specific, such as ASTRAZENECA, BAYER, CELLTECH, ….

This filter was calibrated against British papers in *Nature* and *Science* and achieved a precision (or specificity) of 0.92 and a recall (or sensitivity) of 0.88, that is, it was well able to distinguish the biomedical papers from those concerned with other subjects in journals containing a mixture of both. When applied to the whole SCI it gave an estimate of biomedical output for Austria in 1991-2000 of 26 080 papers compared with 26 222 obtained by the method based on the three categories of journals, or only 0.5% less. [The filter would have omitted a few papers in "biomedical" journals and included some in "irrelevant" ones: effectively these numbers almost balanced.][

The Austrian database constructed as described was further cleaned to remove some extraneous papers (false positives). First, each journal was assigned to a major field and sub-field based on the CHI Research Inc. classification system. The titles of papers in sub-fields remote from biomedicine were inspected and inappropriate papers were discarded. In particular, papers in veterinary journals were removed – this is the one major difference from the UK Research Outputs Database. Second, all the Austrian addresses, some 44 000 in total, were individually inspected and coded by BMBWK (see section 4.1 and Annex 1.2), and 18 papers were found to have been wrongly attributed to Austria. The same number of papers were also found to have the same fault when the papers were inspected in libraries for their funding (see section 5.1 and Annex 1.3). This actually represents an impressively low error rate by the ISI in recording country information (0.07%).

The composition of the final database is shown in Figure A1.1 in terms of the major fields of the papers.

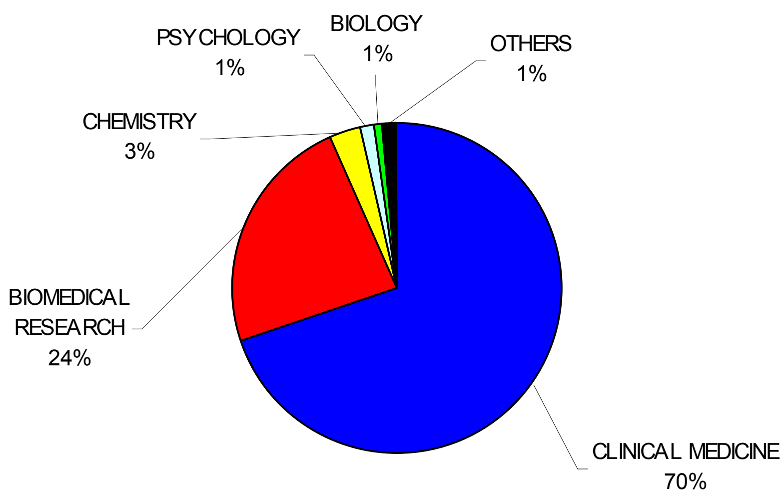


Figure A1.1. Distribution of the papers in the Austrian biomedical research database by major field (according to CHI Research Inc.)

The original database was held in an MS Excel 97 spreadsheet containing the names of the authors, their addresses, the bibliographic reference (journal in abbreviated form, year, volume, issue, pages), the language (German or English), the document type (article, note or review) and the paper title. In order to identify Austrian papers in each of the 32 subject-based sub-fields, the filters that defined them (see section 2.3) were run against the SCI for each year from 1991-2001 and Austrian papers downloaded to a temporary file containing the bibliographic reference only. The two files were then compared. This enabled the biomedical papers in each sub-field to be identified and marked (by means of a "1" in the designated column) on the original spreadsheet, and the sub-field papers in the temporary file for which a match had been found also to be marked. For most sub-fields, the biomedical file contained almost all the papers in the temporary file – typically 98% – but for a few, notably genetics, the discrepancy was much higher, about 13%, because the genetics filter also retrieved non-biomedical papers in botany and zoology.

The journals were categorised by their research level, RL (see section 2.4 and Table 2.6). They were also categorised by their citation impact factor or potential impact category, PIC (see section 2.5 and Table 2.7). This was calculated every two years, and values were available from ISI for 1990 publications (used for 1991 papers), 1992 publications (used for papers from 1992-93), 1994 publications (used for papers from 1994-95) and 1996 publications (used for papers from 1996-2000). About 15% of journals change their PIC value in any two-year period: unlike RL, it is not invariant with time and some journals go up in the world and others decline.

Citations were determined under a sub-contract to ISI, who matched the first author, journal, year, volume and start page of each paper to their master file, and returned the numbers of citations in each year up to 2001. From these data, the five-year citation counts, beginning in the year of publication, were determined so that all the papers could be compared on an equal basis. For the papers in the 32 sub-fields from the five comparator countries, random samples of 200 papers were selected from the 1991-97 publication lists. For this purpose a special macro written by Dr Philip Roe, a consultant to City University, was used. Another macro also automatically generated charts of citation categories for the six countries (see Annex 5). A further macro generated charts of RL (Annex 3) and of PIC (Annex 4), based on all the papers in each sub-field from the comparator countries.

The analysis of foreign addresses was carried out with the aid of another special macro, written by Dr Judit Bar-Ilan of the Hebrew University of Jerusalem, which could filter all the addresses on a paper and not just the first 255 characters (corresponding to the first four or five addresses) as occurs with the standard MS Excel filter function. The address field was filtered successively for the names of each of the countries listed in Tables 1.6 and 1.8, and some others, and papers were marked "1" or "0" for the presence of each country or country group. This macro was also used to count the numbers of addresses, D, both Austrian and foreign, on each paper; the number of authors, A; and (in due course) the numbers of funding bodies acknowledged, F, and the numbers from each sector and major funding sources, see Annex 1.3.

Because the data on the papers are proprietary to the ISI, a special file was created for distribution to the client that contained no ISI data other than those specifically purchased through the contract (citation counts) or generated by City University. Each paper had a unique identity number, and the file contained the following additional data:

- language (DE or EN)
- number of authors (A)
- document type (A or N or R)
- number of addresses (D)
- number of Austrian addresses (D-AT)
- number of foreign addresses (D-for)
- (for international papers), if an Austrian address was first (*)
- journal name (the name used in the ROD, with up to 20 characters)
- journal category (biomedical or fringe)
- CHI major field
- CHI sub-field
- publication year (actual year – 1990)
- research level (RL)
- journal five-year citation impact factor
- potential impact category (PIC)
- paper five-year citation score

- paper citation category (from 0 to 6; see section 2.6 and Figure 2.8)
- whether in each of 32 sub-fields (1 or 0)
- whether co-authored by selected countries or groups (1 or 0)
- codes for Austrian addresses (see Annex 1.2, below)
- codes for funding acknowledgements (see Annex 1.3, below)

The file is designed to allow further analysis by the client of different combinations of conditions such as institution, sub-field, funding, year, etc.

A1.2 The coding of leading research institutions

As described in section 4.1, the Austrian addresses were each given five-part codes by the staff of the BMB according to a complex scheme in which the individual parts changed their meaning depending on the institution type. The individual codes were distributed across an Excel spreadsheet, extending (for one paper with 44 Austrian addresses) to 20 columns.
For analysis purposes, they were all concatenated into a single multiple code for each paper with the individual code parts preceded by a special character (£, $, %, ^ or &). Because the second part of each code could be either the individual Land, or an individual university, with "B" designating both Burgenland and the University of Graz – there was no other overlap – codes with £U$B were changed to £U$Z to avoid confusion and facilitate analysis both of Länder and of universities.
The complete composite code for each paper was, with the exception of that of the paper with 44 Austrian addresses, always less than 255 characters so that it could be filtered with the standard Excel functionality, and the various institutional groups and centres used for the analysis marked as a "1" in the appropriate column of the spreadsheet.

The results of only a limited set of address analyses are presented in this report (see section 4) but data for each individual hospital or university department or company can readily be obtained by filtering the client spreadsheet.

A1.3 Funding acknowledgements

This process was originally developed for the UK Research Outputs Database and has essentially continued in unchanged form since 1993. Workbooks are created, each containing data on about 1000 papers, and recorders, usually history graduates, are employed to visit London libraries and, with the aid of a thesaurus of funding bodies, note down the acknowledgements on each paper in the workbook. Space is provided at the beginning of each workbook for the recorders to write down the names of funding bodies not listed in the thesaurus; these are subsequently researched to determine if their names are simply variants of existing funders, new ones, or not sources of funds at all. Each is given a consecutive number for reference.

The recorders write each funding body as a trigraph, or three-character code. This is all letters for individually-named funders listed in the thesaurus, but may contain numbers for other organisations which are given "generic" codes. For Austria, these codes begin with Z3 and the last digit denotes the category. The codes given to the main Austrian funding bodies are listed in Table A3.1.

Table A3.1. Main Austrian funding organisations, with their trigraph codes used in the database.

Name of organisation	*Code*	*Category*	*Acknowledgements*
Austrian Fund for Scientific Research	FFW	GOV	5552
Austrian National Bank	ONJ	GOV	1461
Austrian Ministry for Science	ATM	GOV	858
Ludwig Boltzmann Society	LWB	PNP	856
Austrian Academy of Sciences	OAW	GOV	514
City of Vienna Mayor's Fund	WIE	GOV	487
Novartis Research Institute, Vienna	SRQ	IND	444
Austrian non-pharma industry	Z35	IND	359
Austrian foundation	Z32	PNP	338
Institute for Molecular Pathology (Boehringer Ingelheim)	IMP	PNP	332
University of Vienna own funds	UVI	PNP	300
Austrian other non-profit	Z39	PNP	274
Austrian pharma industry	Z36	IND	219
Austrian Industrial Research Promotion Fund	AIV	GOV	182
Austrian government (not otherwise specified)	Z33	GOV	153
Baxter	IMV	IND	151
Austrian charity	Z31	PNP	124
Austrian academic funds	Z38	PNP	118
Boehringer Ingelheim Austria	BEJ	IND	111
Austrian government (ministries)	AYU	GOV	110
University of Graz own funds	UGY	PNP	101
Austrian local authority/Länder funds	Z37	GOV	99

The categories are used to allocate funding bodies to one of the main sectors used for analysis: GOV = national government (including local authorities – cities or Länder in Austria), PNP = national private-non-profit, IND = industrial (all countries), international, foreign. In the government sector, a distinction is made between GA (agencies not directly controlled by Ministers) and GD (departments of state). In the private-non-profit sector, CH are collecting charities, FO are endowed foundations, HT are hospital trustees – in practice private monies available in hospitals to support research, MI are "mixed" (*i.e.*, both collecting and endowed) – used primarily for academic institutions which solicit funds for their permanent endowment, such as American universities, and NP are other non-profit – normally bodies that are not primarily engaged in the support of research, such as professional associations. In the industrial sector, a distinction is made between pharmaceutical and non-pharmaceutical companies, the former being licensed to sell drugs. Independent companies (parents) are designated IP and IN respectively, and subsidiaries are designated SP and SN. Biotech companies are designated BT: normally they intend to make and sell drugs at some stage but are not yet licensed to do so.

The country of each funding body is also given: this is its digraph International Standards Organization (ISO) code, see Tables 1.6 and 1.8. For international organisations, the "country code" is XN except for exclusively European organisations such as the European Union for which it is EU. Most of these are governmental in character, but the World Bank is treated as a commercial bank and given the category IN.

Funding is listed under six types, listed in Table A3.2 and designated by a single letter, the second part of the complete funding code.

Table A3.2 Funding types used in the Austrian biomedical research database.

Funding type	*Code*	*Funding type*	*Code*
Extramural	*E*	*Personal*	*P*
Intramural	*I*	*Equipment*	*Q*
In-kind	*K*	*Travel*	*T*

Extramural normally means a grant or contract. Intramural acknowledgements are taken exclusively from the address, and only in respect of government labs, charities, and industry, where acknowledgements to specific funding are not usual. For the Austrian database, an exception was made for the Ludwig Boltzmann Society, designated as FO; all its papers were given a funding credit (as were those of the Austrian Academy of Sciences, designated as GA). [Normally, endowed foundations named in the address field may only have paid for the building, not the research.] In-kind acknowledgements are for services or goods provided, typically drugs given by a pharmaceutical company for clinical trials. [There is usually some other funding as well.] Personal support is for fellowships or studentships, or occasionally for endowed professorships, where it is clear that salary support has been provided to the investigator. Equipment credits are given where a substantial piece of laboratory apparatus has been used in the research and the donor is mentioned: they are rather rare and should, perhaps, be more frequent although sometimes it is hard to distinguish between equipment and a building. Travel grants are noted when only travel and subsistence grants have been given, not salary support.

Copies of the initial pages of the workbooks with newly-found funding bodies were sent to BMBWK for them to characterise the Austrian organisations so found:

- as an existing funding body in the thesaurus, with its own trigraph code or a generic code
- as a new funding body, to be assigned a generic code (see Table A3.1 above), or
- not a source of funds, and therefore to be ignored.

The non-Austrian organisations were researched by City University, mainly using the World Wide Web, and assigned codes or not as appropriate. When all the "new" organisations had been coded, the consecutive numbers in the workbooks were replaced by the newly assigned trigraph codes, or deleted.

For the data entry process, an Oracle 8i database was created with the same data fields as are used for the UK Research Outputs Database, and the Austrian biomedical research database identity numbers for each paper. This enabled the recorders to enter the funding acknowledgements data to each record using the standard screen. Each record was processed twice and the results compared automatically so as to eliminate errors in keying as far as possible. When the trigraph and the funding type are entered, the funding body category and its country are automatically appended, so that an acknowledgement takes the form:

OAW-E-AT-GA

which would mean the Austrian Academy of Sciences had given a grant, and that it was an Austrian government agency. When the data entry process was complete, another Excel spreadsheet was created with the paper identity number, its status (A for inspected, C for not found, D for deletion – because no address was Austrian) and its funding acknowledgements concatenated. These data were then read back to the main file. A check was made that all the papers with Austrian Academy of Sciences or the Ludwig Boltzmann Society in the address field were duly given OAW or LWB intramural credits and these were added if not present.

For the analysis, the funding column was first processed to determine the numbers of funding acknowledgements (F), and then the numbers in each of the following groups were determined:

- Austrian government: -AT-GA, -AT-GD, -AT-LA
- Austrian private-non-profit: -AT-CH, -AT-FO, -AT-HT, -AT-MI, -AT-NP
- industrial: -BT, -IN, -IP, -SN, -SP (but care was taken to omit funding from India: -IN- or from Senegal: -SN-)
- international: -XN-, -EU-
- other foreign: by difference, with the above four sub-totals subtracted from F.

The presence of individual Austrian funding bodies was also determined by filtering, based on the funding bodies that appeared most often. These were the ones listed in Table A3.1 above. The only other individual funding body of note was the European Union. There were, however, many acknowledgements to funding bodies in Germany and the USA, Austria's leading international partners, but these were not separately analysed.

ANNEX 2 BIOMEDICAL RESEARCH OUTPUTS

A2.1 Outputs of six countries in 32 sub-fields

Table A2.1 Sub-fields and their pentagraph codes

Code	*Name*
ANAPH	anatomy, morphology & physiology
ANEST	anaesthesia
ARTHR	arthritis
BCMBI	biochemistry & molecular biology
BIENG	bioengineering
CARDI	cardiology
CHILD	paediatrics & neonatology
CYTHI	cell biology
DENTA	dentistry
DERMA	dermatology & venereology
ENDOC	endocrinology
GASTR	gastroenterology
GENET	genetics
GERON	gerontology
HAEMA	haematology
HUGEN	human genetics
IMMAL	immunology & allergology
INFEC	infectious disease
MENTH	mental health
NEUSC	neuroscience
OBSGY	obstetrics & gynaecology
ONCOL	oncology
OPHTH	ophthalmology
OTORH	otorhinolaryngology
PATHO	pathology
PHATO	pharmacology & toxicology
PUBEP	public health & epidemiology
RADIO	radiotherapy, radiology & nuclear medicine
RENAL	renal medicine
RESPI	respiratory
SURGE	surgery
TROPM	tropical medicine

Table A2.2 **World** outputs in 32 sub-fields (CD-ROM years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*
ANAPH	6479	6747	6889	6298	6865	6914	6909	6880	6560	6735	6728
ANEST	6111	6290	6328	6487	6698	6650	6958	6992	7355	7448	6732
ARTHR	5844	6448	6582	6936	7101	7137	7232	7383	7733	7618	7001
BCMBI	29407	30363	31354	33341	33948	33843	32731	34438	33477	32998	32590
BIENG	2517	2865	3087	3357	3474	3803	3934	4337	4213	4667	3625
CARDI	28306	29046	27735	29973	30230	29833	30842	31362	31518	31492	30034
CHILD	13861	15361	15765	16116	16276	16292	16952	17784	18153	17980	16454
CYTHI	7035	7544	7828	8559	9646	9998	10657	11573	11973	12433	9725
DENTA	3743	3871	3879	3812	4099	4372	4421	4851	4585	4454	4209
DERMA	8459	9169	10074	9487	9312	9434	9597	9962	9524	9994	9501
ENDOC	31093	32874	33526	34468	35461	34808	35374	35905	35707	34904	34412
GASTR	18285	19362	19644	20432	21006	21201	21282	21999	22514	21394	20712
GENET	27523	30155	32202	34838	36878	37247	38640	40326	40569	40830	35921
GERON	6614	7213	7341	8183	8584	8938	9693	9868	10227	10981	8764
HAEMA	16015	16799	16298	18067	17561	17973	17882	17992	17964	17751	17430
HUGEN	725	816	861	959	1040	1057	1340	1356	1438	1488	1108
IMMAL	21306	22403	23975	23634	24129	24269	23906	24455	24650	23430	23616
INFEC	33591	35178	40857	36843	37556	38120	38107	39487	40352	40111	38020
MENTH	6020	6310	6142	6882	6565	7094	7297	7817	8043	8253	7042
NEUSC	23603	25583	27709	25434	26432	26989	27575	27753	28644	28814	26854
OBSGY	13740	15028	15285	15654	16207	15532	15616	16221	16014	15786	15508
ONCOL	25680	28106	28567	30962	31960	32400	33485	33725	35156	35349	31539
OPHTH	6366	6817	6443	6428	6541	6826	7069	7711	7247	7787	6924
OTORH	4701	4766	4322	4984	5454	5510	5836	6097	6346	6422	5444
PATHO	15283	16313	17908	17152	17631	17498	17706	18156	17851	17998	17350
PHATO	17563	18108	17295	18176	17419	18013	17162	17052	17905	17305	17600
PUBEP	7195	13072	8230	9379	9523	10119	10450	11469	12071	12432	10394
RADIO	7765	6221	6302	6795	7239	7291	7642	7628	7846	7854	7258
RENAL	7970	7204	7026	7255	7333	7663	7464	7837	7815	7227	7479
RESPI	10569	11229	11097	11941	12517	12559	12818	13378	13634	13723	12347
SURGE	18823	13935	14665	16410	16885	16705	16458	17555	17699	17801	16694
TROPM	4352	4489	4652	4517	4453	4578	4784	4936	5184	4791	4674

Table A2.3 **Austrian** outputs in 32 sub-fields (publication years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*	*World*	*AT/w %*	*Ratio*
ANAPH	46	47	28	41	35	46	55	42	45	59	44	6728	0.66	0.660
ANEST	49	57	57	69	63	84	162	229	146	165	108	6732	1.61	1.607
ARTHR	40	48	51	56	64	77	73	69	82	97	66	7001	0.94	0.939
BCMBI	163	181	175	231	216	261	286	293	317	294	242	32590	0.74	0.742
BIENG	24	19	32	36	32	36	56	57	77	60	43	3625	1.18	1.184
CARDI	288	346	278	297	326	317	416	367	427	440	350	30034	1.17	1.167
CHILD	97	128	122	151	156	155	185	191	212	239	164	16454	0.99	0.995
CYTHI	49	76	72	80	82	97	125	118	145	130	97	9725	1.00	1.002
DENTA	16	14	12	17	27	26	28	43	53	36	27	4209	0.65	0.647
DERMA	97	125	90	105	107	143	134	138	125	131	120	9501	1.26	1.259
ENDOC	225	242	280	262	316	338	373	371	403	409	322	34412	0.94	0.936
GASTR	126	169	156	175	168	202	197	198	209	235	184	20712	0.89	0.887
GENET	144	147	188	195	237	229	292	304	344	324	240	35921	0.67	0.670
GERON	53	55	59	76	73	87	100	131	124	150	91	8764	1.04	1.037
HAEMA	177	205	210	230	254	257	280	297	317	303	253	17430	1.45	1.452
HUGEN	1	10	12	8	10	10	17	28	24	18	14	1108	1.25	1.246
IMMAL	182	247	257	275	314	356	318	304	363	338	295	23616	1.25	1.252
INFEC	186	202	208	231	280	304	287	286	336	317	264	38020	0.69	0.694
MENTH	55	63	76	73	69	117	90	111	112	141	91	7042	1.29	1.289
NEUSC	148	141	152	169	167	209	201	210	259	256	191	26854	0.71	0.712
OBSGY	164	153	182	144	170	169	209	189	192	197	177	15508	1.14	1.141
ONCOL	273	292	302	325	355	399	435	475	484	516	386	31539	1.22	1.223
OPHTH	33	46	45	63	35	37	63	68	65	84	54	6924	0.78	0.779
OTORH	27	42	38	54	35	49	77	91	95	90	60	5444	1.10	1.099
PATHO	158	166	192	198	203	224	254	240	261	280	218	17350	1.25	1.255
PHATO	90	127	99	90	141	168	135	138	144	125	126	17600	0.71	0.715
PUBEP	45	86	60	80	90	84	106	115	123	135	92	10394	0.89	0.890
RADIO	68	64	78	75	81	112	117	152	126	142	102	7258	1.40	1.399
RENAL	76	84	74	72	94	98	95	88	112	88	88	7479	1.18	1.179
RESPI	61	94	96	116	94	111	132	156	173	181	121	12347	0.98	0.984
SURGE	135	163	144	177	169	159	201	250	270	265	193	16694	1.16	1.159
TROPM	14	11	8	18	23	29	30	27	31	26	22	4674	0.46	0.465

Table A2.4 **Swiss** outputs in 32 sub-fields (publication years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*	*World*	*CH/w %*	*Ratio*
ANAPH	78	114	104	116	111	138	99	94	109	125	109	6728	1.62	0.785
ANEST	88	93	108	133	117	113	129	167	130	185	126	6732	1.88	0.911
ARTHR	113	140	130	156	173	203	185	180	166	204	165	7001	2.36	1.144
BCMBI	652	645	725	823	768	736	784	781	794	748	746	32590	2.29	1.110
BIENG	30	41	37	61	60	84	85	103	113	128	74	3625	2.05	0.993
CARDI	479	480	523	513	587	546	584	583	615	660	557	30034	1.85	0.900
CHILD	215	236	266	226	267	253	299	313	312	319	271	16454	1.64	0.798
CYTHI	180	208	210	222	231	251	286	282	295	318	248	9725	2.55	1.239
DENTA	45	58	49	59	64	87	84	76	70	77	67	4209	1.59	0.771
DERMA	132	187	181	191	218	256	235	206	237	242	209	9501	2.19	1.065
ENDOC	537	561	624	690	640	588	621	653	635	647	620	34412	1.80	0.874
GASTR	276	327	345	416	350	373	368	413	446	447	376	20712	1.82	0.881
GENET	535	520	624	724	747	775	838	856	887	862	737	35921	2.05	0.996
GERON	82	90	99	120	133	130	174	171	173	249	142	8764	1.62	0.787
HAEMA	324	318	348	363	326	366	382	399	371	376	357	17430	2.05	0.995
HUGEN	16	15	16	18	21	10	33	30	29	27	22	1108	1.94	0.942
IMMAL	575	640	665	669	721	677	713	697	710	688	676	23616	2.86	1.388
INFEC	611	663	696	809	798	808	900	930	984	998	820	38020	2.16	1.046
MENTH	104	141	134	146	148	164	176	203	184	217	162	7042	2.30	1.114
NEUSC	384	486	455	499	541	535	552	588	621	611	527	26854	1.96	0.953
OBSGY	206	182	230	194	202	38	182	218	192	224	187	15508	1.20	0.585
ONCOL	424	454	570	569	531	601	618	625	687	629	571	31539	1.81	0.878
OPHTH	129	185	132	154	168	158	163	184	192	186	165	6924	2.38	1.157
OTORH	68	52	52	46	71	72	82	71	117	150	78	5444	1.43	0.696
PATHO	238	262	287	341	361	324	304	329	300	329	308	17350	1.77	0.860
PHATO	286	302	335	286	342	334	286	353	354	305	318	17600	1.81	0.878
PUBEP	138	159	155	159	185	188	213	245	263	258	196	10394	1.89	0.917
RADIO	68	72	74	89	109	100	127	135	132	150	106	7258	1.45	0.706
RENAL	122	125	127	142	173	146	141	156	169	139	144	7479	1.93	0.934
RESPI	176	193	195	232	238	243	291	287	281	305	244	12347	1.98	0.960
SURGE	189	194	179	213	197	250	290	288	314	353	247	16694	1.48	0.717
TROPM	139	143	126	121	146	123	171	156	184	160	147	4674	3.14	1.526

Table A2.5 **German** outputs in 32 sub-fields (publication years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*	*World*	*DE/w %*	*Ratio*
ANAPH	368	421	414	387	442	489	499	512	478	505	452	6728	6.71	0.880
ANEST	420	396	422	444	535	577	645	629	664	793	553	6732	8.21	1.076
ARTHR	308	376	374	414	439	474	519	651	569	613	474	7001	6.77	0.887
BCMBI	2436	2444	2425	2736	2855	2897	3025	3139	3159	3035	2815	32590	8.64	1.132
BIENG	161	164	168	216	237	281	295	306	325	384	254	3625	7.00	0.917
CARDI	2086	2113	2196	2234	2395	2404	2792	2927	2931	3175	2525	30034	8.41	1.102
CHILD	729	783	922	829	848	950	1031	1151	1165	1188	960	16454	5.83	0.765
CYTHI	597	660	687	758	805	968	996	1103	1198	1165	894	9725	9.19	1.205
DENTA	94	124	117	127	133	200	206	247	269	277	179	4209	4.26	0.559
DERMA	679	667	736	798	822	959	1000	1025	1075	1111	887	9501	9.34	1.224
ENDOC	1965	1974	2245	2200	2233	2372	2501	2628	2727	2727	2357	34412	6.85	0.898
GASTR	1369	1397	1458	1446	1554	1588	1756	1888	1836	1838	1613	20712	7.79	1.021
GENET	2097	2146	2451	2802	2927	3235	3280	3553	3707	3749	2995	35921	8.34	1.093
GERON	321	338	340	408	485	493	603	661	757	767	517	8764	5.90	0.774
HAEMA	1195	1279	1359	1415	1503	1556	1653	1656	1746	1784	1515	17430	8.69	1.139
HUGEN	38	48	56	76	61	76	118	118	124	132	85	1108	7.64	1.002
IMMAL	1570	1692	1840	1883	2078	2138	2209	2118	2295	2347	2017	23616	8.54	1.120
INFEC	2406	2491	2568	2731	2691	2865	2968	3154	3290	3248	2841	38020	7.47	0.980
MENTH	568	598	625	732	749	861	899	995	1024	1007	806	7042	11.44	1.500
NEUSC	1523	1644	1778	1879	2091	2233	2324	2597	2694	2802	2157	26854	8.03	1.053
OBSGY	1262	730	1452	892	896	902	1035	990	984	1013	1016	15508	6.55	0.859
ONCOL	1861	1972	2229	2304	2491	2684	2937	2918	3217	3273	2589	31539	8.21	1.076
OPHTH	547	557	573	560	583	700	874	862	928	920	710	6924	10.26	1.345
OTORH	232	201	229	273	298	339	426	416	442	491	335	5444	6.15	0.806
PATHO	1018	1043	1179	1171	1273	1306	1403	1460	1561	1683	1310	17350	7.55	0.990
PHATO	1168	1205	1095	1165	1133	1211	1187	1329	1197	1216	1191	17600	6.76	0.887
PUBEP	330	423	444	503	480	585	646	719	792	837	576	10394	5.54	0.726
RADIO	487	464	517	540	582	656	725	766	797	814	635	7258	8.75	1.147
RENAL	539	550	605	581	650	752	761	800	783	722	674	7479	9.02	1.182
RESPI	511	546	616	645	721	755	835	855	914	1000	740	12347	5.99	0.786
SURGE	705	772	757	841	926	976	1093	1229	1280	1362	994	16694	5.95	0.781
TROPM	168	170	173	209	212	213	232	239	260	268	214	4674	4.59	0.601

Table A2.6 **Israeli** outputs in 32 sub-fields (publication years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*	*World*	*IL/w %*	*Ratio*
ANAPH	49	52	57	60	61	66	61	74	49	57	59	6728	0.87	0.693
ANEST	61	47	70	76	68	81	84	76	80	96	74	6732	1.10	0.873
ARTHR	105	141	129	119	113	126	152	141	148	149	132	7001	1.89	1.503
BCMBI	364	380	405	444	432	394	412	412	429	452	412	32590	1.27	1.007
BIENG	33	44	55	55	53	47	58	57	48	69	52	3625	1.43	1.139
CARDI	303	359	358	314	341	347	410	387	380	405	360	30034	1.20	0.955
CHILD	252	285	325	317	316	292	302	327	287	385	309	16454	1.88	1.493
CYTHI	76	92	89	90	115	122	116	136	152	145	113	9725	1.17	0.927
DENTA	69	62	70	74	60	85	81	87	85	110	78	4209	1.86	1.480
DERMA	137	122	131	139	114	124	133	147	131	137	132	9501	1.38	1.101
ENDOC	390	449	485	453	497	501	480	465	459	462	464	34412	1.35	1.073
GASTR	161	205	175	198	224	177	242	210	227	266	209	20712	1.01	0.801
GENET	293	330	378	379	400	370	444	490	469	502	406	35921	1.13	0.898
GERON	94	98	95	101	97	134	121	127	120	122	111	8764	1.27	1.007
HAEMA	227	241	288	269	283	262	262	285	282	266	267	17430	1.53	1.216
HUGEN	9	9	10	8	2	14	12	23	26	20	13	1108	1.20	0.955
IMMAL	267	345	351	320	347	347	330	309	350	347	331	23616	1.40	1.116
INFEC	394	415	468	478	470	394	451	464	429	453	442	38020	1.16	0.924
MENTH	116	138	148	150	202	212	194	185	237	233	182	7042	2.58	2.050
NEUSC	257	268	292	288	305	348	329	373	342	344	315	26854	1.17	0.932
OBSGY	279	334	341	352	372	367	307	347	322	354	338	15508	2.18	1.731
ONCOL	312	367	342	398	401	410	414	438	404	431	392	31539	1.24	0.988
OPHTH	89	114	101	80	94	101	114	100	102	105	100	6924	1.44	1.149
OTORH	92	72	79	82	75	80	75	82	98	115	85	5444	1.56	1.242
PATHO	177	175	156	168	199	175	179	194	167	181	177	17350	1.02	0.812
PHATO	131	142	105	142	134	116	145	142	155	184	140	17600	0.79	0.631
PUBEP	118	143	163	157	157	173	160	179	186	194	163	10394	1.57	1.247
RADIO	61	58	46	70	65	67	58	60	66	69	62	7258	0.85	0.679
RENAL	77	87	75	94	87	95	85	88	85	100	87	7479	1.17	0.928
RESPI	91	112	112	121	124	119	123	122	116	132	117	12347	0.95	0.755
SURGE	170	174	173	166	177	207	235	190	212	222	193	16694	1.15	0.918
TROPM	59	41	67	73	52	40	36	34	47	33	48	4674	1.03	0.820

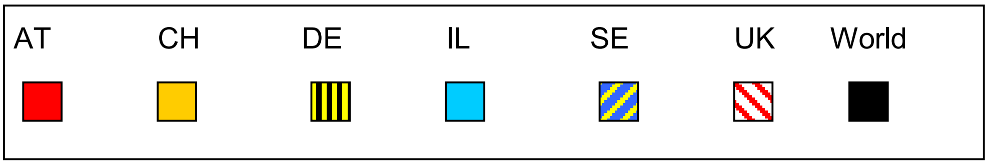
Table A2.7 **Swedish** outputs in 32 sub-fields (publication years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*	*World*	*SE/w %*	*Ratio*
ANAPH	259	251	209	241	201	225	215	218	182	173	217	6728	3.23	1.180
ANEST	200	207	207	196	243	239	239	235	228	234	223	6732	3.31	1.208
ARTHR	172	168	188	197	203	218	234	260	279	260	218	7001	3.11	1.136
BCMBI	716	663	713	863	849	842	895	863	852	842	810	32590	2.48	0.907
BIENG	85	92	120	132	117	139	159	152	145	128	127	3625	3.50	1.278
CARDI	748	747	723	751	719	775	772	783	789	833	764	30034	2.54	0.929
CHILD	412	437	450	454	453	475	521	490	528	490	471	16454	2.86	1.045
CYTHI	155	162	163	181	231	233	223	239	285	256	213	9725	2.19	0.799
DENTA	204	228	225	221	255	237	231	269	214	203	229	4209	5.43	1.984
DERMA	231	212	163	229	243	245	231	235	277	250	232	9501	2.44	0.890
ENDOC	1081	1059	1096	1198	1174	1241	1288	1239	1238	1185	1180	34412	3.43	1.252
GASTR	607	572	554	607	625	651	627	610	626	579	606	20712	2.92	1.068
GENET	603	648	738	815	875	920	940	976	1016	938	847	35921	2.36	0.861
GERON	201	241	229	253	277	347	352	314	370	358	294	8764	3.36	1.226
HAEMA	404	406	457	460	462	514	489	483	463	447	459	17430	2.63	0.960
HUGEN	26	20	28	30	29	41	44	43	56	49	37	1108	3.30	1.206
IMMAL	659	622	621	723	779	795	783	768	829	747	733	23616	3.10	1.133
INFEC	815	828	872	870	868	963	898	929	941	925	891	38020	2.34	0.856
MENTH	181	195	223	248	244	289	334	333	373	332	275	7042	3.91	1.427
NEUSC	774	785	804	841	870	783	811	866	839	846	822	26854	3.06	1.117
OBSGY	342	395	377	374	438	478	499	462	458	524	435	15508	2.80	1.023
ONCOL	666	636	696	794	840	868	897	809	895	851	795	31539	2.52	0.921
OPHTH	97	109	124	137	119	118	147	144	151	142	129	6924	1.86	0.679
OTORH	165	147	142	154	160	129	194	175	172	178	162	5444	2.97	1.084
PATHO	409	434	394	453	451	488	505	484	496	449	456	17350	2.63	0.960
PHATO	422	433	438	388	448	386	371	440	435	392	415	17600	2.36	0.862
PUBEP	339	339	388	418	402	512	534	550	593	602	468	10394	4.50	1.643
RADIO	140	161	185	162	220	195	223	196	162	174	182	7258	2.50	0.914
RENAL	202	230	205	191	210	201	230	192	210	177	205	7479	2.74	1.000
RESPI	313	289	279	337	303	355	357	350	415	404	340	12347	2.76	1.006
SURGE	452	461	467	446	454	489	513	458	461	440	464	16694	2.78	1.015
TROPM	84	83	102	85	86	100	94	88	102	93	92	4674	1.96	0.716

Table A2.8 **British** outputs in 32 sub-fields (publication years)

Code	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Mean*	*World*	*UK/w %*	*Ratio*
ANAPH	524	511	556	561	562	791	573	609	580	569	584	6728	8.67	0.848
ANEST	841	835	857	823	791	846	768	840	805	829	824	6732	12.23	1.196
ARTHR	829	932	943	967	924	932	945	854	926	950	920	7001	13.14	1.285
BCMBI	2505	2513	2635	3310	3438	3079	3243	3040	2937	2912	2961	32590	9.09	0.888
BIENG	226	247	258	322	328	318	367	366	384	395	321	3625	8.86	0.866
CARDI	2369	2533	2581	2715	2692	2623	2654	2580	2668	2902	2632	30034	8.76	0.857
CHILD	1686	1731	1782	1910	1902	1867	1895	1964	2011	2041	1879	16454	11.42	1.116
CYTHI	663	690	757	878	915	937	998	1047	1067	1072	902	9725	9.28	0.907
DENTA	451	474	517	489	553	588	578	609	598	629	549	4209	13.03	1.274
DERMA	960	1024	1047	1030	943	1033	999	1002	1016	1080	1013	9501	10.67	1.043
ENDOC	2773	2993	3218	3303	3174	3282	3167	3152	3119	3133	3131	34412	9.10	0.890
GASTR	1829	1892	1959	2091	2036	1866	1923	1858	1833	1758	1905	20712	9.20	0.899
GENET	2604	2898	3183	3555	3698	3688	3880	4071	4024	4194	3580	35921	9.96	0.974
GERON	620	754	738	805	823	942	1055	940	1037	1157	887	8764	10.12	0.989
HAEMA	1485	1521	1728	1754	1646	1633	1699	1641	1670	1654	1643	17430	9.43	0.922
HUGEN	116	147	126	135	180	188	219	197	215	239	176	1108	15.90	1.555
IMMAL	2093	2206	2320	2311	2372	2351	2399	2382	2382	2408	2322	23616	9.83	0.961
INFEC	3483	3647	3855	4062	5081	4030	4053	4210	4250	4379	4105	38020	10.80	1.055
MENTH	1023	1017	1006	1122	1218	1489	1469	1360	1504	1602	1281	7042	18.19	1.778
NEUSC	2093	2092	2164	2201	2382	2568	2403	2415	2539	2580	2344	26854	8.73	0.853
OBSGY	1489	1510	1577	1757	1727	1789	1604	1726	1696	1757	1663	15508	10.72	1.048
ONCOL	2499	2585	2750	2948	2831	2917	2800	2747	2956	2914	2795	31539	8.86	0.866
OPHTH	572	753	736	723	745	751	731	788	786	839	742	6924	10.72	1.048
OTORH	539	530	539	551	607	607	630	593	663	697	596	5444	10.94	1.070
PATHO	1669	1711	1768	1712	1654	1666	1684	1646	1594	1640	1674	17350	9.65	0.943
PHATO	1621	1746	1726	1820	1944	1883	1717	1665	1590	1680	1739	17600	9.88	0.966
PUBEP	788	956	1213	1292	1422	1551	1537	1801	1836	2051	1445	10394	13.90	1.359
RADIO	587	571	570	640	569	541	556	567	583	601	579	7258	7.97	0.779
RENAL	621	649	646	661	560	610	574	539	587	559	601	7479	8.03	0.785
RESPI	1263	1319	1327	1408	1407	1431	1379	1487	1461	1527	1401	12347	11.35	1.109
SURGE	1184	1177	1233	1284	1237	1189	1147	1127	1218	1271	1207	16694	7.23	0.707
TROPM	572	577	649	722	654	645	735	731	765	823	687	4674	14.71	1.438

Key to figures A2.1 to A2.8:



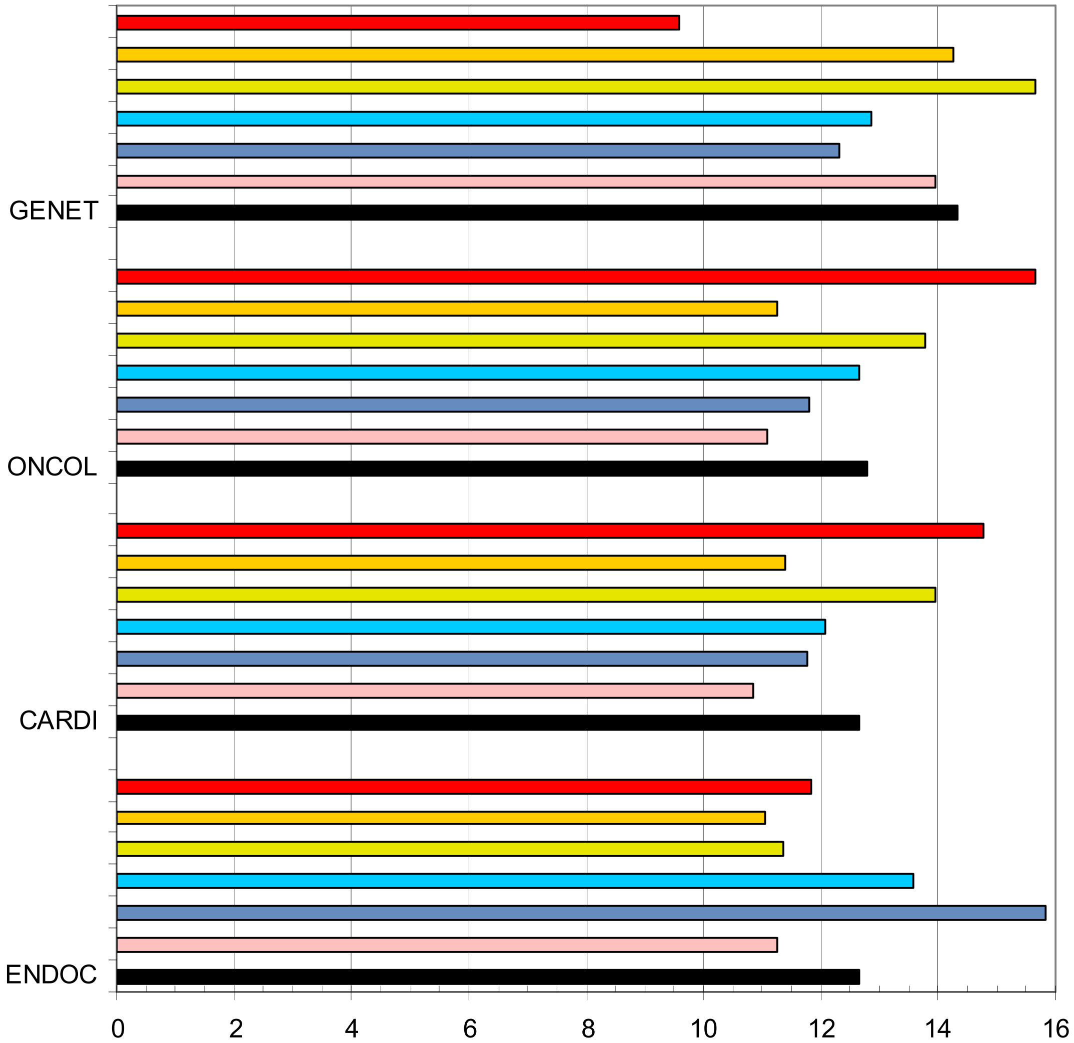


Figure A2.1 Outputs of sub-fields 1-4 (genetics, oncology, cardiology, endocrinology) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000.

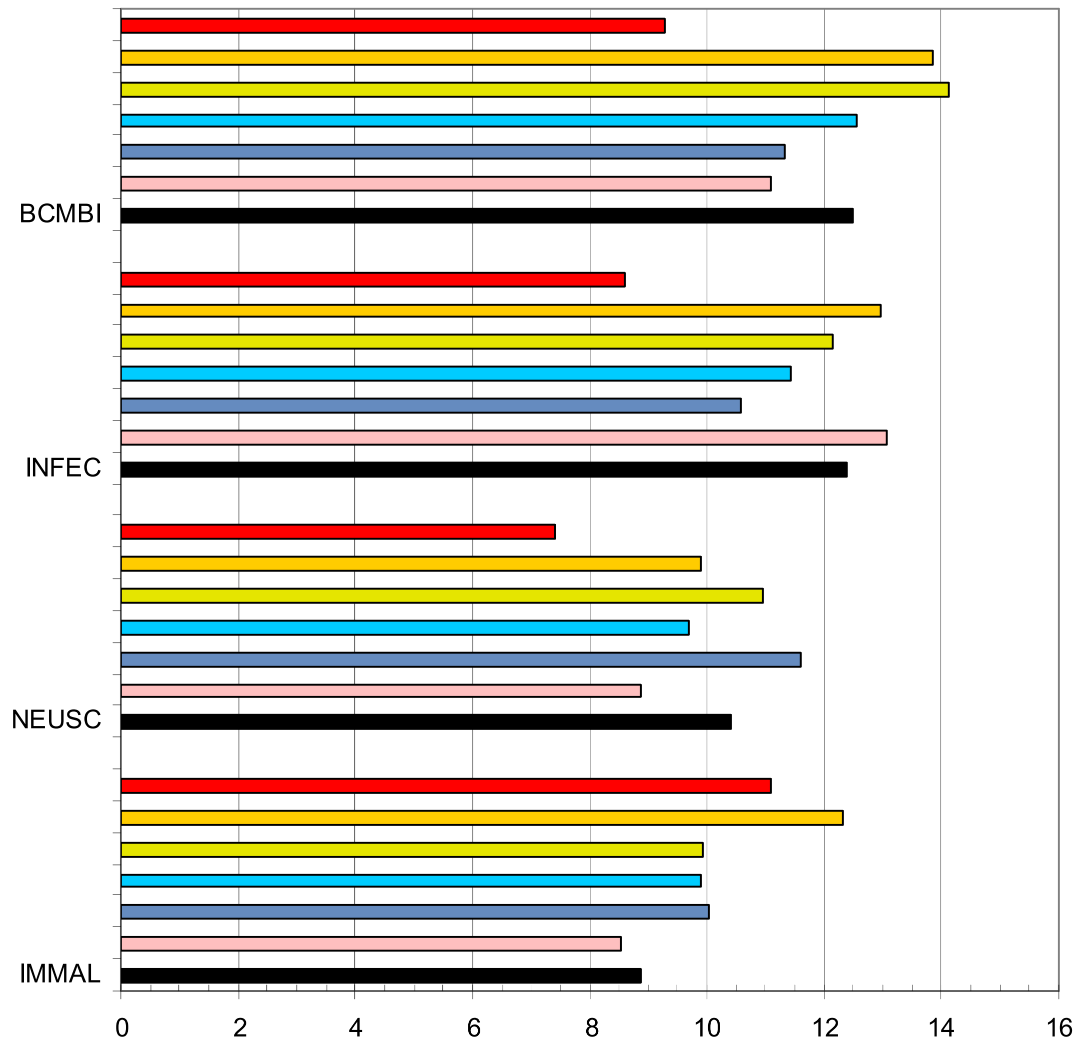
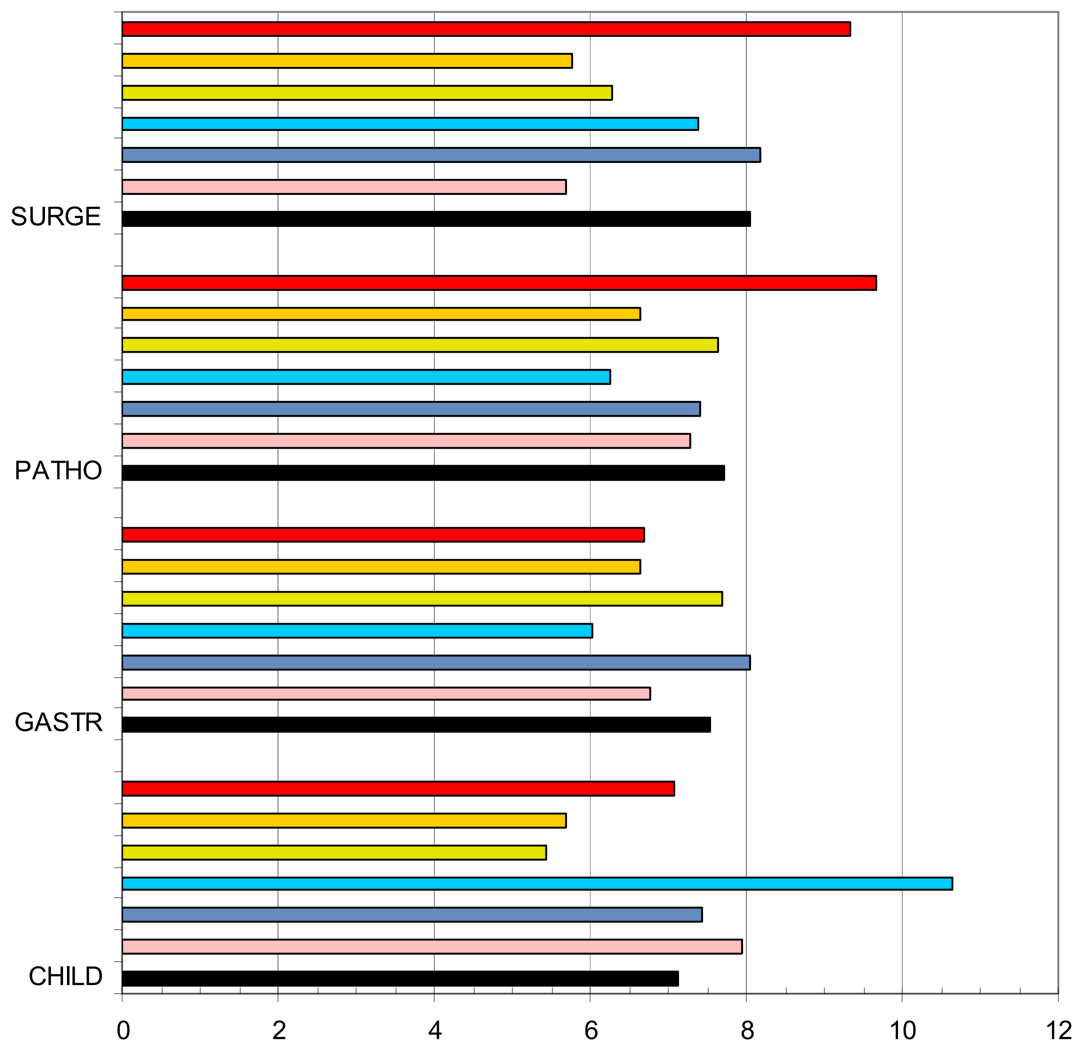


Figure A2.2 Outputs of sub-fields 5-8 (biochemistry & molecular biology, infection, neuroscience, immunology & allergology) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000

Figure A2.3 Outputs of sub-fields 9-12 (surgery, pathology, gastroenterology, paediatrics



& neonatology) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000

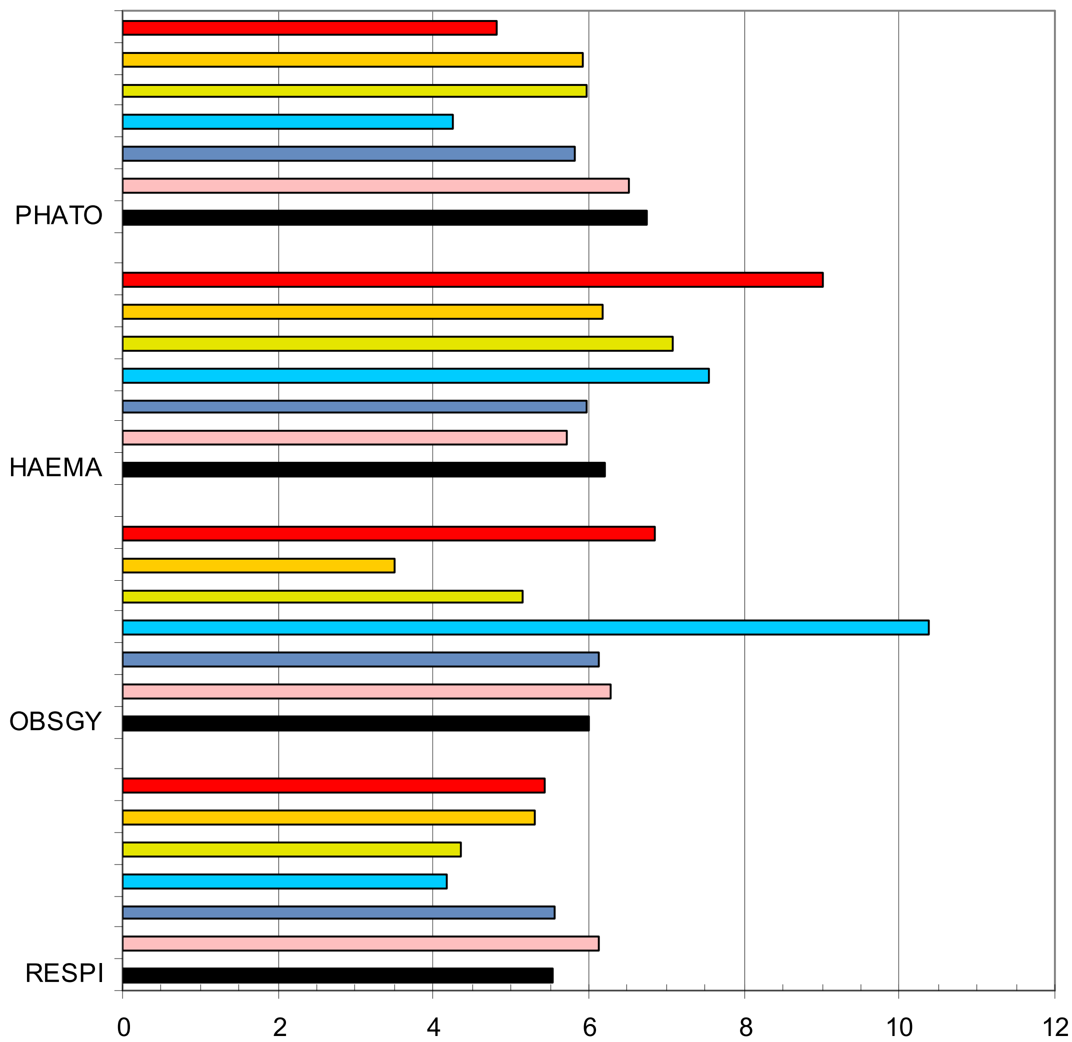


Figure A2.4 Outputs of sub-fields 13-16 (pharmacology & toxicology, haematology, obstetrics & gynaecology, respiratory medicine) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000

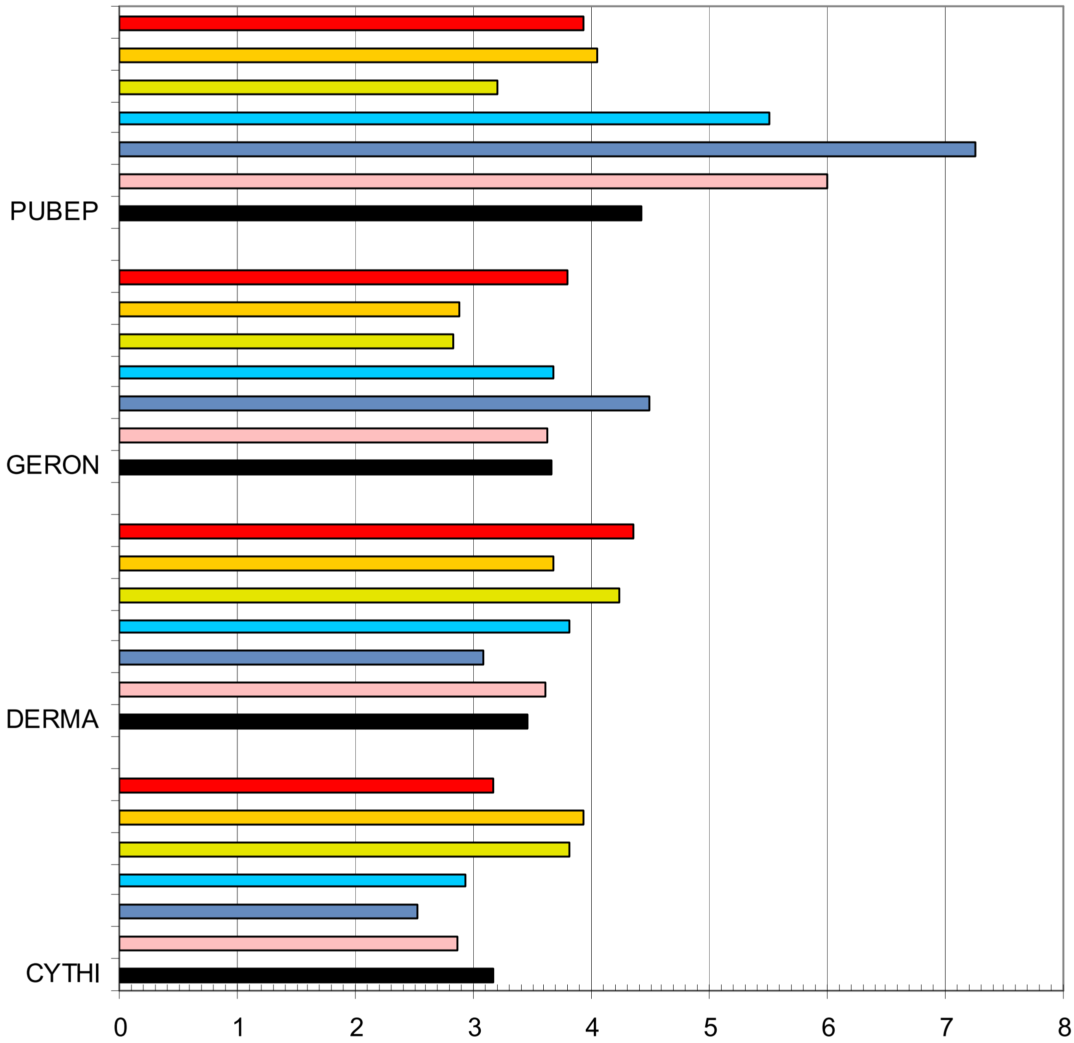


Figure A2.5 Outputs of sub-fields 17-20 (public health & epidemiology, gerontology, dermatology & venereology, cell biology) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000

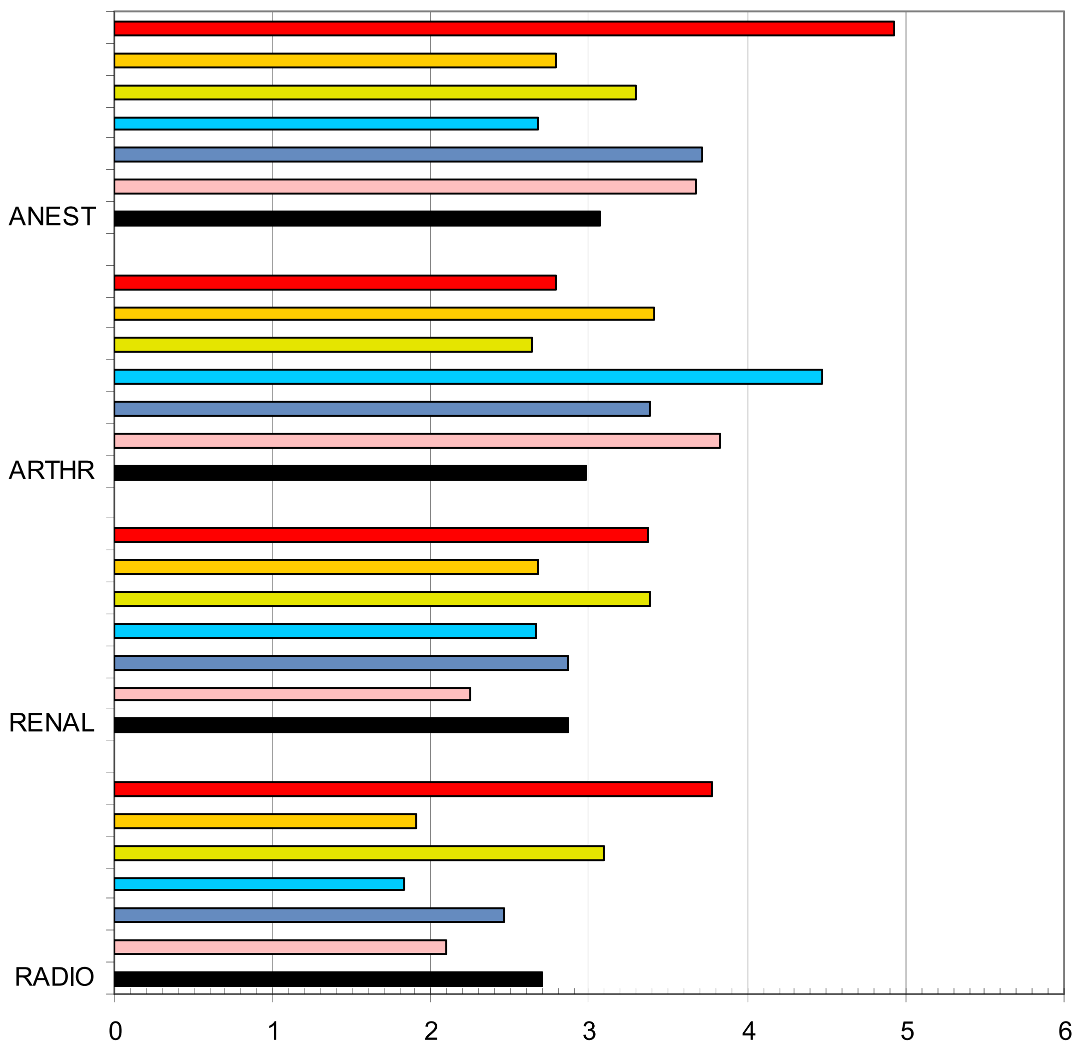


Figure A2.6 Outputs of sub-fields 21-24 (anaesthesia, arthritis, renal medicine, radiology radiotherapy & nuclear medicine) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000

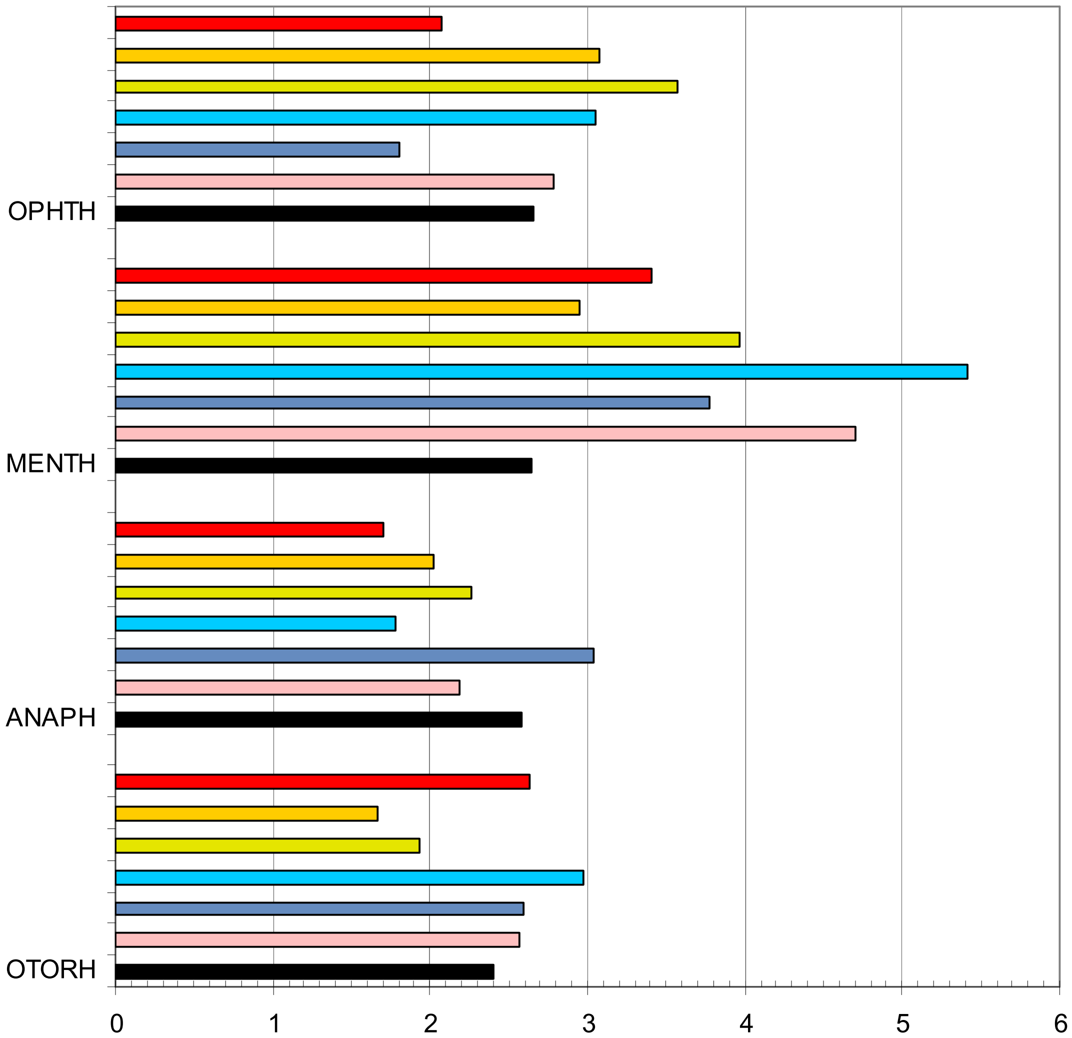


Figure A2.7 Outputs of sub-fields 25-28 (ophthalmology, mental health, anatomy morphology & physiology, otorhinolaryngology) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000. Note: world outputs in mental health in SCI only.

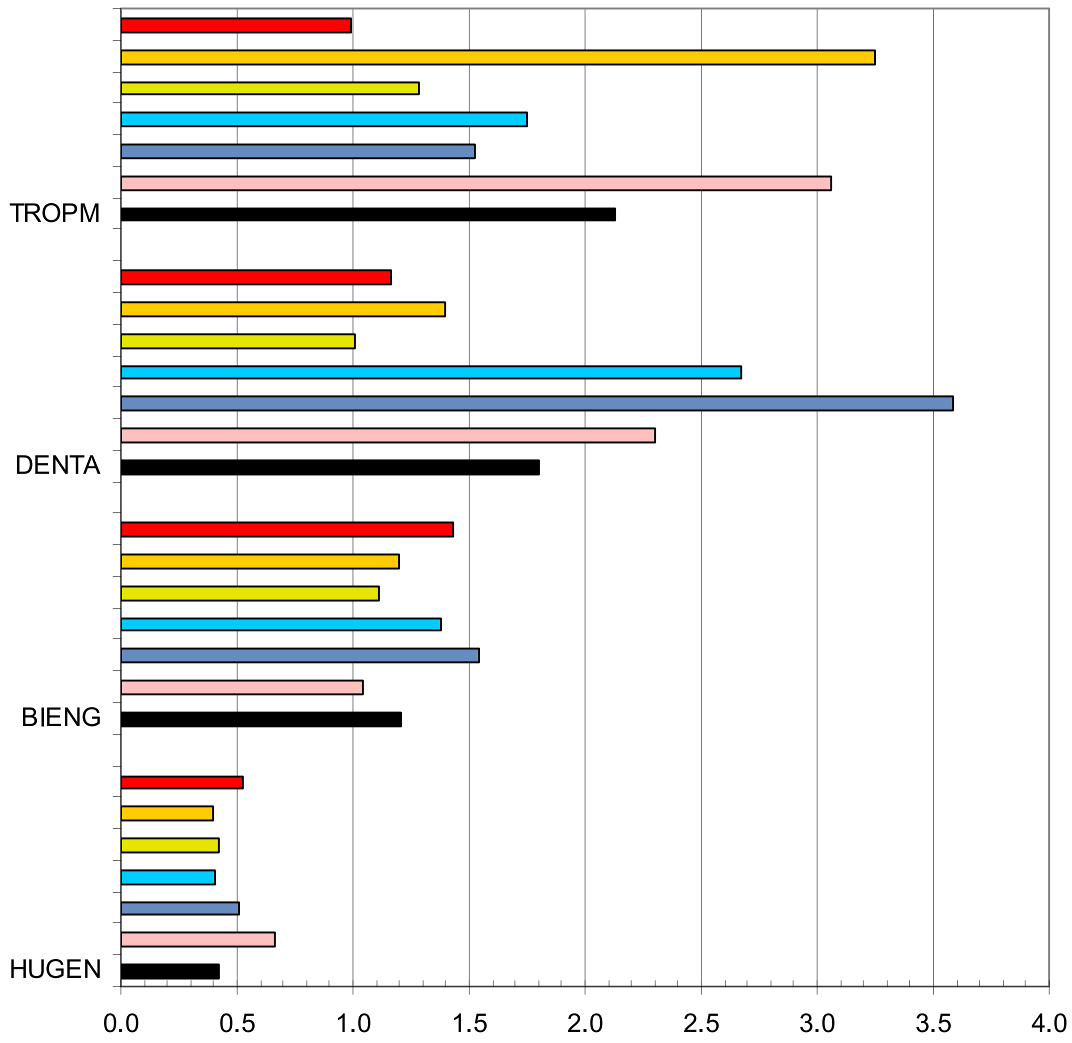


Figure A2.8 Outputs of sub-fields 29-32 (tropical medicine, dentistry, biomedical engineering, human genetics) ranked by world output as % of biomedicine for Austria, Switzerland, Germany, Israel, Sweden, the UK and the World, percent of each country's biomedical output 1991-2000

A2.2 Outputs of Austrian institutional sectors in 32 sub-fields

Table A2.9 Austrian outputs from different sectors in 32 sub-fields, 1991-95

1991-95	*All*	*Univs*	*Med facs*	*Sci facs*	*Others*	*Hosp*	*Comp*	*LBI*	*AAS*	*Other*
All	11004	8931	7030	1506	395	1813	859	719	299	391
ANAPH	197	191	144	39	8	13	1	5	1	2
ANEST	295	252	238	14	0	59	4	26	0	7
ARTHR	259	186	177	8	1	78	23	50	2	11
BCMBI	966	764	388	290	86	17	176	37	62	12
BIENG	140	118	85	14	19	27	2	28	3	9
CARDI	1534	1253	1111	135	7	330	49	92	59	43
CHILD	654	551	536	11	4	178	15	27	5	13
CYHTHI	359	286	231	49	6	19	62	22	20	5
DENTA	85	76	72	6	0	17	0	0	1	3
DERMA	523	444	426	11	7	54	35	22	7	19
ENDOC	1325	1099	978	127	0	256	55	117	77	36
GASTR	792	657	621	41	0	187	28	45	7	23
GENET	911	678	449	184	45	81	202	44	28	36
GERON	316	244	227	11	6	94	4	46	15	3
HAEMA	1076	823	791	25	7	249	151	91	19	24
HUGEN	41	37	31	6	0	6	3	3	3	2
IMMAL	1275	989	910	87	0	174	254	111	73	44
INFEC	1106	858	634	117	107	113	187	116	19	42
MENTH	336	272	255	9	8	66	6	22	7	23
NEUSC	777	699	520	156	23	64	16	57	36	7
OBSGY	813	677	644	31	2	174	14	33	33	24
ONCOL	1545	1218	1166	64	0	424	133	95	15	30
OPHTH	222	195	183	12	0	31	3	4	1	1
OTORH	192	159	153	6	0	48	2	7	6	3
PATHO	917	784	705	93	0	145	36	64	58	18
PHATO	547	454	326	144	0	51	45	13	12	25
PUBEP	361	300	290	8	2	102	8	21	5	20
RADIO	365	285	284	3	0	111	3	43	3	28
RENAL	400	345	330	13	2	77	11	23	2	6
RESPI	461	365	334	28	3	131	21	45	4	19
SURGE	788	610	601	16	0	249	5	68	2	11
TROPM	74	69	63	2	4	7	2	3	0	4

Table A2.10 Austrian outputs from different sectors in 32 sub-fields, 1996-2000

1996-00	*All*	*Univs*	*Med facs*	*Sci facs*	*Others*	*Hosp*	*Comp*	*LBI*	*AAS*	*Other*
All	15753	13289	10241	2265	783	2241	921	1030	398	579
ANAPH	247	233	166	63	4	27	1	11	6	4
ANEST	786	719	704	21	0	101	6	80	1	14
ARTHR	398	297	277	20	0	118	28	91	10	8
BCMBI	1451	1216	573	517	126	36	194	77	72	18
BIENG	279	256	210	25	21	32	4	26	4	8
CARDI	1967	1718	1612	136	0	295	55	115	81	40
CHILD	981	821	805	25	0	249	13	35	5	23
CYHTHI	615	496	379	120	0	39	90	43	44	8
DENTA	186	173	167	11	0	20	1	2	4	3
DERMA	671	550	520	25	5	100	52	27	11	18
ENDOC	1892	1600	1414	184	2	359	70	131	66	46
GASTR	1041	888	839	64	0	226	36	50	5	23
GENET	1491	1215	845	281	89	179	180	86	36	43
GERON	591	470	446	24	0	121	12	79	40	14
HAEMA	1454	1167	1108	58	1	341	131	101	17	33
HUGEN	97	80	68	13	0	19	8	6	2	2
IMMAL	1677	1410	1288	117	5	212	202	123	69	38
INFEC	1527	1303	898	242	163	150	140	131	32	62
MENTH	571	483	458	21	4	85	12	56	8	32
NEUSC	1135	1008	797	203	8	106	39	104	30	22
OBSGY	956	836	794	42	0	176	19	62	31	28
ONCOL	2306	1864	1779	96	0	585	127	151	26	60
OPHTH	317	283	263	23	0	49	8	9	4	5
OTORH	394	349	330	19	0	79	8	12	2	6
PATHO	1258	1103	993	118	0	185	41	96	52	11
PHATO	710	587	419	199	0	59	73	18	4	53
PUBEP	561	481	463	17	1	124	9	42	10	41
RADIO	648	540	532	14	0	151	6	50	2	39
RENAL	481	427	416	19	0	82	11	17	0	5
RESPI	752	653	610	51	0	147	30	53	12	19
SURGE	1143	976	970	11	0	278	7	67	3	12
TROPM	143	131	113	15	3	6	2	6	0	8

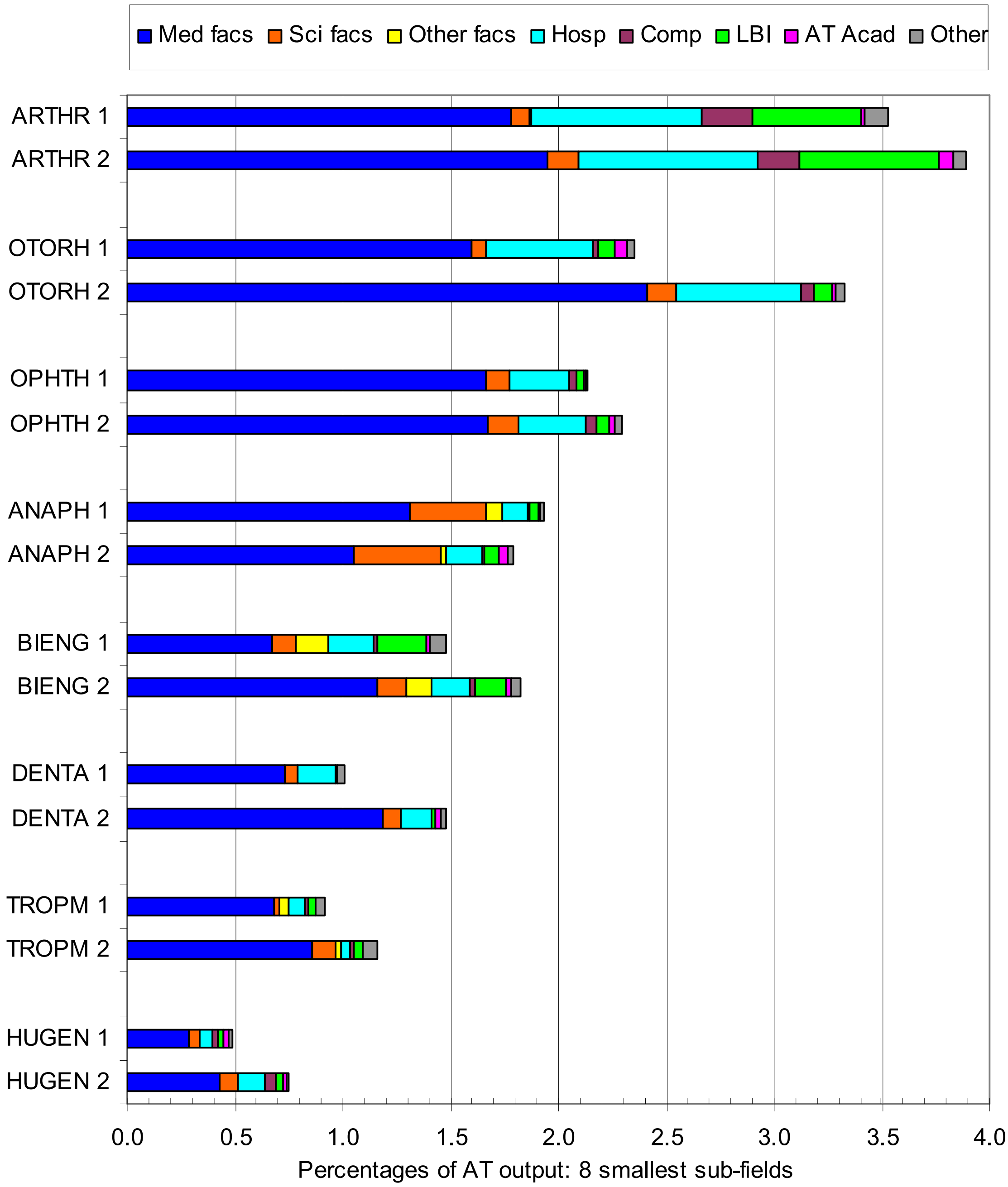


Figure A2.9 Contributions of Austrian insititutional sectors to individual sub-fields: 1 = 1991-95, 2 = 1996-2000.

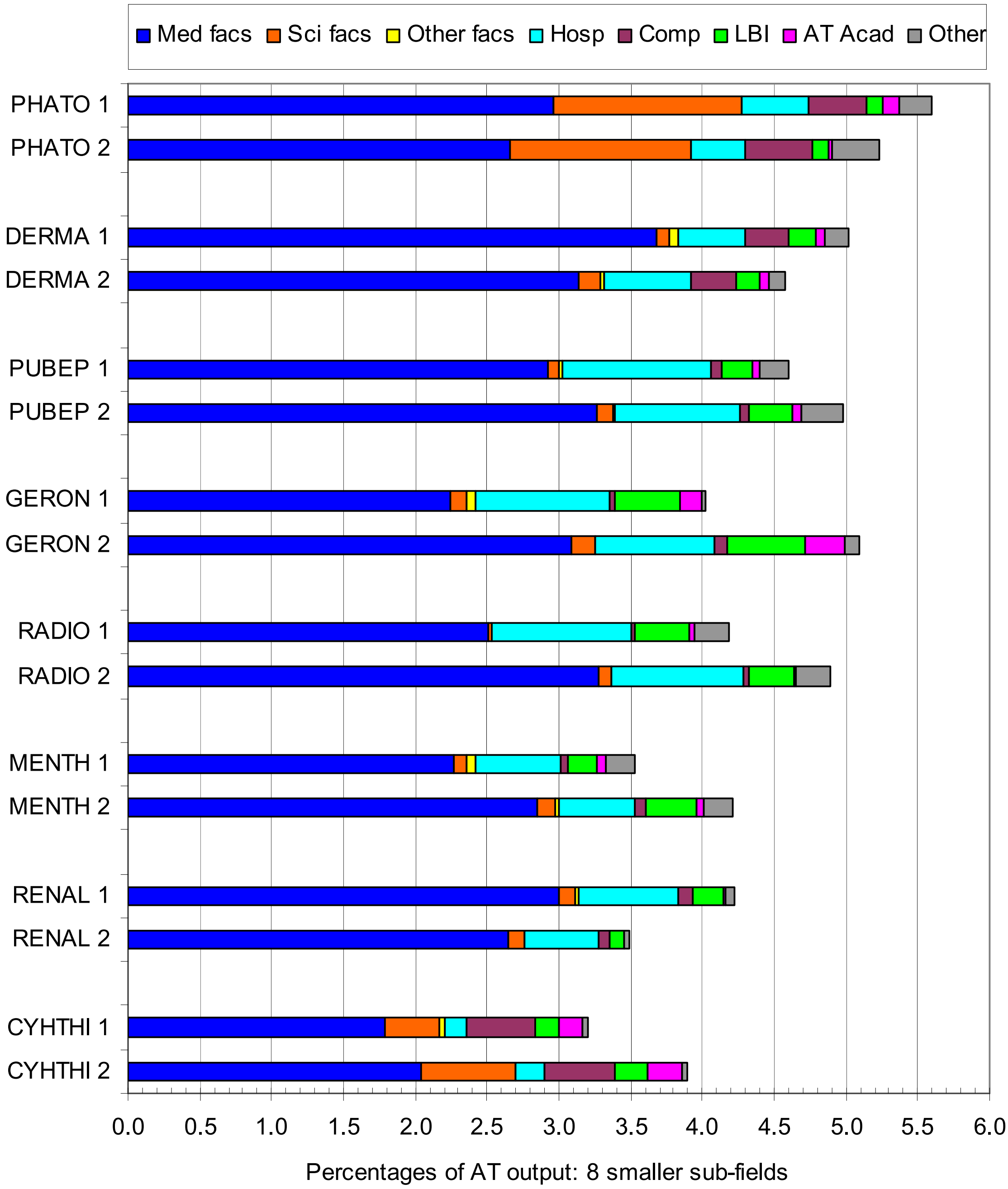


Figure A2.10 Contributions of Austrian insititutional sectors to individual sub-fields: 1 = 1991-95, 2 = 1996-2000

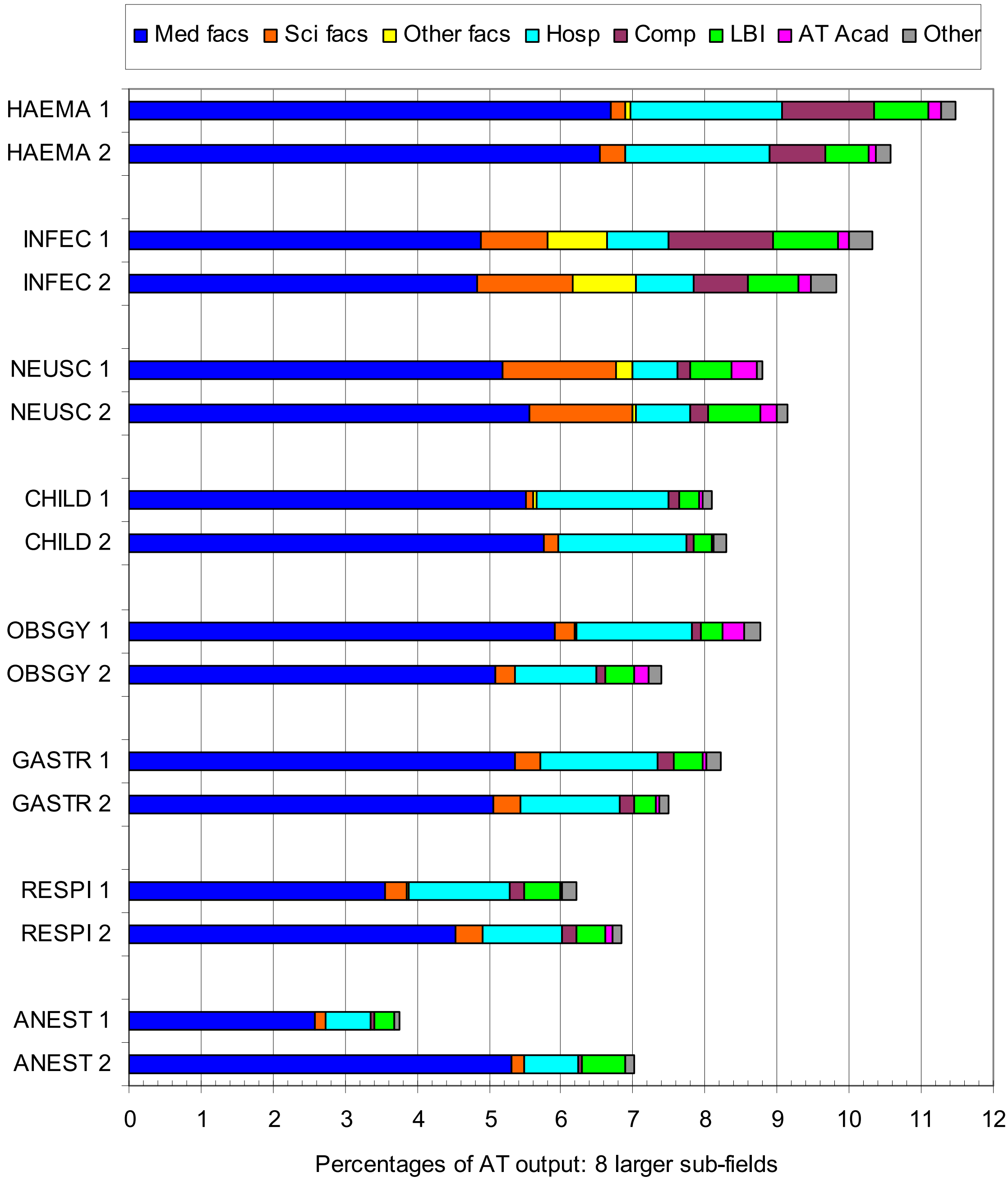


Figure A2.11 Contributions of Austrian insititutional sectors to individual sub-fields: 1 = 1991-95, 2 = 1996-2000

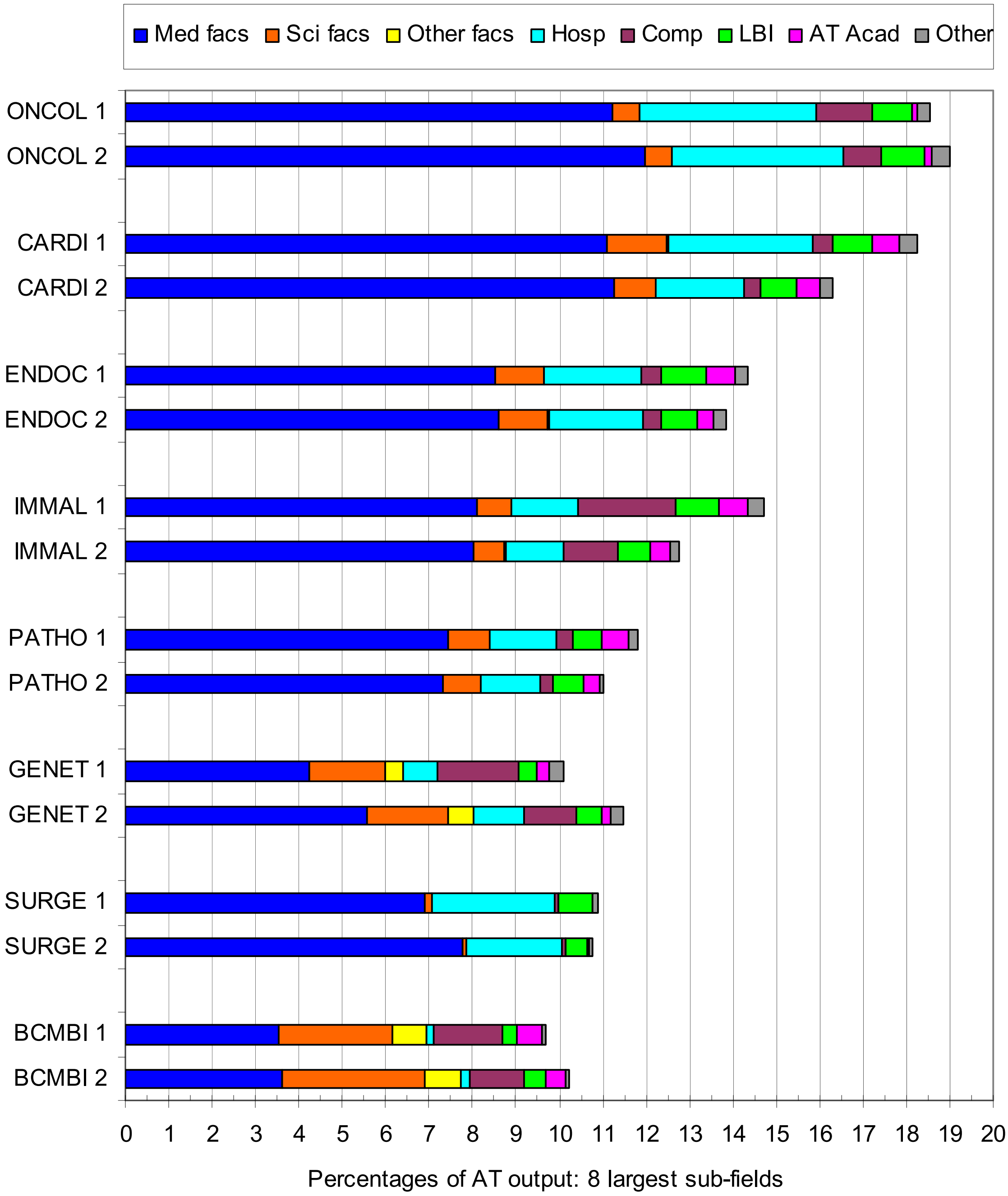


Figure A2.12 Contributions of Austrian insititutional sectors to individual sub-fields: 1 = 1991-95, 2 = 1996-2000

A2.3 Outputs of main funding sectors and sources

Table A2.11 Numbers of papers in each sub-field for each funding source

All years	*Inspected*	*Gov*	*FFW*	*ANB*	*MSR*	*AAS*	*WIE*	*PNP*	*LBI*	*IND*	*INT*	*EU*	*OTH*	*None*
All	**25969**	**7693**	**5477**	**1460**	**857**	**859**	**487**	**3202**	**1927**	**3948**	**1182**	**741**	**5686**	**11576**
ANAPH	436	214	173	51	16	9	10	56	19	34	14	12	136	141
ANEST	1065	175	109	54	18	7	21	162	119	176	9	5	159	656
ARTHR	640	126	68	18	16	14	23	179	151	99	21	15	150	252
BCMBI	2365	1484	1200	256	161	176	32	29	118	594	215	140	893	297
BIENG	413	120	80	43	16	8	10	83	59	39	10	5	58	183
CARDI	3425	89	596	239	59	155	90	447	241	400	57	42	479	1821
CHILD	1601	223	126	47	29	11	19	178	72	155	44	28	259	991
CYTHI	954	519	406	107	52	74	39	160	63	229	72	47	351	174
DENTA	265	35	16	6	3	6	11	12	5	14	2	1	16	205
DERMA	1165	240	171	43	16	19	31	101	53	172	28	20	248	632
ENDOC	3150	1108	776	290	60	170	74	483	272	457	92	72	731	1265
GASTR	1807	360	240	98	10	23	34	222	116	242	22	17	318	1007
GENET	2348	1075	780	217	112	85	53	304	139	479	225	126	942	430
GERON	890	180	96	44	34	56	11	160	126	125	22	18	162	436
HAEMA	2480	648	419	154	44	46	87	357	19	472	81	59	523	1038
HUGEN	136	61	47	12	5	9	2	16	12	24	12	8	52	24
IMMAL	2874	1108	812	155	157	157	81	370	250	776	155	102	907	804
INFEC	2548	849	606	125	155	70	39	365	260	574	194	117	780	842
MENTH	834	120	53	20	27	16	12	93	75	94	29	21	129	485
NEUSC	1853	819	682	133	55	89	27	301	163	257	139	109	650	464
OBSGY	1751	363	176	68	21	65	79	201	116	157	28	22	239	1070
ONCOL	3787	836	479	222	67	56	155	544	285	534	125	79	807	1874
OPHTH	513	83	58	20	7	4	4	23	14	30	8	5	54	368
OTORH	577	73	33	18	7	9	18	47	29	28	9	7	56	408
PATHO	2124	716	504	185	61	122	41	293	175	251	76	63	515	879
PHATO	1227	430	341	86	27	37	17	117	37	347	46	36	200	414
PUBEP	897	154	54	38	12	17	21	119	68	105	36	28	158	479
RADIO	995	58	26	23	6	5	14	157	149	31	16	4	133	681
RENAL	861	178	150	27	5	9	11	74	46	93	18	13	126	526
RESPI	1187	263	176	53	29	21	25	181	115	144	28	20	183	614
SURGE	1915	137	58	50	8	6	26	190	153	93	5	3	95	1502
TROPM	206	33	21	7	0	1	4	19	11	39	33	8	92	82

Gov = Austrian government; FFW = Austrian Fund of Scientific Research; ANB = Austrian National Bank; MSR = Ministry of Science and Research; AAS = Austrian Academy of Sciences; WIE = Vienna Mayor's Fund; PNP = Austrian private-non-profit; LBI = Ludwig Boltzmann Institute; IND = industry; INT = international organizations; EU = European Union; OTH = others (foreign governmental and private-non-profit).

Table A2.12 Relative commitment to individual sub-fields by Austrian government, Austrian Fund of Scientific Research, Austrian National Bank, Ministry of Science and Research and Vienna Mayor's Fund.

AT government		*AT Fu Sci Res*		*AT Natl Bank*		*Min Sci Res*		*AT Acad Sci*		*Vienna Mayor*	
BCMBI	2.12	BCMBI	2.41	ANAPH	2.08	BCMBI	2.06	CYTHI	2.35	OBSGY	2.41
CYTHI	1.84	CYTHI	2.02	CYTHI	1.99	INFEC	1.84	BCMBI	2.25	DENTA	2.21
ANAPH	1.66	ANAPH	1.88	BCMBI	1.93	IMMAL	1.66	HUGEN	2.00	ONCOL	2.18
GENET	1.55	NEUSC	1.75	BIENG	1.85	CYTHI	1.65	GERON	1.90	CYTHI	2.18
HUGEN	1.51	HUGEN	1.64	GENET	1.64	GENET	1.45	PATHO	1.74	ARTHR	1.92
NEUSC	1.49	GENET	1.58	ENDOC	1.64	BIENG	1.17	IMMAL	1.65	HAEMA	1.87
IMMAL	1.30	IMMAL	1.34	HUGEN	1.57	GERON	1.16	ENDOC	1.63	OTORH	1.66
ENDOC	1.19	PHATO	1.32	PATHO	1.55	HUGEN	1.11	NEUSC	1.45	IMMAL	1.50
PHATO	1.18	ENDOC	1.17	NEUSC	1.28	ANAPH	1.11	CARDI	1.37	DERMA	1.42
PATHO	1.14	INFEC	1.13	PHATO	1.25	**ALL**	**1.00**	OBSGY	1.12	CARDI	1.40
INFEC	1.12	PATHO	1.13	CARDI	1.24	MENTH	0.98	GENET	1.09	BIENG	1.29
ALL	**1.00**	**ALL**	**1.00**	HAEMA	1.10	NEUSC	0.90	**ALL**	**1.00**	ENDOC	1.25
BIENG	0.98	BIENG	0.92	ONCOL	1.04	PATHO	0.87	PHATO	0.91	PUBEP	1.25
CARDI	0.89	RENAL	0.83	**ALL**	**1.00**	ARTHR	0.76	INFEC	0.83	ANAPH	1.22
HAEMA	0.88	CARDI	0.83	GASTR	0.96	RESPI	0.74	DENTA	0.68	GENET	1.20
RESPI	0.75	HAEMA	0.80	IMMAL	0.96	PHATO	0.67	ARTHR	0.66	RESPI	1.12
ONCOL	0.75	RESPI	0.70	ANEST	0.90	ENDOC	0.58	ANAPH	0.62	ANEST	1.05
OBSGY	0.70	DERMA	0.70	GERON	0.88	CHILD	0.55	BIENG	0.59	TROPM	1.04
RENAL	0.70	GASTR	0.63	INFEC	0.87	HAEMA	0.54	MENTH	0.58	PATHO	1.03
DERMA	0.70	ONCOL	0.60	RESPI	0.79	ONCOL	0.54	PUBEP	0.57	GASTR	1.00
GERON	0.68	OPHTH	0.54	PUBEP	0.75	CARDI	0.52	HAEMA	0.56	**ALL**	**1.00**
GASTR	0.67	GERON	0.51	OPHTH	0.69	ANEST	0.51	RESPI	0.53	INFEC	0.82
ARTHR	0.66	ARTHR	0.50	OBSGY	0.69	DERMA	0.42	DERMA	0.49	HUGEN	0.78
PUBEP	0.58	ANEST	0.49	DERMA	0.66	OPHTH	0.41	OTORH	0.47	NEUSC	0.78
ANEST	0.55	TROPM	0.48	TROPM	0.60	PUBEP	0.41	ONCOL	0.45	MENTH	0.77
OPHTH	0.55	OBSGY	0.48	RENAL	0.56	OTORH	0.37	GASTR	0.38	RADIO	0.75
TROPM	0.54	CHILD	0.37	OTORH	0.55	OBSGY	0.36	RENAL	0.32	PHATO	0.74
MENTH	0.49	MENTH	0.30	CHILD	0.52	DENTA	0.34	OPHTH	0.24	SURGE	0.72
CHILD	0.47	DENTA	0.29	ARTHR	0.50	RADIO	0.18	CHILD	0.21	BCMBI	0.72
DENTA	0.45	PUBEP	0.29	SURGE	0.46	RENAL	0.18	ANEST	0.20	RENAL	0.68
OTORH	0.43	OTORH	0.27	MENTH	0.43	GASTR	0.17	RADIO	0.15	GERON	0.66
SURGE	0.24	SURGE	0.14	RADIO	0.41	SURGE	0.13	TROPM	0.15	CHILD	0.63
RADIO	0.20	RADIO	0.12	DENTA	0.40	TROPM	0.00	SURGE	0.09	OPHTH	0.42

The ratios are equal to the number of papers from the given funder in the sub-field, divided by the total output of the funder, and by the ratio of the total output in the sub-field to all inspected papers.

Table A2.13 Relative commitment to individual sub-fields by Austrian private-non-profit sources, the Ludwig Boltzmann Institute, industry, international sources and the European Union.

AT non-profit		*Ludwig Boltzm.*		*Industry*		*International*		*European Union*	
ARTHR	2.27	ARTHR	3.18	PHATO	1.86	TROPM	3.52	BCMBI	2.07
BIENG	1.63	RADIO	2.02	IMMAL	1.78	GENET	2.11	HUGEN	2.06
GERON	1.46	BIENG	1.93	BCMBI	1.65	BCMBI	2.00	NEUSC	2.06
CYTHI	1.36	GERON	1.91	CYTHI	1.58	HUGEN	1.94	GENET	1.88
NEUSC	1.32	ANEST	1.51	INFEC	1.48	INFEC	1.67	CYTHI	1.73
RADIO	1.28	INFEC	1.38	GENET	1.34	CYTHI	1.66	INFEC	1.61
ENDOC	1.24	RESPI	1.31	HAEMA	1.25	NEUSC	1.65	TROPM	1.36
RESPI	1.24	MENTH	1.21	TROPM	1.25	IMMAL	1.18	IMMAL	1.24
ANEST	1.23	HUGEN	1.19	HUGEN	1.16	**ALL**	**1.00**	PUBEP	1.09
HAEMA	1.17	NEUSC	1.19	ANEST	1.09	PUBEP	0.88	PATHO	1.04
ONCOL	1.17	IMMAL	1.17	ARTHR	1.02	PHATO	0.82	PHATO	1.03
INFEC	1.16	ENDOC	1.16	**ALL**	**1.00**	PATHO	0.79	**ALL**	**1.00**
PATHO	1.12	PATHO	1.11	DERMA	0.97	MENTH	0.76	ANAPH	0.96
PUBEP	1.08	SURGE	1.08	ENDOC	0.95	ONCOL	0.73	MENTH	0.88
CARDI	1.06	PUBEP	1.02	ONCOL	0.93	ARTHR	0.72	HAEMA	0.83
GENET	1.05	ONCOL	1.01	GERON	0.92	HAEMA	0.72	ARTHR	0.82
IMMAL	1.04	**ALL**	**1.00**	NEUSC	0.91	ANAPH	0.71	ENDOC	0.80
ANAPH	1.04	CARDI	0.95	GASTR	0.88	ENDOC	0.64	ONCOL	0.73
ALL	**1.00**	OBSGY	0.89	RESPI	0.80	CHILD	0.60	GERON	0.71
GASTR	1.00	CYTHI	0.89	PATHO	0.78	GERON	0.54	CHILD	0.61
HUGEN	0.95	GASTR	0.87	PUBEP	0.77	BIENG	0.53	DERMA	0.60
OBSGY	0.93	GENET	0.80	CARDI	0.77	DERMA	0.53	RESPI	0.59
MENTH	0.90	RENAL	0.72	MENTH	0.74	RESPI	0.52	RENAL	0.53
CHILD	0.90	TROPM	0.72	RENAL	0.71	RENAL	0.46	OBSGY	0.44
SURGE	0.80	OTORH	0.68	CHILD	0.64	CARDI	0.37	CARDI	0.43
PHATO	0.77	BCMBI	0.67	BIENG	0.62	RADIO	0.35	OTORH	0.43
TROPM	0.75	DERMA	0.61	OBSGY	0.59	OBSGY	0.35	BIENG	0.42
DERMA	0.70	CHILD	0.61	ANAPH	0.51	OTORH	0.34	OPHTH	0.34
RENAL	0.70	ANAPH	0.59	OPHTH	0.38	OPHTH	0.34	GASTR	0.33
OTORH	0.66	PHATO	0.41	DENTA	0.35	GASTR	0.27	ANEST	0.16
DENTA	0.37	OPHTH	0.37	SURGE	0.32	ANEST	0.19	RADIO	0.14
OPHTH	0.36	DENTA	0.25	OTORH	0.32	DENTA	0.17	DENTA	0.13
BCMBI	0.10	HAEMA	0.10	RADIO	0.20	SURGE	0.06	SURGE	0.05

The ratios are equal to the number of papers from the given funder in the sub-field, divided by the total output of the funder, and by the ratio of the total output in the sub-field to all inspected papers.

Table A2.14 Relative commitment to individual sub-fields by other funding sources (foreign governmental and private-non-profit) and by papers with no funding acknowledgements.

Other funders				*No funding acknowledgements*			
TROPM	2.04	PUBEP	0.80	SURGE	1.76	**ALL**	1.00
GENET	1.83	GASTR	0.80	DENTA	1.74	BIENG	0.99
HUGEN	1.75	PHATO	0.74	OPHTH	1.61	HAEMA	0.94
BCMBI	1.72	CHILD	0.74	OTORH	1.59	PATHO	0.93
CYTHI	1.68	MENTH	0.71	RADIO	1.54	ENDOC	0.90
NEUSC	1.60	RESPI	0.70	CHILD	1.39	TROPM	0.89
IMMAL	1.44	ANEST	0.68	ANEST	1.38	ARTHR	0.88
ANAPH	1.42	RENAL	0.67	OBSGY	1.37	PHATO	0.76
INFEC	1.40	BIENG	0.64	RENAL	1.37	INFEC	0.74
PATHO	1.11	CARDI	0.64	MENTH	1.30	ANAPH	0.73
ARTHR	1.07	OBSGY	0.62	GASTR	1.25	IMMAL	0.63
ENDOC	1.06	RADIO	0.61	DERMA	1.22	NEUSC	0.56
ALL	**1.00**	OPHTH	0.48	PUBEP	1.20	GENET	0.41
ONCOL	0.97	OTORH	0.44	CARDI	1.19	CYTHI	0.41
DERMA	0.97	DENTA	0.28	RESPI	1.16	HUGEN	0.40
HAEMA	0.96	SURGE	0.23	ONCOL	1.11	BCMBI	0.28
GERON	0.83			GERON	1.10		

The ratios are equal to the number of papers from the given funder in the sub-field, divided by the total output of the funder, and by the ratio of the total output in the sub-field to all inspected papers.

Table A2.15. Numbers of papers from Austrian medical schools and science faculties and hospitals acknowledging support from the main funding sectors and sources, 1991-2000

Institution:	*All*	*Gov*	*FFW*	*ANB*	*MSR*	*AAS*	*WIE*	*PNP*	*LBI*	*IND*	*INT*	*EU*	*OTH*	*None*
Med. Sch's	17047	4586	3258	1057	410	398	406	2041	1045	1970	515	362	3085	8851
Graz	3191	802	610	217	78	49	6	264	61	262	61	49	457	1882
Innsbr.	4156	1442	1171	291	132	175	9	456	170	532	142	106	987	1870
Wien	10190	2498	1576	577	223	198	403	1403	855	1255	324	217	1698	5311
Sci. fac's	3629	2023	1685	318	199	101	41	367	181	500	226	156	1092	876
Graz	988	549	474	97	28	16	2	66	7	142	39	28	319	217
Innsbr.	569	291	211	41	53	11	1	21	7	72	35	29	145	154
Salzburg	479	263	209	56	20	33	2	45	16	49	30	19	139	119
Wien	1649	955	815	134	100	42	36	245	152	246	124	82	498	399
Hospitals	3981	565	253	164	56	79	100	730	499	346	72	57	417	2395

Gov = Austrian government; FFW = Austrian Fund of Scientific Research; ANB = Austrian National Bank; MSR = Ministry of Science and Research; AAS = Austrian Academy of Sciences; WIE = Vienna Mayor's Fund; PNP = Austrian private-non-profit; LBI = Ludwig Boltzmann Institute; IND = industry; INT = international organizations; EU = European Union; OTH = others (foreign governmental and private-non-profit).

ANNEX 3 CATEGORIZATION OF PAPERS BY RESEARCH LEVEL

A3.1 Outputs of six countries in 32 sub-fields

Table A3.1 Outputs in anatomy, morphology and physiology (ANAPH)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	98	49	44	6	197	AT	121	85	34	1	241
Switzerland	CH	147	197	138	41	523	CH	283	185	89	8	565
Germany	DE	635	767	483	147	2032	DE	1196	842	417	28	2483
Israel	IL	104	79	77	19	279	IL	182	83	37	5	307
Sweden	SE	415	552	140	54	1161	SE	480	435	96	2	1013
UK	UK	987	728	599	400	2714	UK	1294	798	1011	19	3122

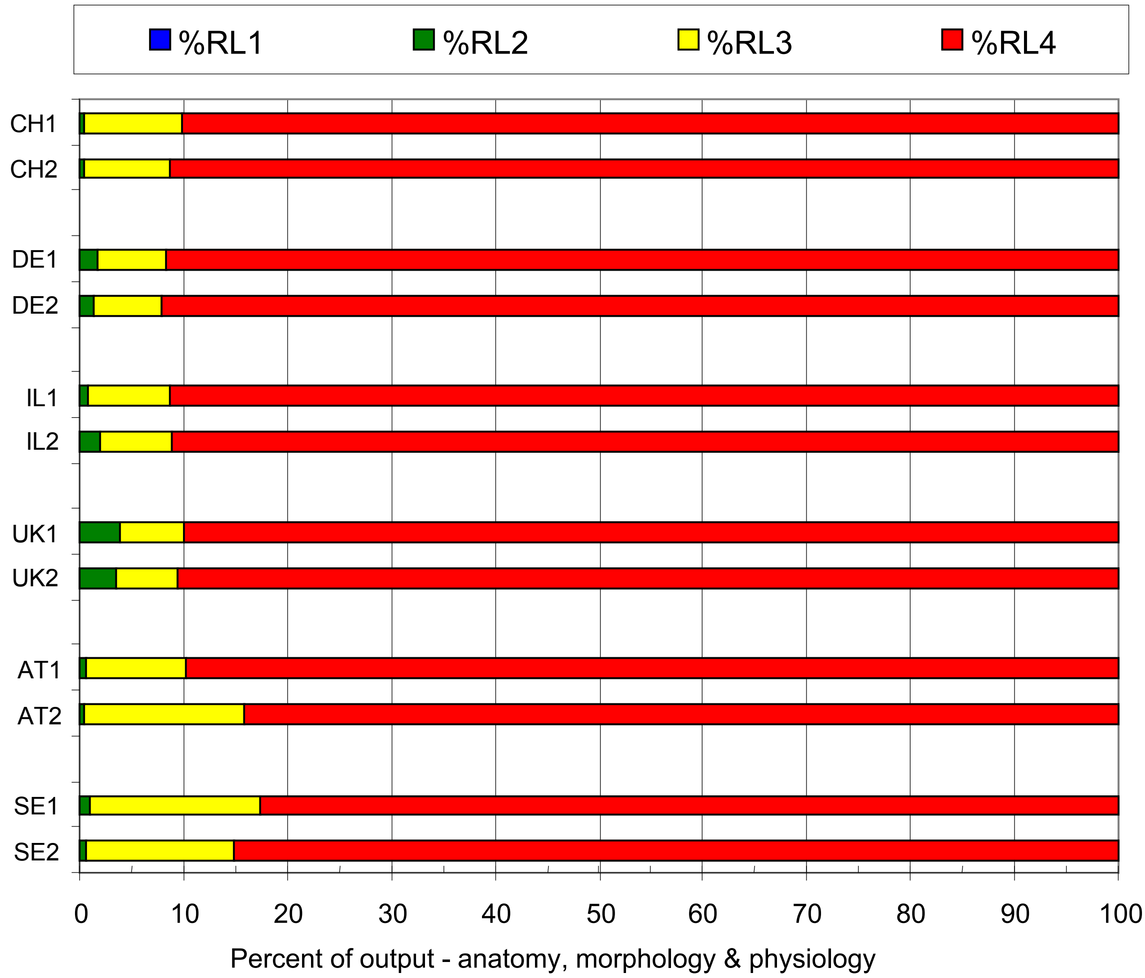


Table A3.2 Outputs in anaesthesia (ANEST)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	112	118	54	11	295	AT	202	506	46	26	780
Switzerland	CH	193	224	80	41	538	CH	239	339	98	30	706
Germany	DE	473	1100	445	197	2215	DE	893	1586	458	294	3231
Israel	IL	88	111	56	67	322	IL	135	154	67	52	408
Sweden	SE	160	538	217	138	1053	SE	186	562	231	162	1141
UK	UK	1582	1458	719	369	4128	UK	1572	1526	570	351	4019

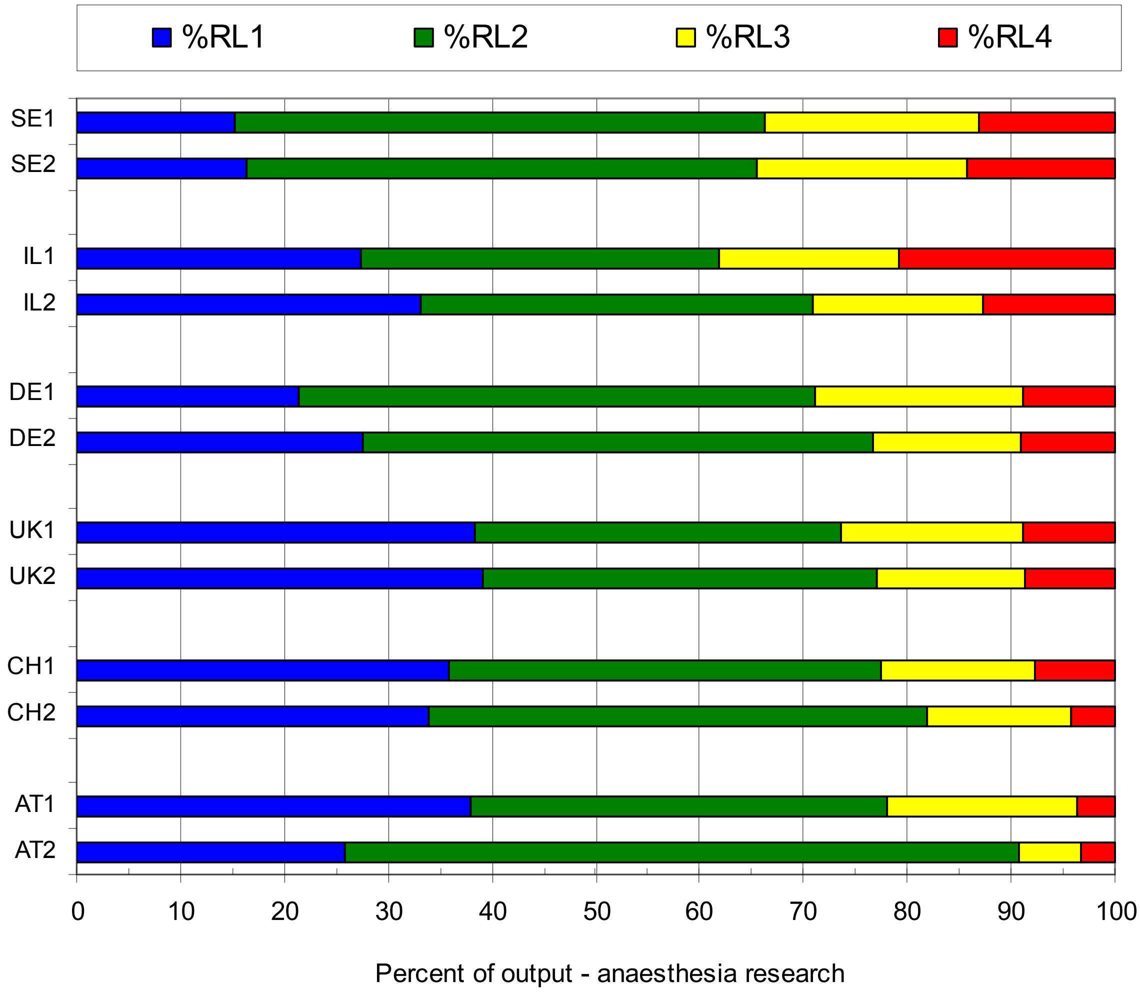


Table A3.3 Outputs in arthritis research (ARTHR)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	74	94	69	22	259	AT	96	129	137	33	395
Switzerland	CH	151	185	249	127	712	CH	209	270	291	140	910
Germany	DE	586	539	522	264	1911	DE	674	911	793	380	2758
Israel	IL	59	270	212	65	606	IL	69	359	186	92	706
Sweden	SE	131	368	307	122	928	SE	153	431	435	188	1207
UK	UK	1069	1909	1115	501	4594	UK	869	1722	1288	610	4489

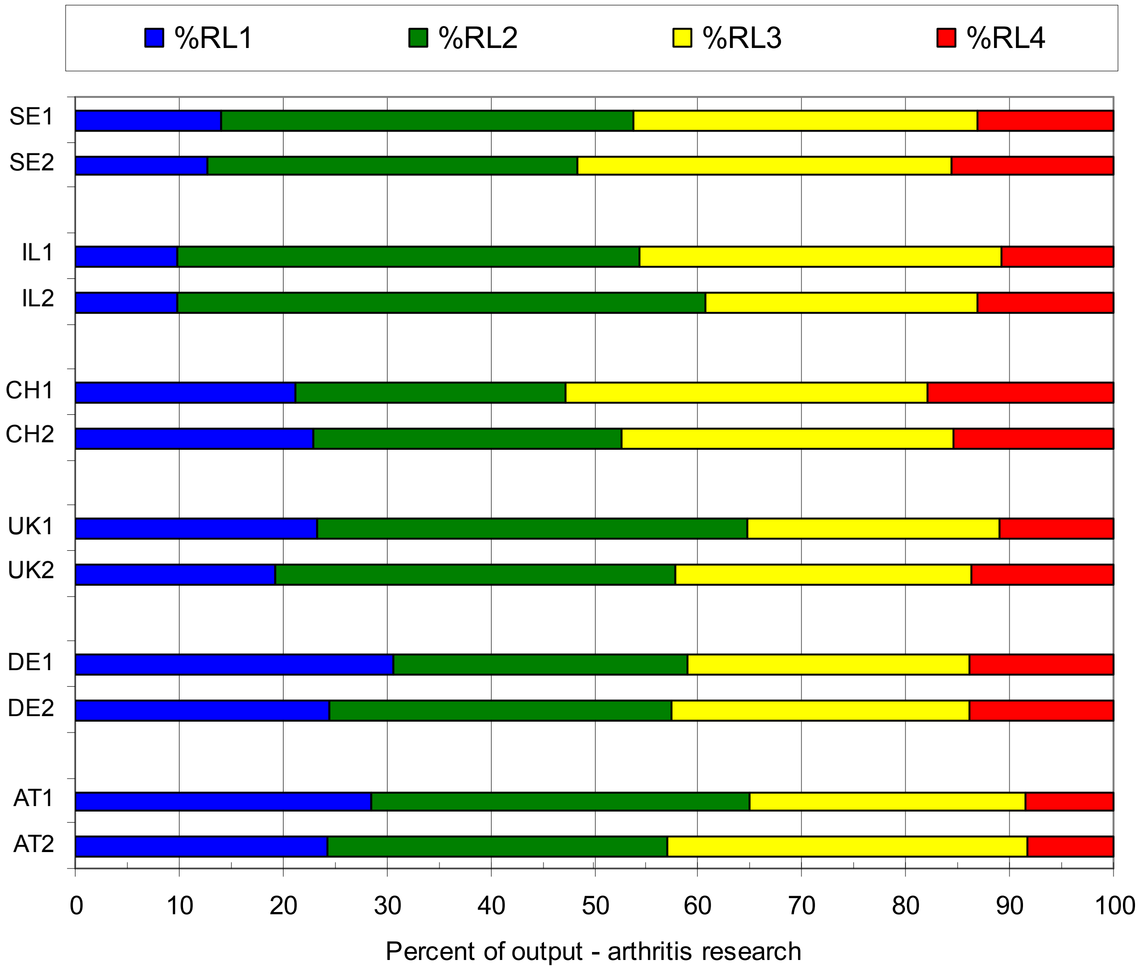


Table A3.4 Outputs in biochemistry and molecular biology (BCMBI)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	0	0	73	893	966	AT	2	0	130	1299	1431
Switzerland	CH	0	0	187	3426	3613	CH	0	0	274	3516	3790
Germany	DE	0	0	755	12141	12896	DE	0	0	1038	14037	15075
Israel	IL	0	0	108	1917	2025	IL	0	0	127	1956	2083
Sweden	SE	0	0	373	3431	3804	SE	0	0	398	3850	4248
UK	UK	3	0	1034	13364	14401	UK	1	0	844	14156	15001

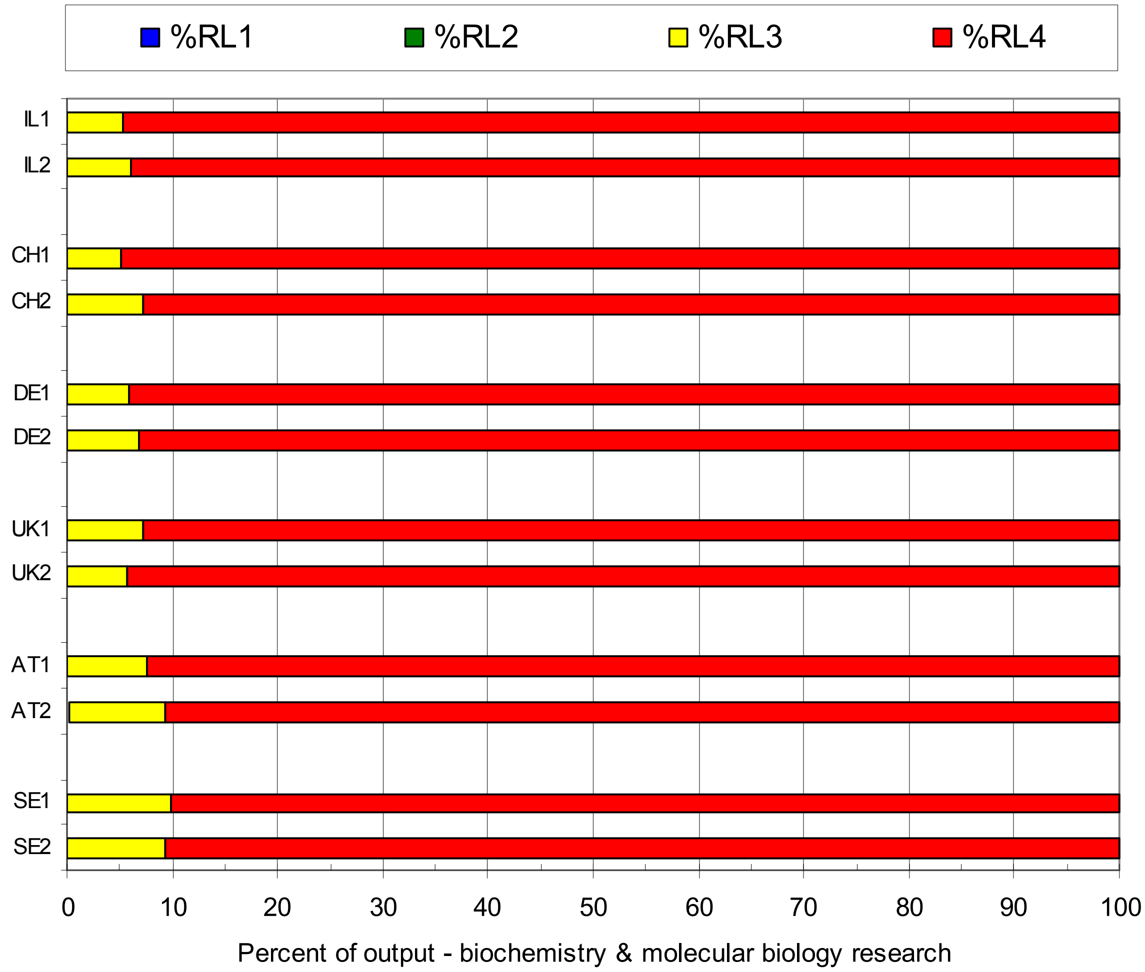


Table A3.5 Outputs in bioengineering (BIENG)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	42	35	35	28	140	AT	68	108	47	48	271
Switzerland	CH	49	51	75	54	229	CH	105	146	122	106	479
Germany	DE	225	253	286	181	945	DE	323	488	406	268	1485
Israel	IL	36	66	94	44	240	IL	49	79	87	45	260
Sweden	SE	116	177	165	88	546	SE	144	209	196	111	660
UK	UK	240	461	400	280	1381	UK	266	648	463	325	1702

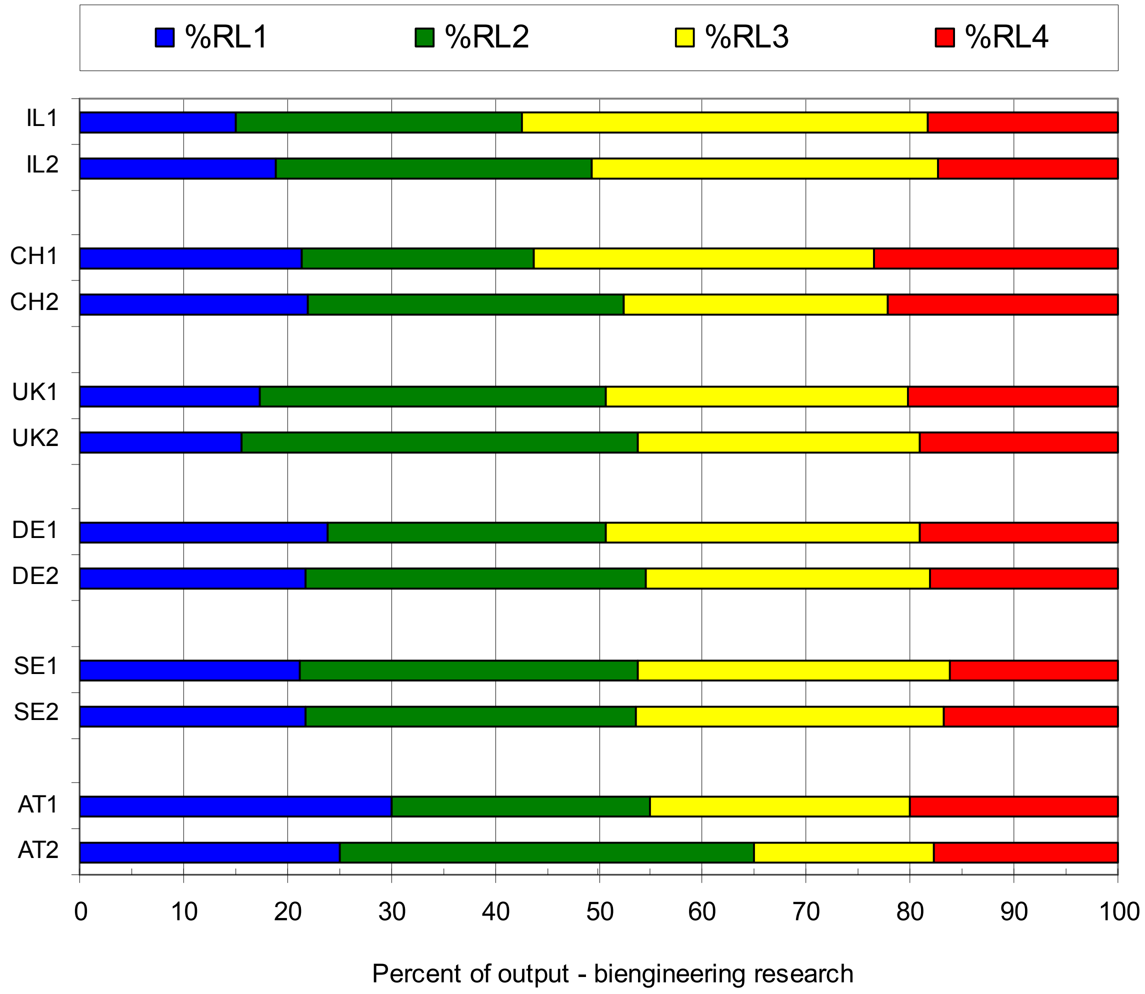


Table A3.6 Outputs in cardiology research (CARDI)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	493	382	502	158	1535	AT	502	584	658	204	1948
Switzerland	CH	728	637	823	393	2581	CH	832	834	800	431	2897
Germany	DE	2557	3573	3274	1616	11020	DE	3420	4656	3803	1946	13825
Israel	IL	341	643	410	281	1675	IL	410	730	478	236	1854
Sweden	SE	562	1165	1228	732	3687	SE	548	1297	1230	654	3729
UK	UK	3408	3708	3805	1958	12879	UK	3394	3783	3805	2057	13039

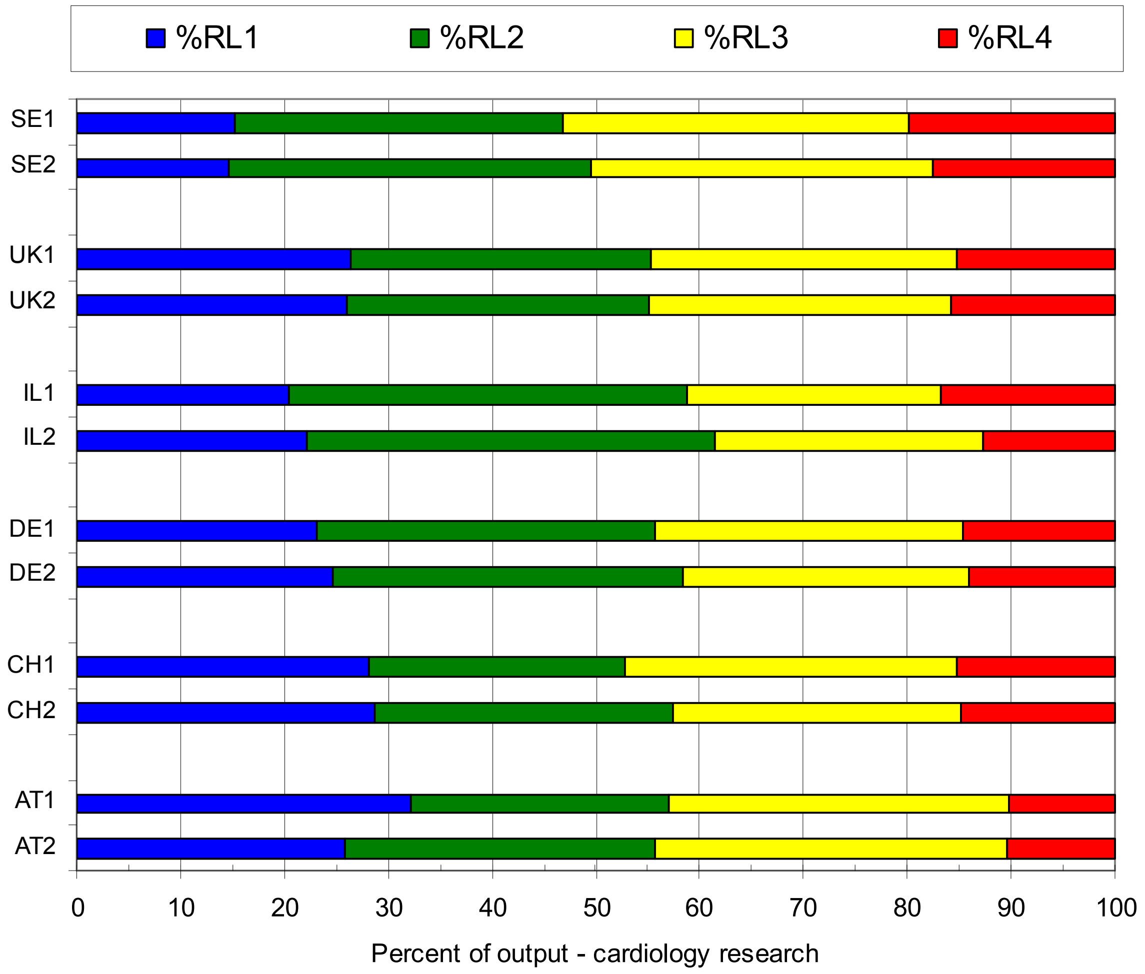


Table A3.7 Outputs in paediatrics & neonatology research (CHILD)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	204	291	130	29	654	AT	256	426	199	94	975
Switzerland	CH	336	510	249	115	1210	CH	374	633	336	114	1457
Germany	DE	970	1903	826	412	4111	DE	1217	2396	1128	588	5329
Israel	IL	480	670	236	109	1495	IL	486	761	217	102	1566
Sweden	SE	413	1073	500	220	2206	SE	382	1253	565	236	2436
UK	UK	2283	4576	1382	766	9007	UK	2412	4619	1673	798	9502

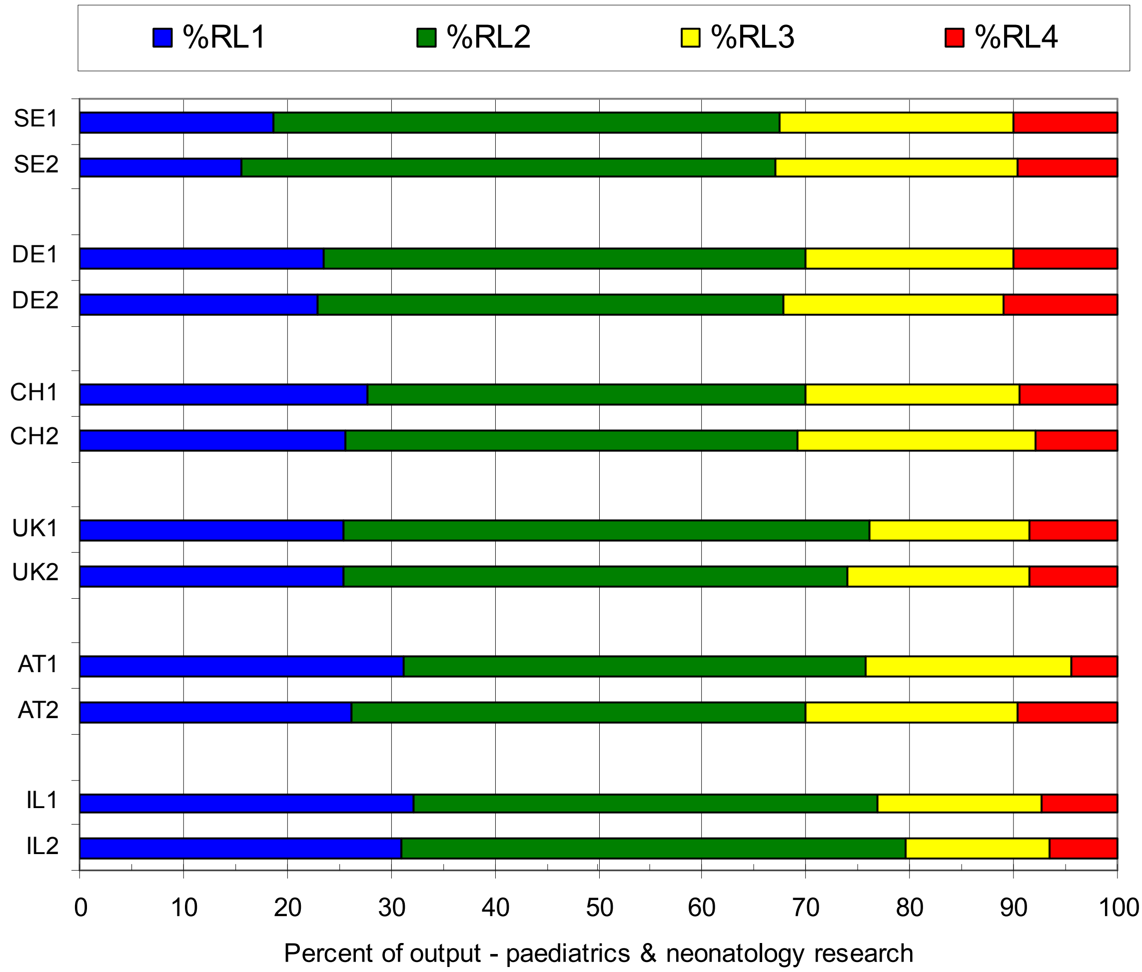


Table A3.8 Outputs in cell biology (CYTHI)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	8	38	125	188	359	AT	25	69	179	333	606
Switzerland	CH	9	61	218	763	1051	CH	29	86	313	980	1408
Germany	DE	69	313	807	2315	3504	DE	104	522	1397	3329	5352
Israel	IL	9	29	134	289	461	IL	10	72	186	387	655
Sweden	SE	18	78	255	540	891	SE	23	129	368	701	1221
UK	UK	61	405	883	2553	3902	UK	82	470	1310	3147	5009

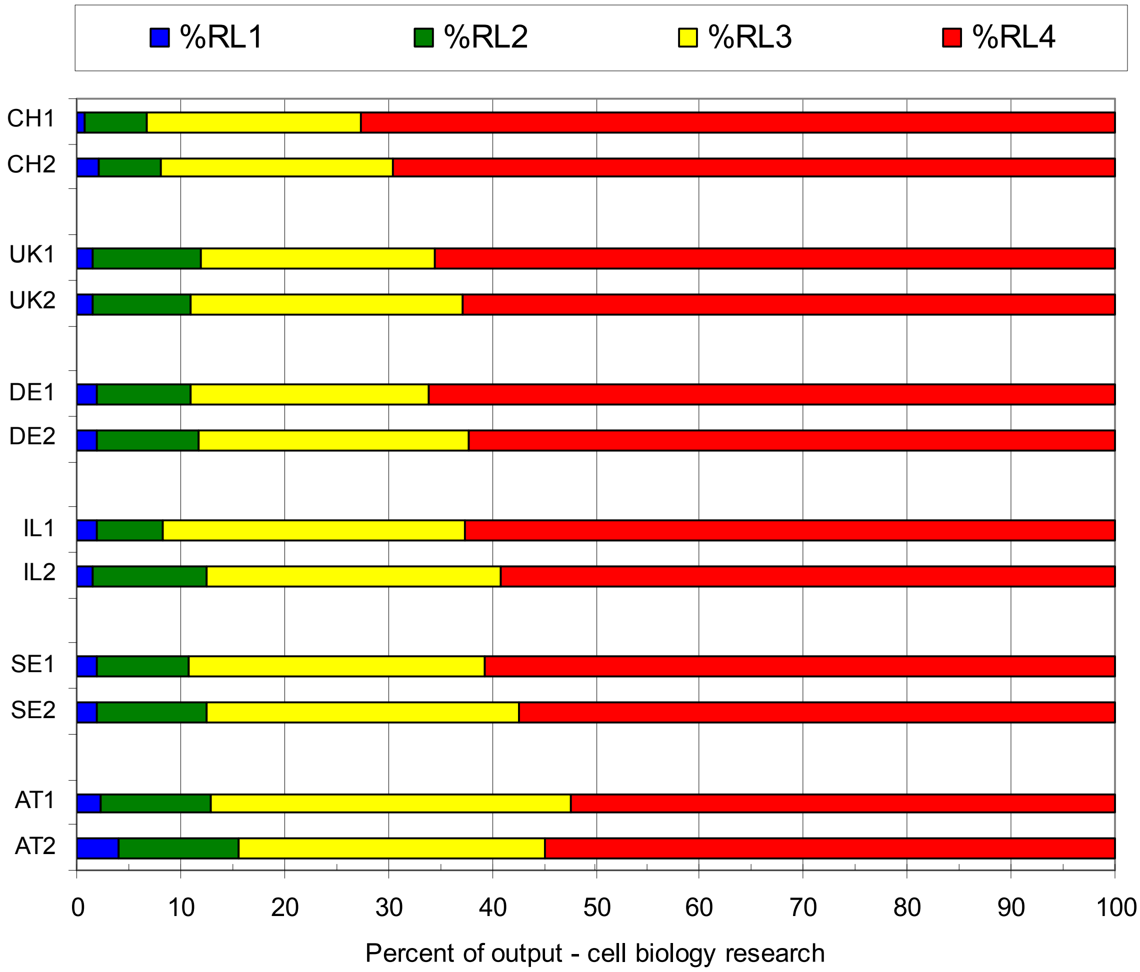


Table A3.9 Outputs in dentistry research (DENTA)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	42	25	12	7	86	AT	91	61	19	6	177
Switzerland	CH	110	63	75	26	274	CH	191	103	75	14	383
Germany	DE	221	164	125	82	592	DE	419	360	227	135	1141
Israel	IL	130	135	46	21	332	IL	186	174	54	25	439
Sweden	SE	441	331	317	42	1131	SE	455	359	267	42	1123
UK	UK	877	1036	421	149	2483	UK	969	1237	530	219	2955

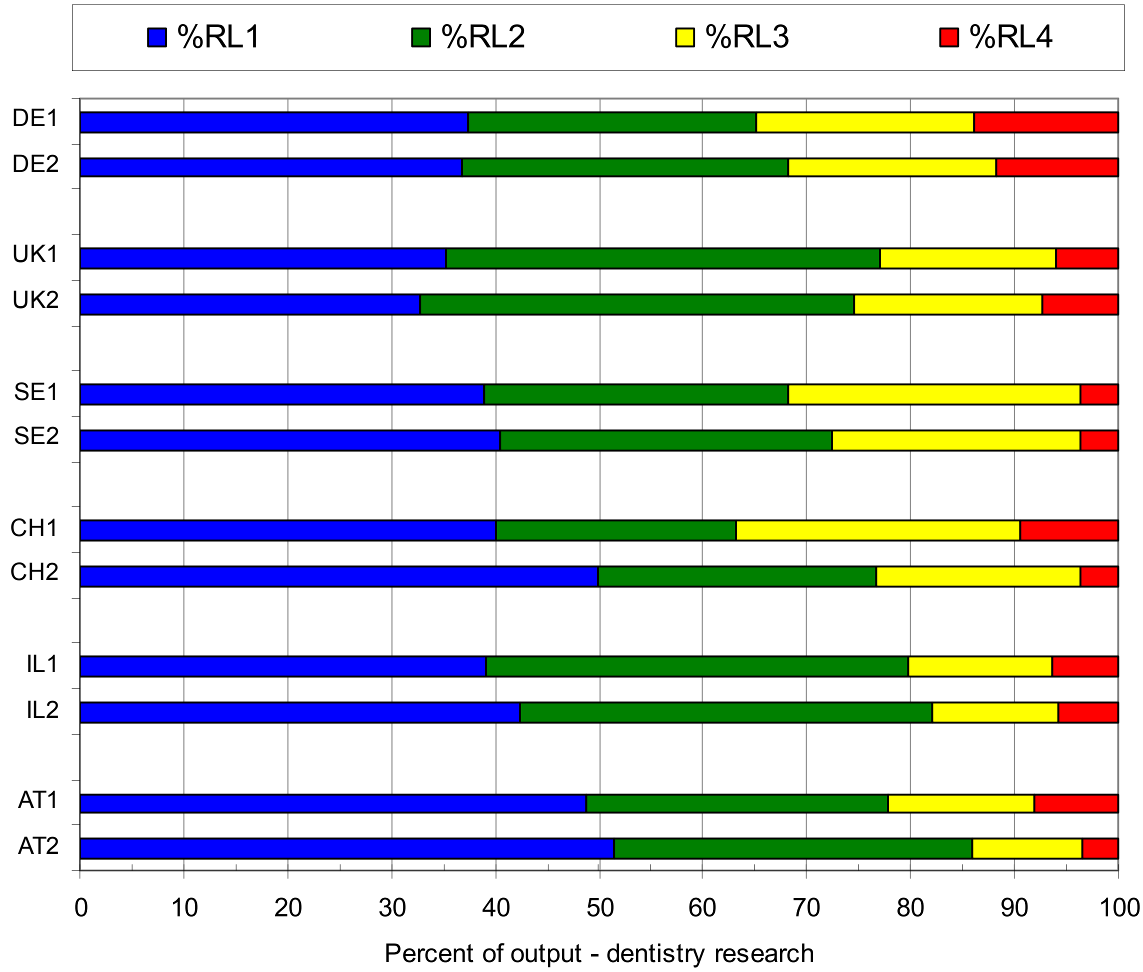


Table A3.10 Outputs in dermatology & venereology research (DERMA)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	253	127	105	39	524	AT	249	202	139	60	650
Switzerland	CH	461	194	178	76	909	CH	581	290	168	130	1169
Germany	DE	2158	659	608	277	3702	DE	2568	1244	847	491	5150
Israel	IL	358	183	65	37	643	IL	344	190	87	49	670
Sweden	SE	604	243	152	79	1078	SE	537	350	230	112	1229
UK	UK	2184	1554	908	358	5004	UK	1978	1857	783	486	5104

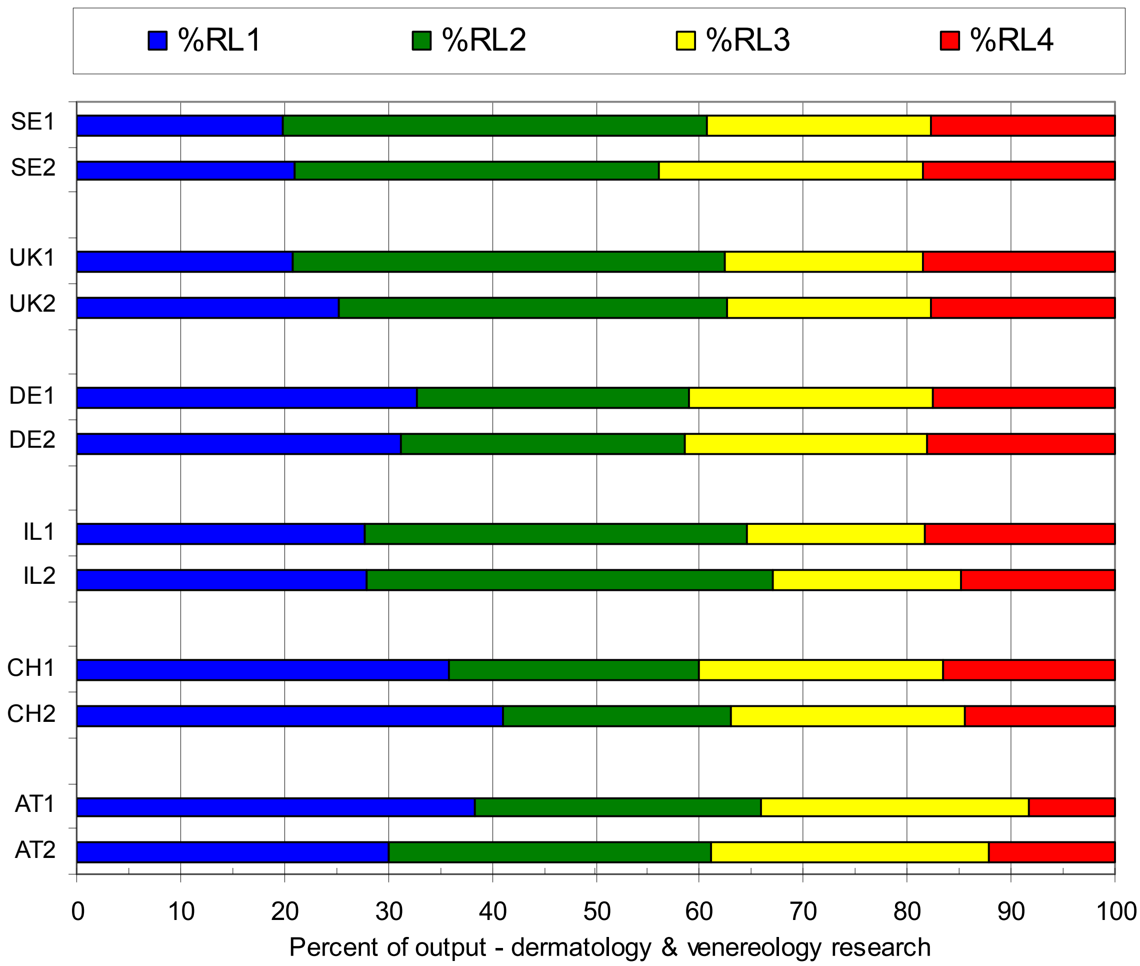


Table A3.11 Outputs in endocrinology research (ENDOC)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	263	252	522	288	1325	AT	402	392	683	398	1875
Switzerland	CH	316	527	1214	991	3048	CH	384	569	1237	876	3066
Germany	DE	1223	2324	3775	3286	10608	DE	1568	2631	4776	3664	12639
Israel	IL	270	622	757	623	2272	IL	281	666	790	575	2312
Sweden	SE	393	1215	2242	1756	5606	SE	501	1350	2435	1728	6014
UK	UK	1773	3679	5488	4507	15447	UK	1918	3695	5679	4176	15468

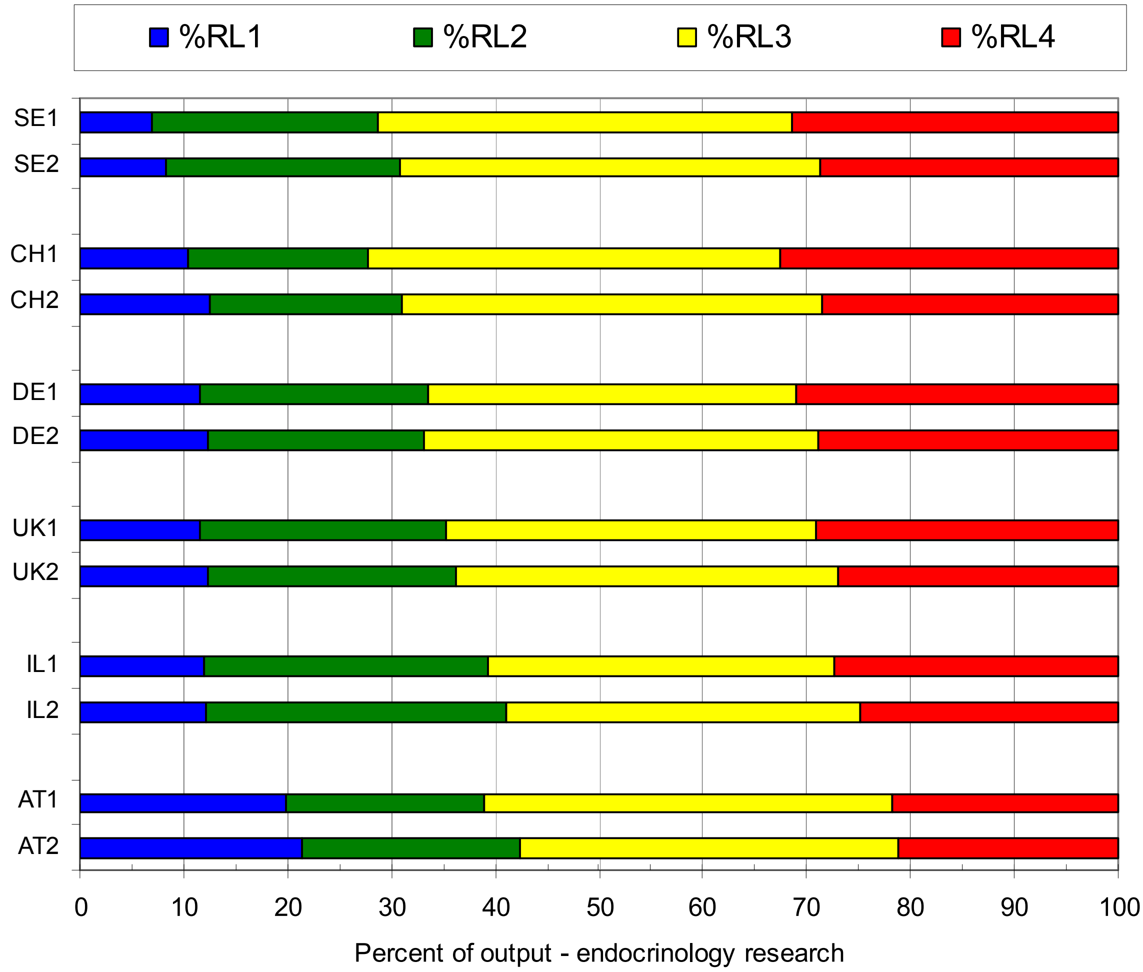


Table A3.12 Outputs in gastroenterology research (GASTR)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	225	242	215	111	793	AT	283	396	231	128	1038
Switzerland	CH	465	483	387	378	1713	CH	507	647	522	337	2013
Germany	DE	1619	2440	1776	1381	7216	DE	1904	3143	2145	1584	8776
Israel	IL	283	378	157	141	959	IL	277	429	246	160	1112
Sweden	SE	304	1125	872	662	2963	SE	337	1198	894	598	3027
UK	UK	2134	3821	2119	1716	9790	UK	1916	3482	2118	1528	9044

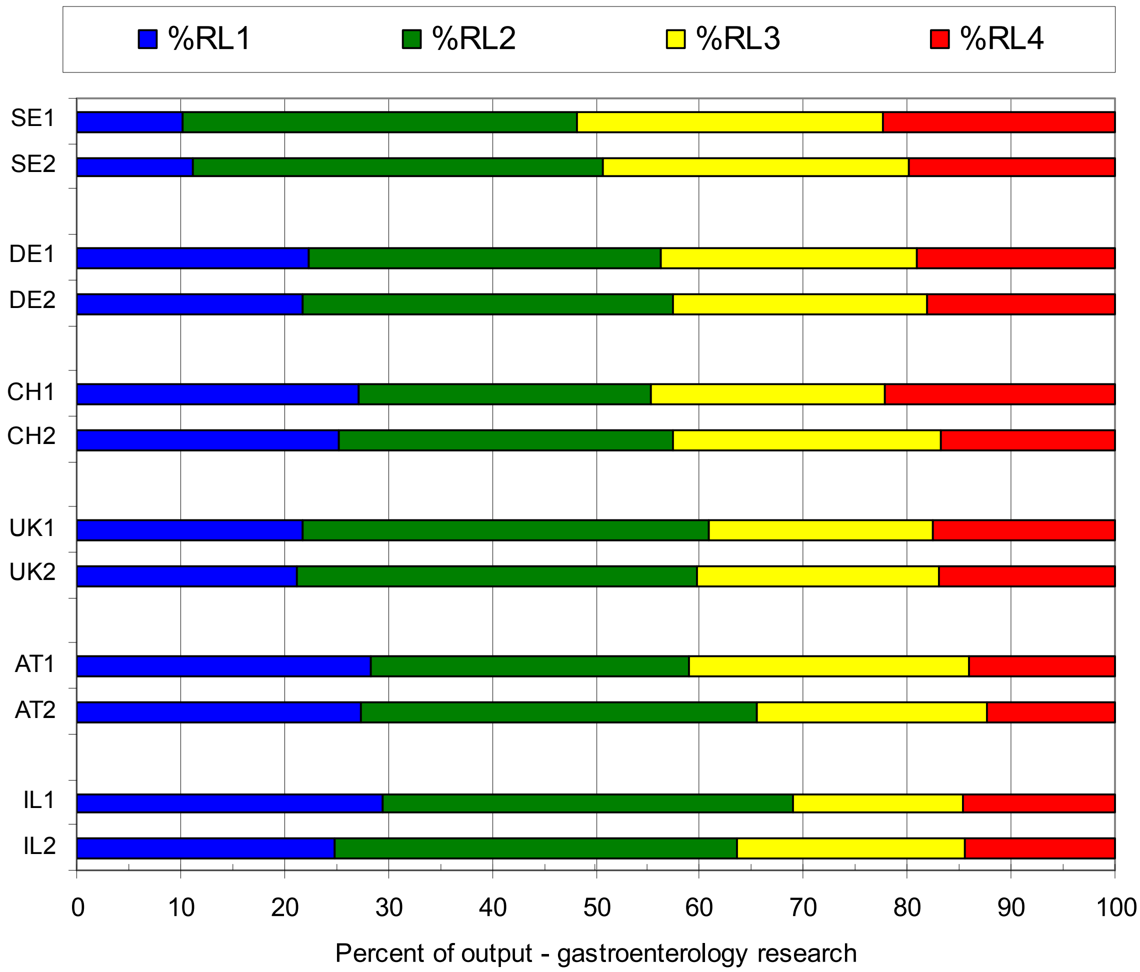


Table A3.13 Outputs in genetics (GENET)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	39	105	225	542	911	AT	55	238	436	737	1466
Switzerland	CH	72	197	679	2202	3150	CH	101	402	1011	2546	4060
Germany	DE	216	1283	2548	8368	12415	DE	397	2188	4127	10330	17042
Israel	IL	33	282	379	1086	1780	IL	59	365	543	1231	2198
Sweden	SE	79	505	1018	2072	3674	SE	96	674	1363	2509	4642
UK	UK	342	2311	3487	9785	15925	UK	502	2834	4536	11307	19179

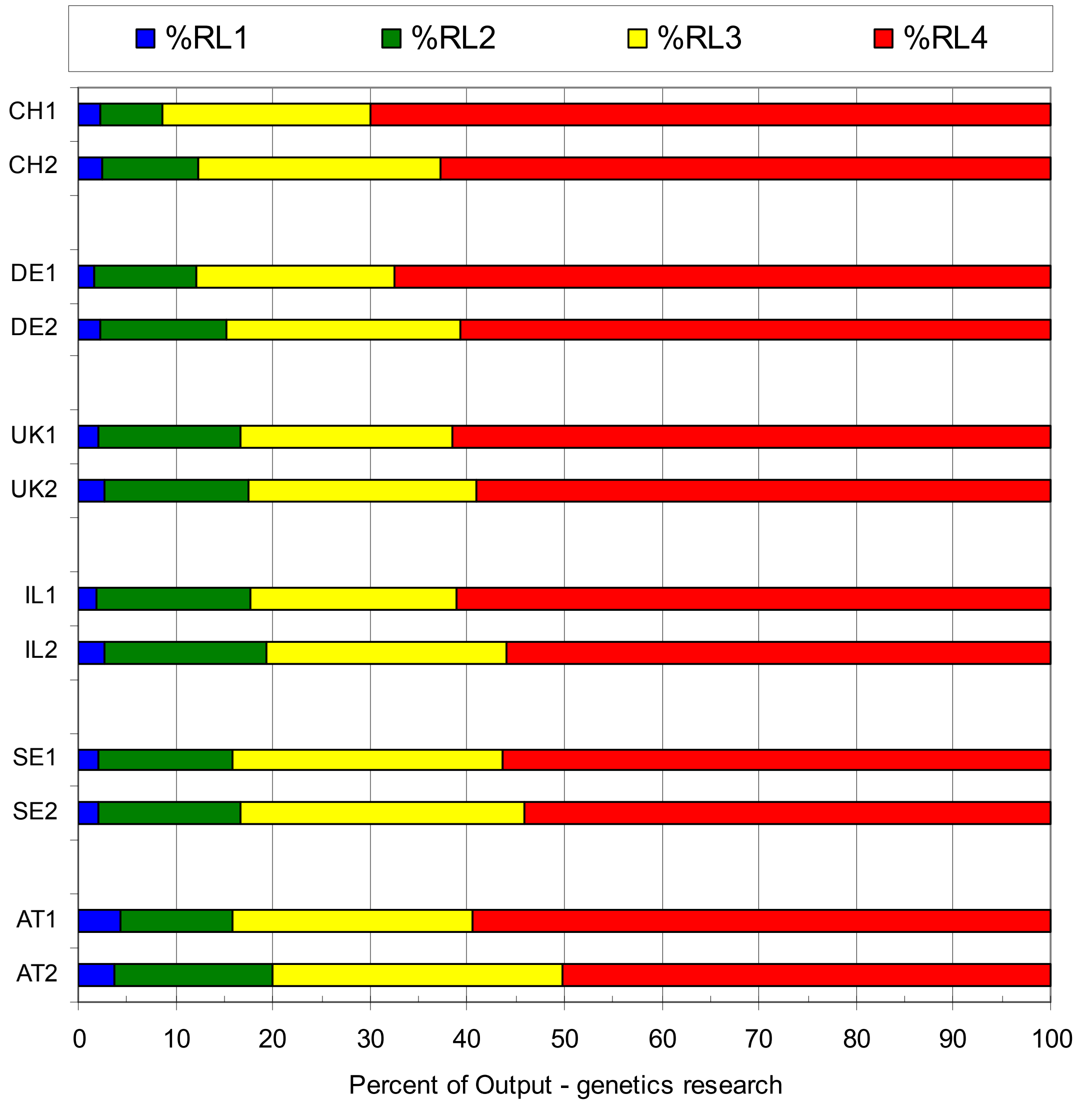


Table A3.14 Outputs in gerontology research (GERON)

	91-95	RL1	RL2	RL3	RL4	Total	96-00	RL1	RL2	RL3	RL4	Total
Austria	AT	112	81	66	57	316	AT	200	142	154	94	590
Switzerland	CH	139	168	132	83	522	CH	253	285	217	116	871
Germany	DE	617	457	404	411	1889	DE	1004	861	662	594	3121
Israel	IL	124	163	118	77	482	IL	155	205	148	92	600
Sweden	SE	271	464	263	199	1197	SE	422	633	374	248	1677
UK	UK	1416	1177	644	499	3736	UK	1619	1584	1019	718	4940

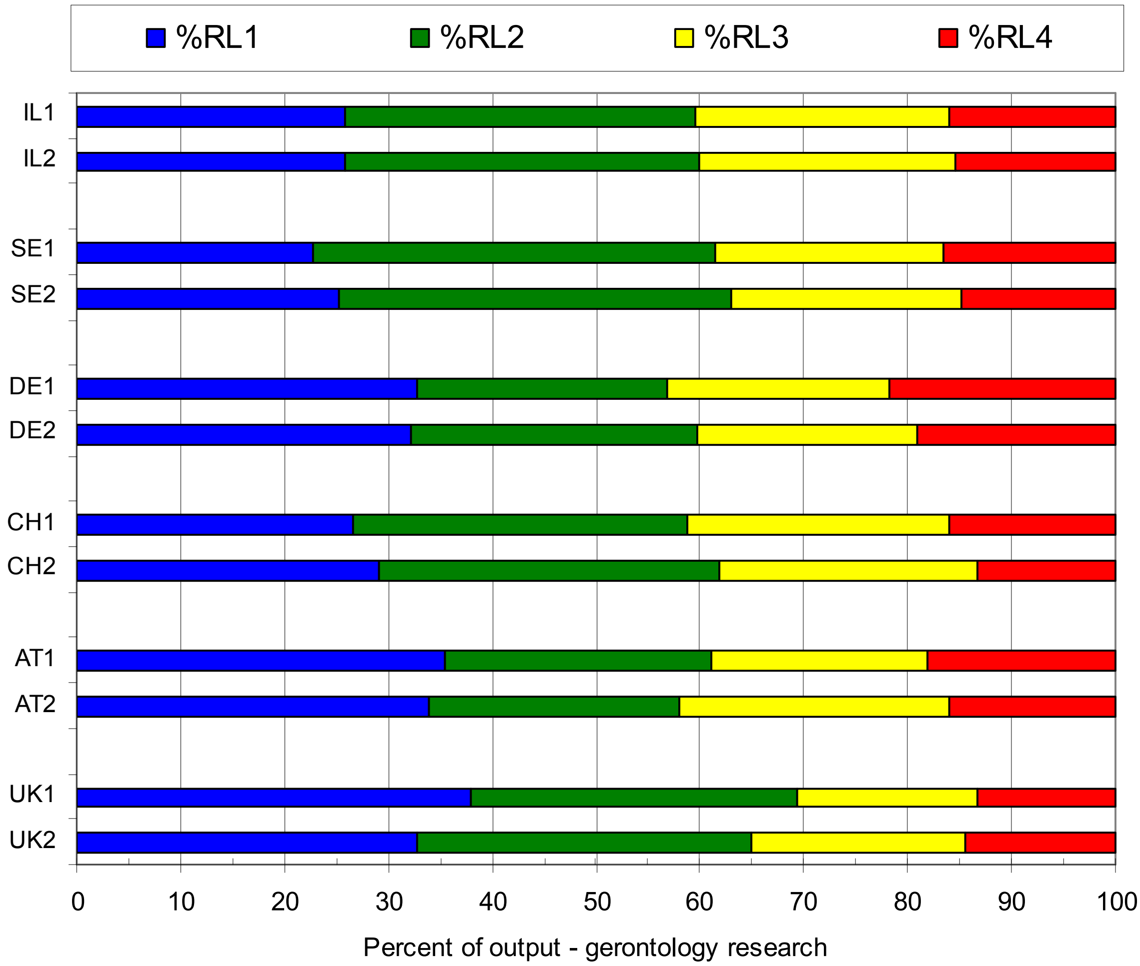


Table A3.15 Outputs in haematology research (HAEMA)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	169	287	500	120	1076	AT	161	376	763	143	1443
Switzerland	CH	266	315	769	329	1679	CH	253	451	815	343	1862
Germany	DE	1039	1708	2842	1155	6744	DE	1071	2230	3653	1297	8251
Israel	IL	109	411	561	226	1307	IL	111	438	579	201	1329
Sweden	SE	162	685	989	353	2189	SE	159	665	1137	395	2356
UK	UK	887	2534	3429	1279	8129	UK	743	2348	3810	1263	8164

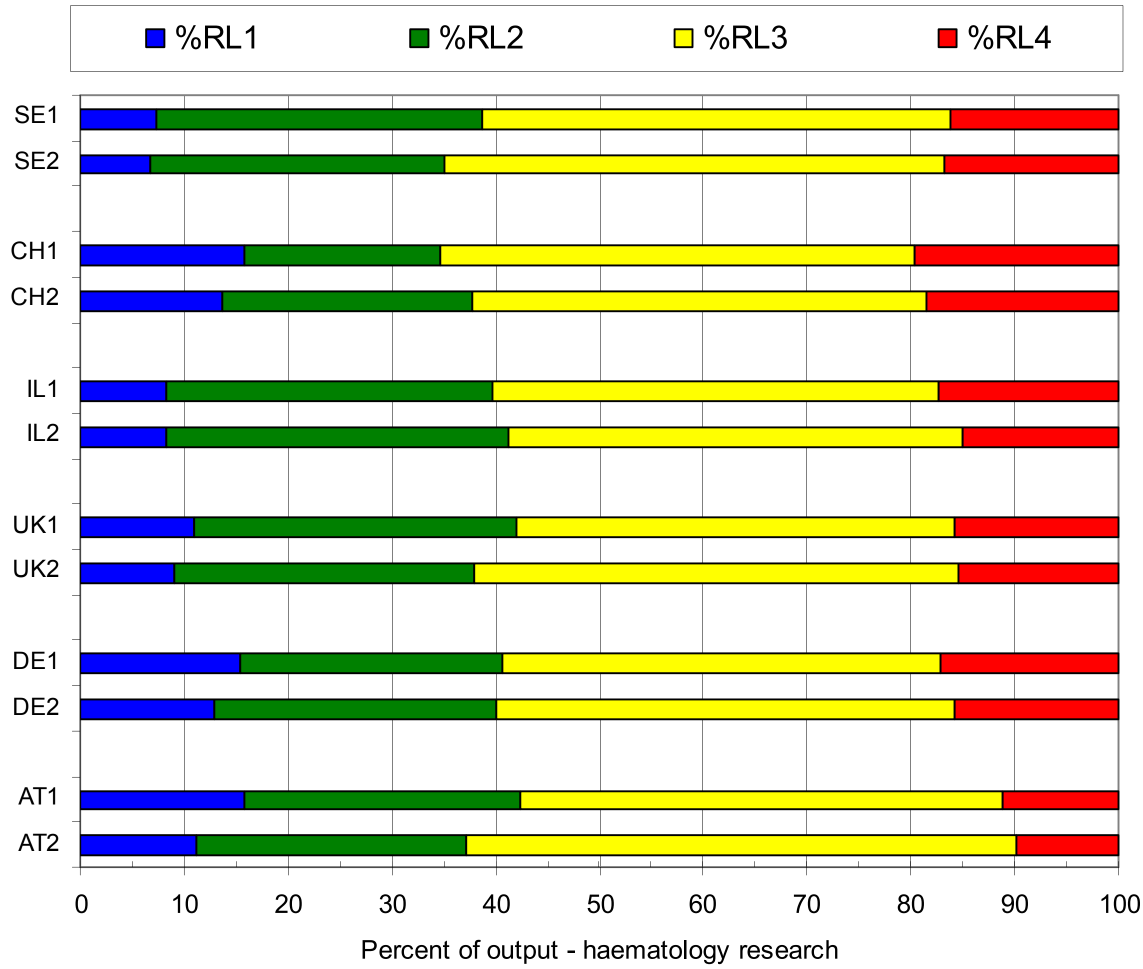


Table A3.16 Outputs in human genetics (HUGEN)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	1	12	20	8	41	AT	12	17	50	18	97
Switzerland	CH	7	16	33	30	86	CH	15	21	56	32	124
Germany	DE	10	76	122	69	277	DE	37	131	282	104	554
Israel	IL	3	14	14	7	38	IL	6	16	54	14	90
Sweden	SE	7	31	62	33	133	SE	9	40	133	45	227
UK	UK	57	205	259	182	703	UK	82	304	392	244	1022

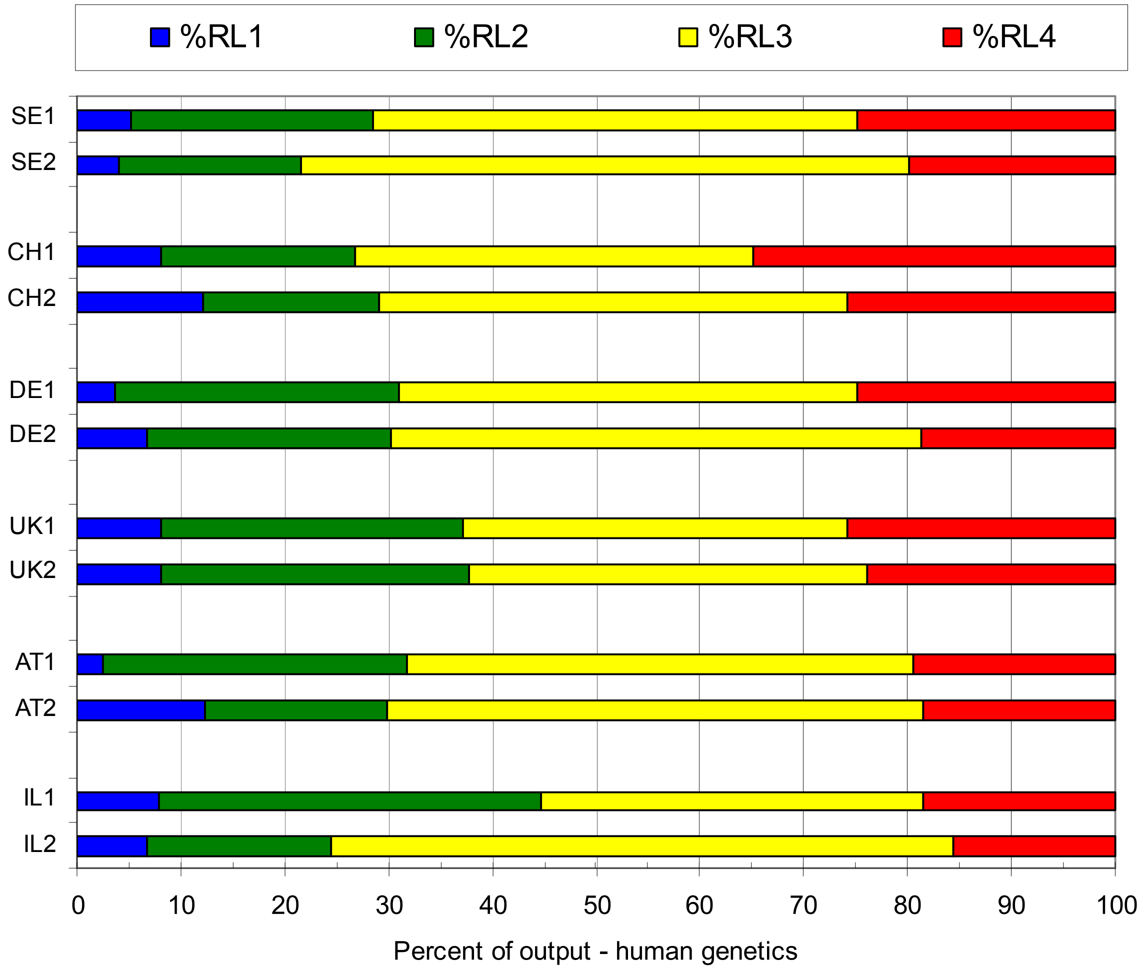


Table A3.17 Outputs in immunology & allergology research (IMMAL)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	143	254	689	189	1275	AT	162	407	872	226	1667
Switzerland	CH	213	511	1794	751	3269	CH	281	497	1901	751	3430
Germany	DE	923	1717	4431	1989	9060	DE	881	2193	5551	2308	10933
Israel	IL	73	419	814	324	1630	IL	104	426	818	305	1653
Sweden	SE	307	783	1741	572	3403	SE	355	926	1969	618	3868
UK	UK	712	2918	5488	2179	11297	UK	794	2762	5810	2379	11745

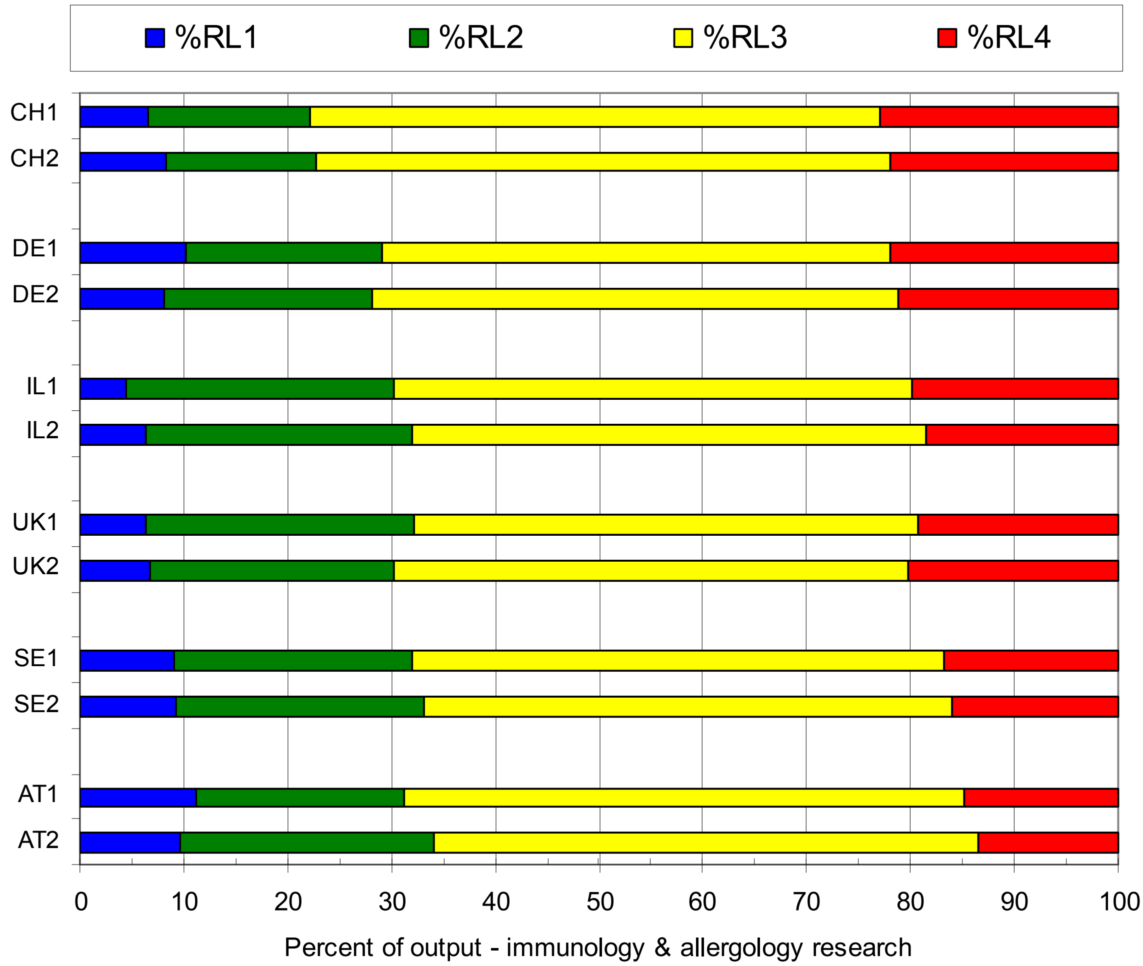


Table A3.18 Outputs in infectious disease research (INFEC)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	180	227	295	405	1107	AT	217	311	460	532	1520
Switzerland	CH	533	682	959	1402	3576	CH	596	939	1167	1754	4456
Germany	DE	1164	2193	2788	6728	12873	DE	1203	2700	3619	7529	15051
Israel	IL	232	550	505	933	2220	IL	251	497	541	852	2141
Sweden	SE	496	856	1388	1512	4252	SE	426	995	1433	1664	4518
UK	UK	1964	5096	5107	7932	20099	UK	1636	5247	5039	8444	20366

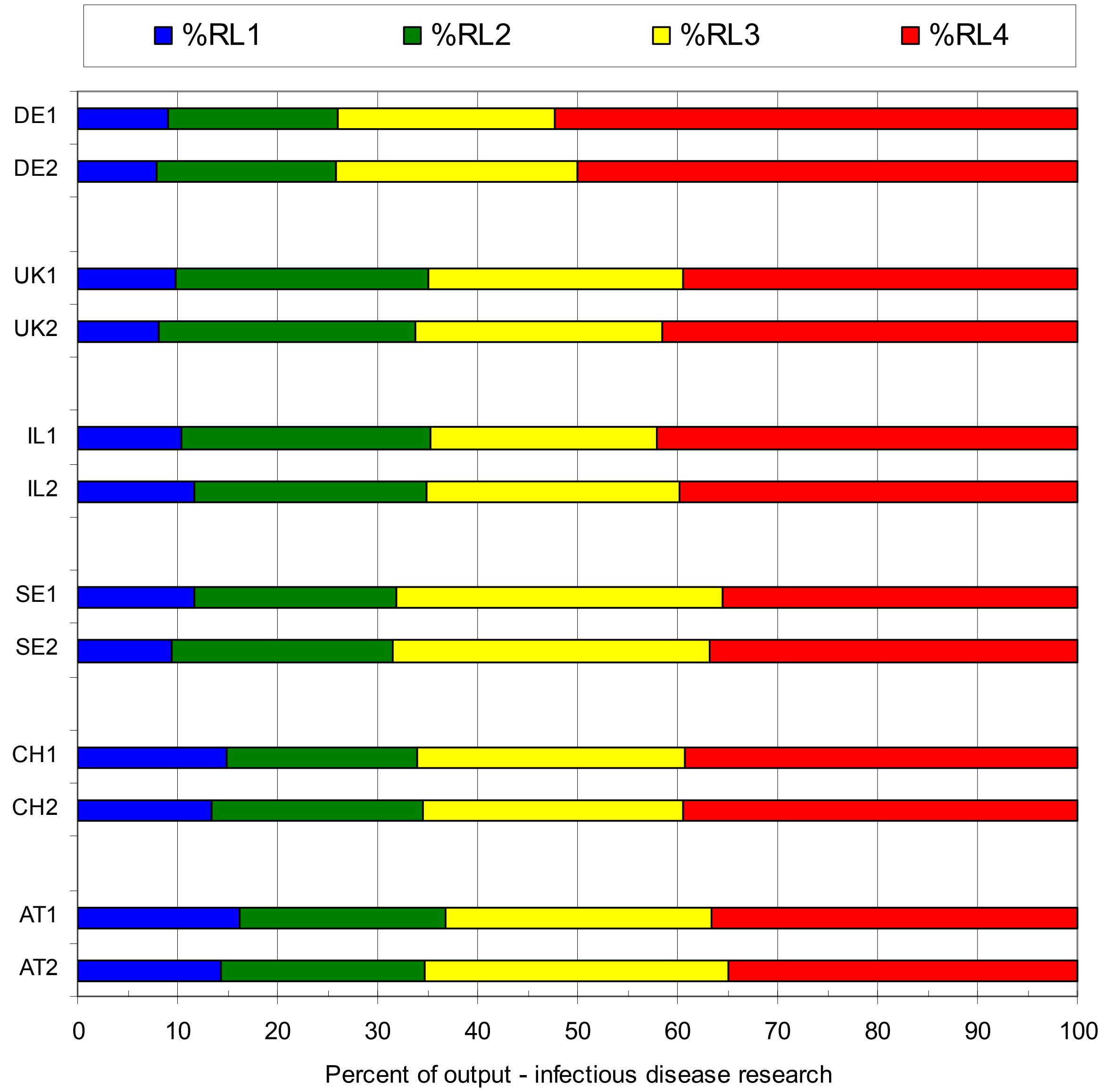


Table A3.19 Outputs in mental health research (MENTH)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	141	79	46	39	305	AT	232	150	77	57	516
Switzerland	CH	261	158	106	67	592	CH	343	215	119	112	789
Germany	DE	1426	640	310	283	2659	DE	1886	927	471	540	3824
Israel	IL	330	167	67	58	622	IL	380	237	148	78	843
Sweden	SE	213	415	173	163	964	SE	343	587	217	182	1329
UK	UK	2560	1119	430	457	4566	UK	3147	1477	534	617	5775

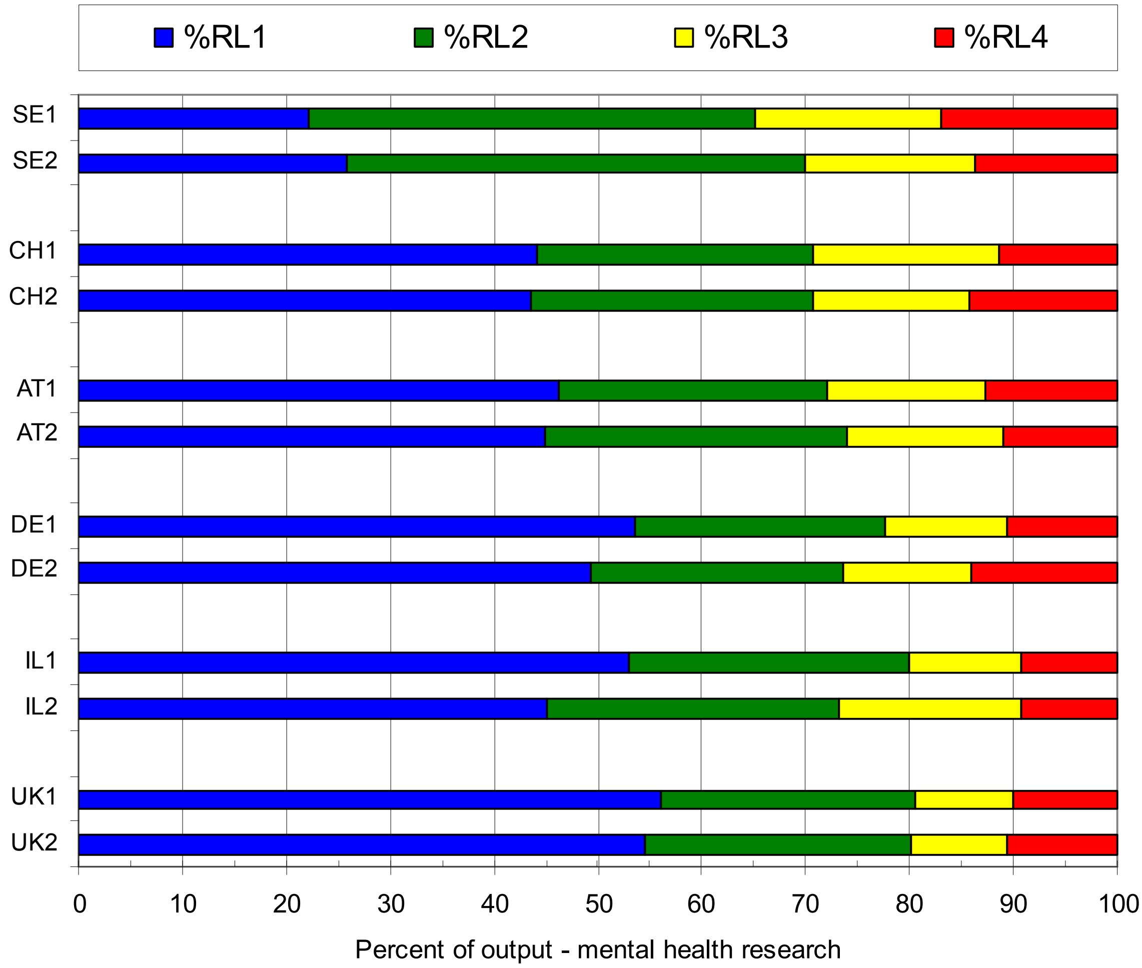


Table A3.20 Outputs in neuroscience (NEUSC)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	35	74	263	405	777	AT	55	146	294	624	1119
Switzerland	CH	60	178	553	1573	2364	CH	68	218	646	1922	2854
Germany	DE	247	785	1967	5913	8912	DE	317	1103	2421	8574	12415
Israel	IL	21	128	280	981	1410	IL	44	134	353	1164	1695
Sweden	SE	98	360	1035	2581	4074	SE	85	361	1027	2626	4099
UK	UK	270	1148	2746	6764	10928	UK	254	1251	2896	7922	12323

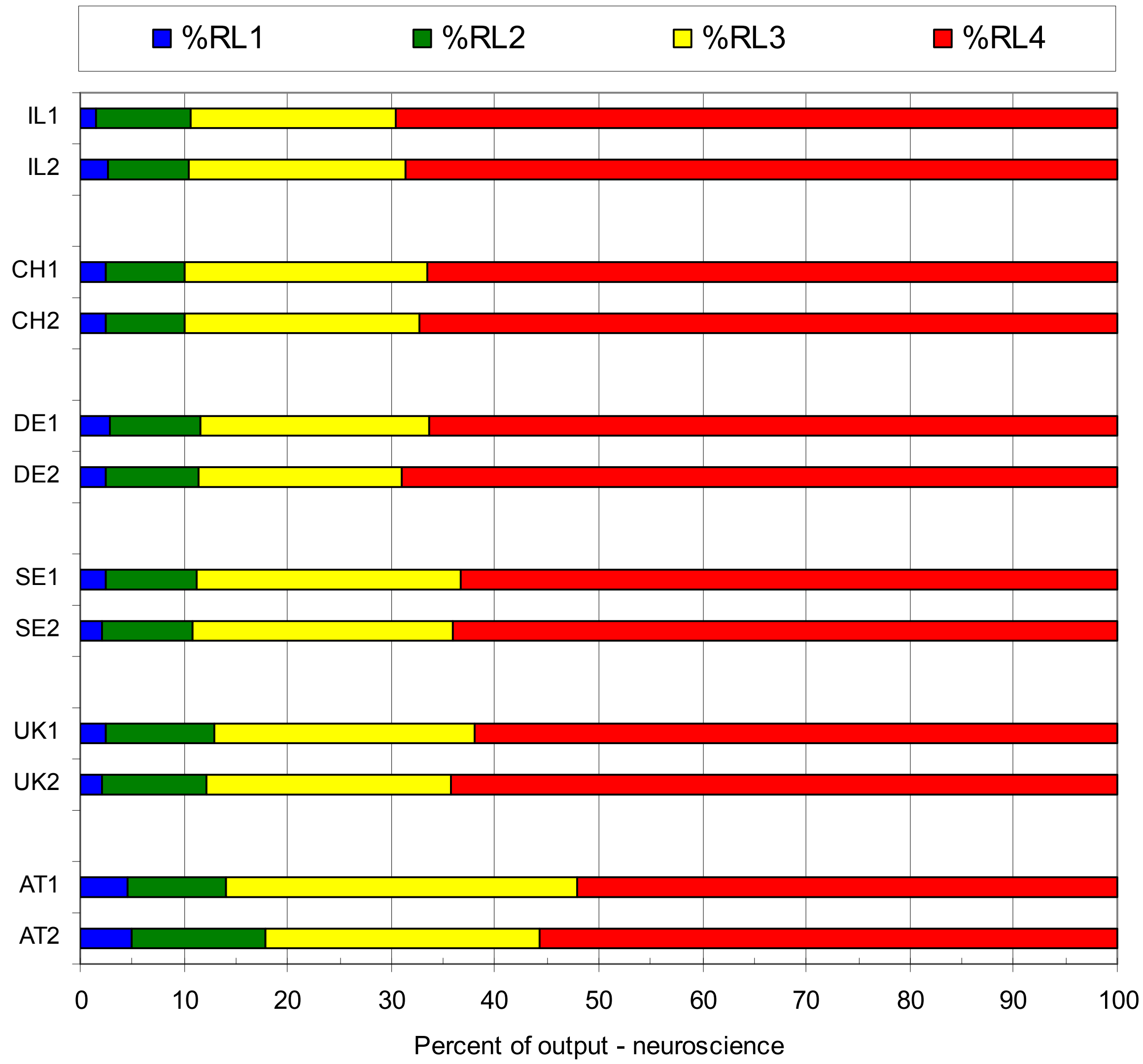


Table A3.21 Outputs in obstetrics & gynaecology research (OBSGY)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	291	299	151	72	813	AT	283	354	214	99	950
Switzerland	CH	224	378	222	190	1014	CH	213	310	195	112	830
Germany	DE	1262	2132	1034	802	5230	DE	1292	1457	1163	911	4823
Israel	IL	483	656	374	163	1676	IL	448	680	340	210	1678
Sweden	SE	266	776	554	330	1926	SE	266	1072	647	374	2359
UK	UK	1385	3533	1955	1181	8054	UK	1415	3709	2096	1150	8370

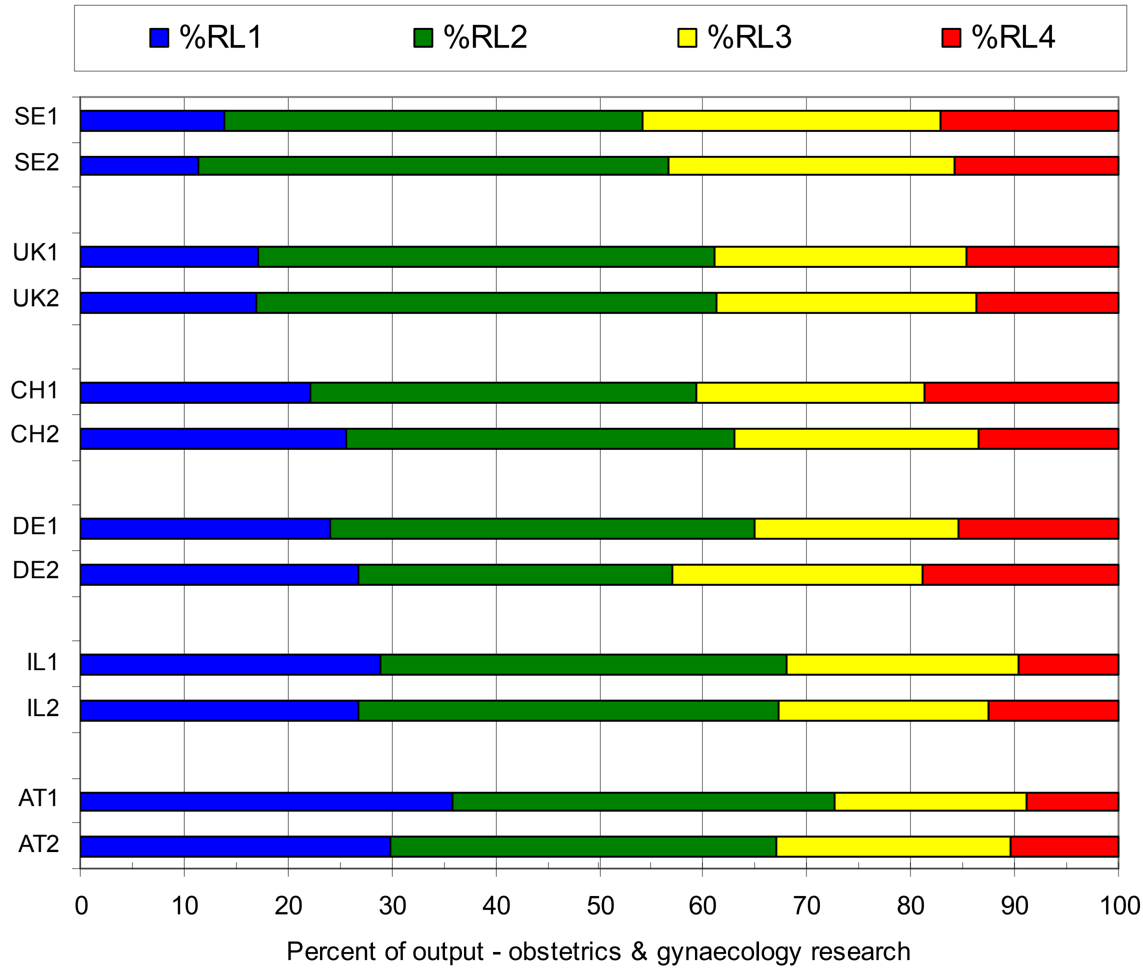


Table A3.22 Outputs in oncology research (ONCOL)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	328	533	506	179	1546	AT	411	874	734	261	2280
Switzerland	CH	417	713	987	430	2547	CH	451	994	1101	559	3105
Germany	DE	2005	3465	3503	1879	10852	DE	2455	5022	4784	2513	14774
Israel	IL	274	635	549	359	1817	IL	290	718	623	427	2058
Sweden	SE	336	1425	1383	488	3632	SE	429	1664	1553	583	4229
UK	UK	2314	4935	4138	2218	13605	UK	2067	4997	4469	2487	14020

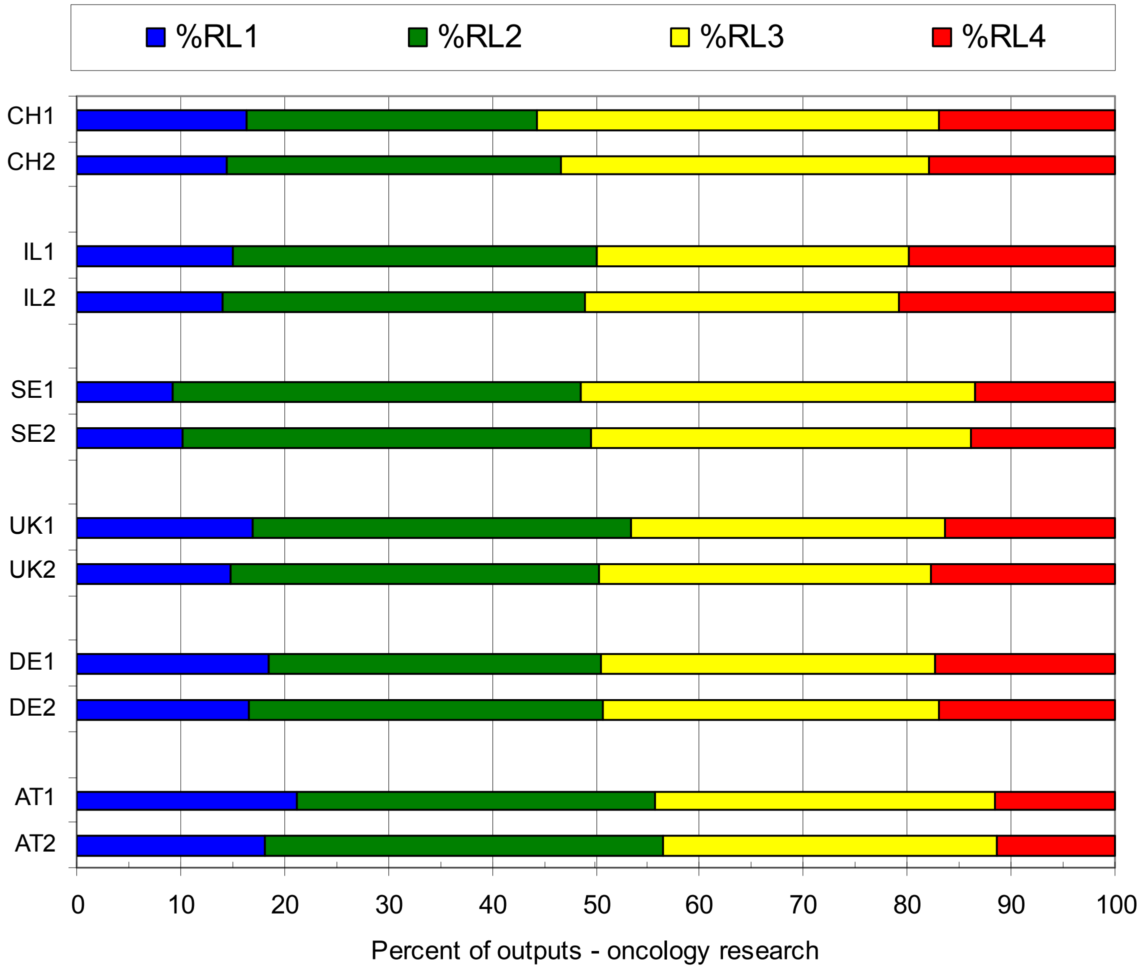


Table A3.23 Outputs in ophthalmology research (OPHTH)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	50	94	51	27	222	AT	75	119	70	39	303
Switzerland	CH	326	183	105	153	767	CH	246	256	151	182	835
Germany	DE	665	614	379	1161	2819	DE	851	991	498	1419	3759
Israel	IL	68	187	74	147	476	IL	97	188	77	119	481
Sweden	SE	26	299	127	134	586	SE	42	388	143	109	682
UK	UK	390	1673	456	1008	3527	UK	401	1530	613	1218	3762

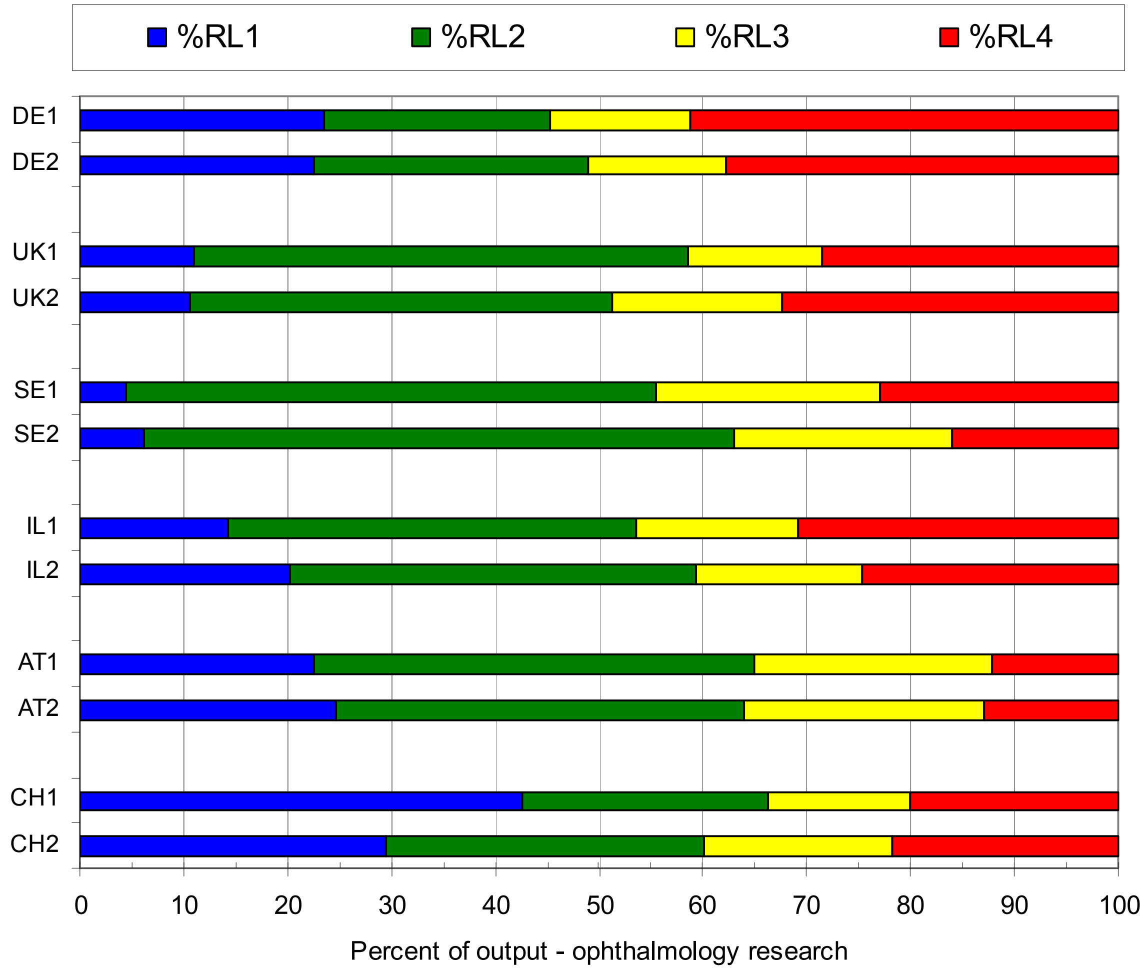


Table A3.24 Outputs in otorhinolaryngology research (OTORH)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	64	75	42	11	192	AT	154	164	55	17	390
Switzerland	CH	95	119	43	32	289	CH	174	175	82	53	484
Germany	DE	290	463	283	196	1232	DE	503	761	425	391	2080
Israel	IL	153	166	54	27	400	IL	195	160	57	29	441
Sweden	SE	172	420	137	39	768	SE	196	440	146	53	835
UK	UK	1576	696	274	220	2766	UK	1574	972	353	256	3155

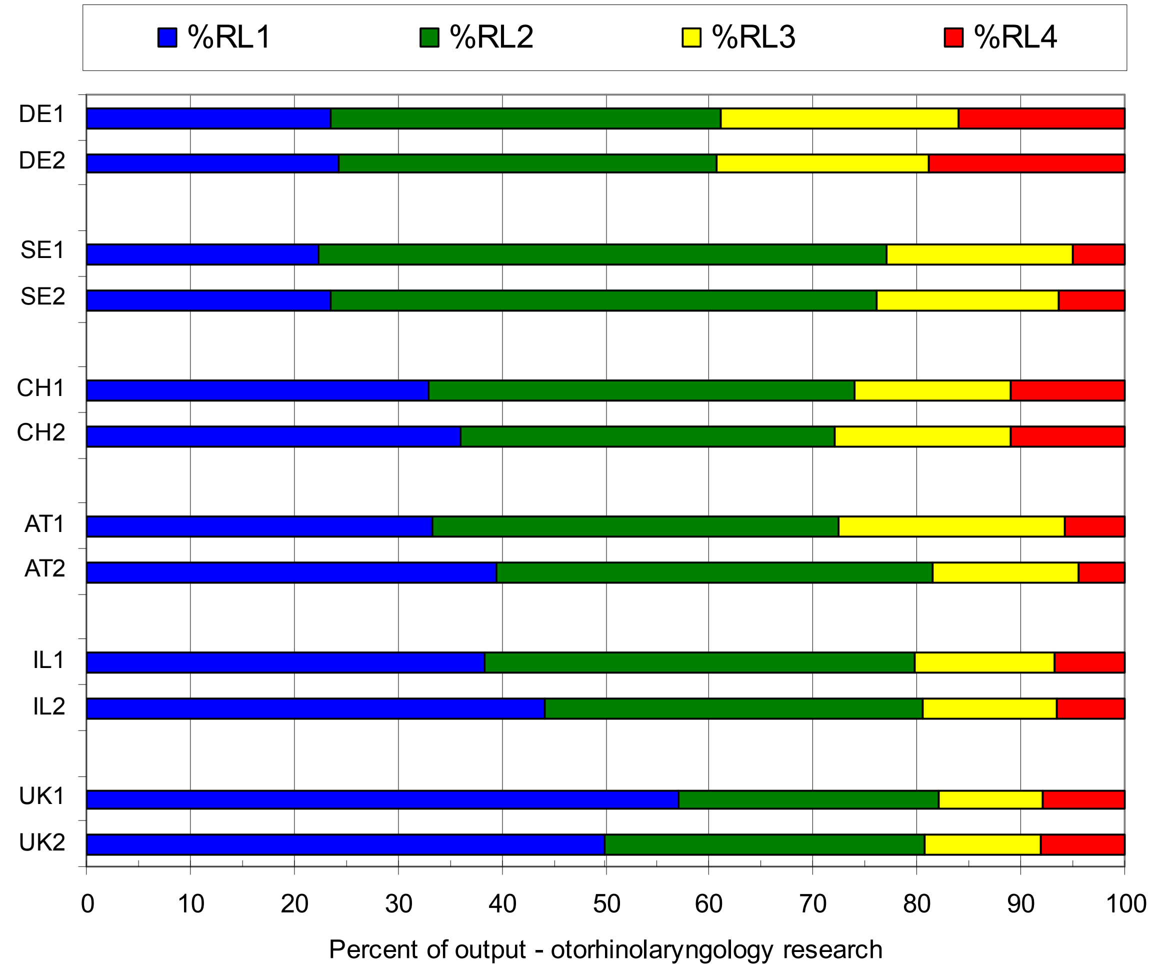


Table A3.25 Outputs in pathology research (PATHO)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	138	237	351	191	917	AT	131	305	526	285	1247
Switzerland	CH	141	277	542	527	1487	CH	128	303	620	477	1528
Germany	DE	488	1397	2067	1728	5680	DE	521	1596	3116	2024	7257
Israel	IL	89	238	332	216	875	IL	95	255	324	203	877
Sweden	SE	122	465	926	628	2141	SE	116	445	1077	722	2360
UK	UK	647	3055	3138	1670	8510	UK	563	2335	3262	1850	8010

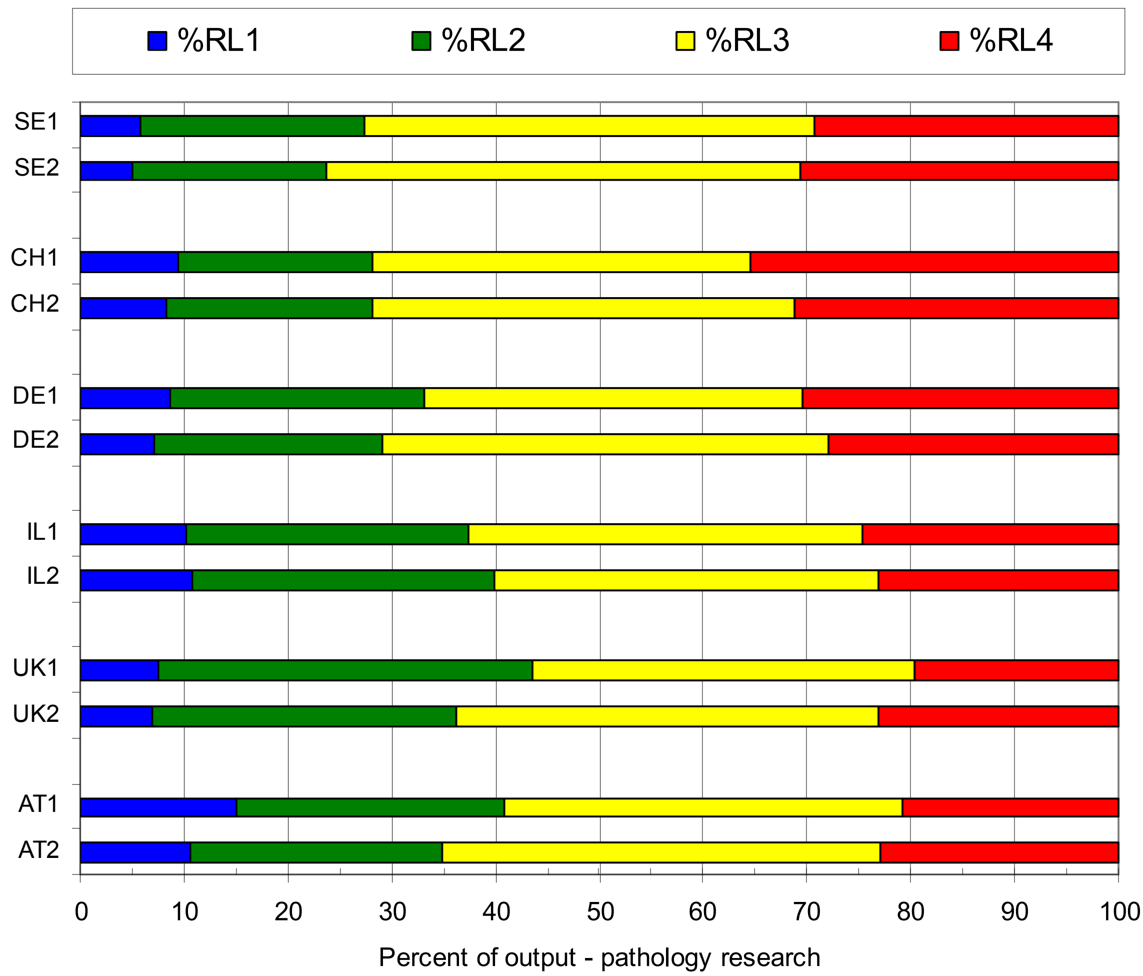


Table A3.26 Outputs in pharmacology & toxicology research (PHATO)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	9	96	408	34	547	AT	16	153	503	29	701
Switzerland	CH	41	311	1064	135	1551	CH	59	350	1104	87	1600
Germany	DE	79	1113	4202	372	5766	DE	168	1316	4217	336	6037
Israel	IL	43	133	408	70	654	IL	60	185	446	45	736
Sweden	SE	39	457	1475	158	2129	SE	49	477	1321	126	1973
UK	UK	149	1865	6307	536	8857	UK	198	2130	5544	428	8300

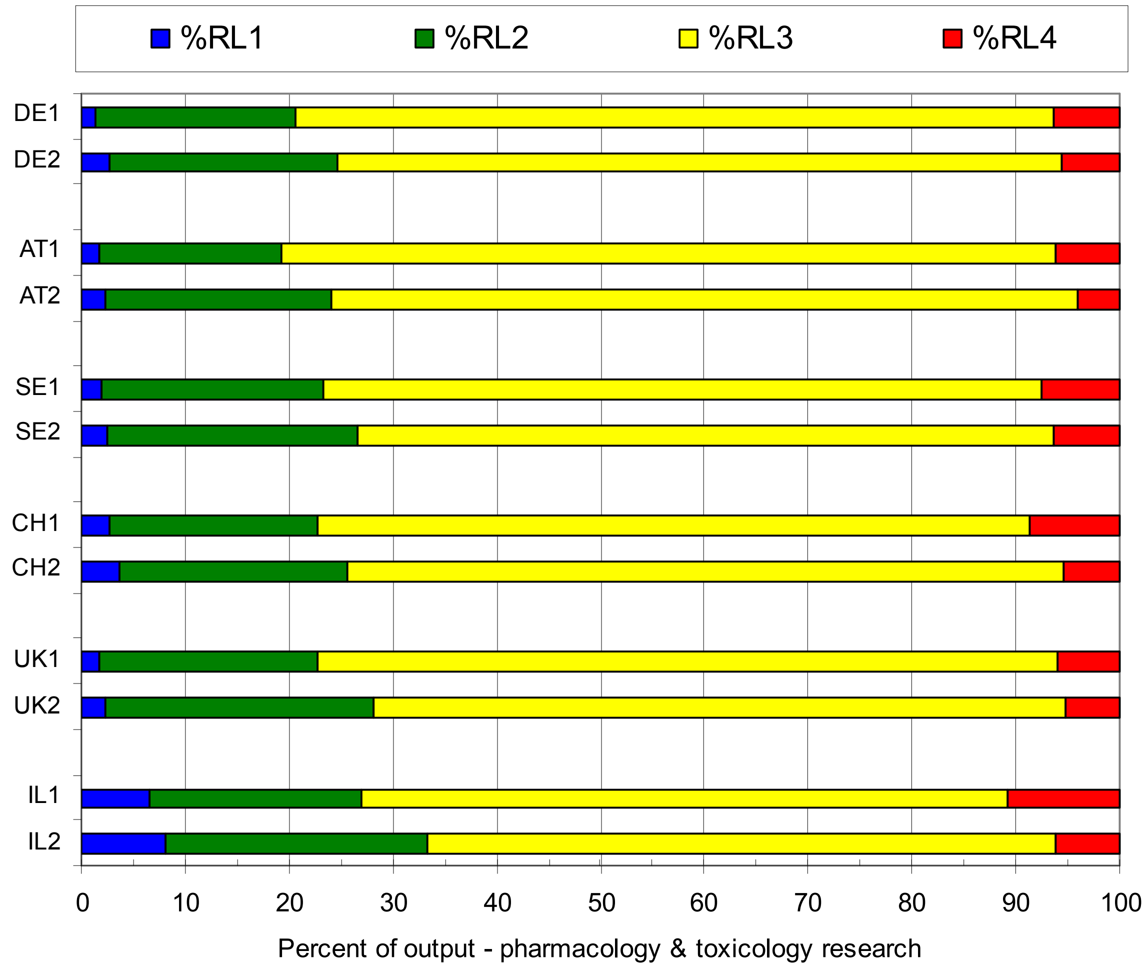


Table A3.27 Outputs in public health & epidemiology research (PUBEP)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	92	155	87	19	353	AT	183	179	152	37	551
Switzerland	CH	249	288	197	36	770	CH	342	426	229	60	1057
Germany	DE	494	818	503	169	1984	DE	858	1191	806	279	3134
Israel	IL	201	339	95	39	674	IL	230	349	154	41	774
Sweden	SE	502	790	393	74	1759	SE	654	1114	539	105	2412
UK	UK	2013	1987	874	297	5171	UK	2903	2751	1184	431	7269

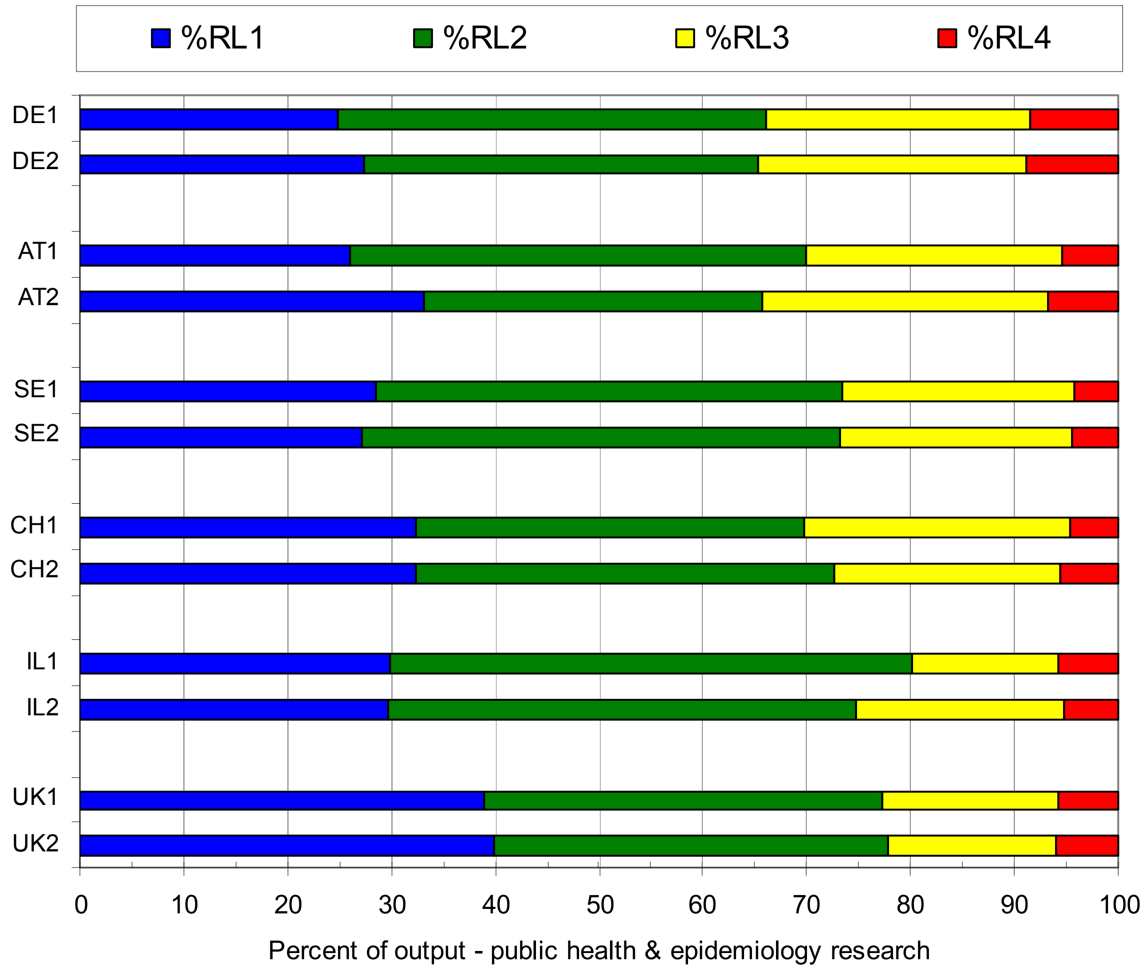


Table A3.28 Outputs in radiotherapy, radiology & nuclear medicine (RADIO)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	217	119	18	12	366	AT	321	271	36	15	643
Switzerland	CH	160	186	48	18	412	CH	190	318	79	28	615
Germany	DE	1390	823	163	213	2589	DE	1559	1608	259	222	3648
Israel	IL	119	148	15	18	300	IL	133	157	23	4	317
Sweden	SE	148	512	149	59	868	SE	155	535	163	68	921
UK	UK	868	1551	245	273	2937	UK	820	1419	287	244	2770

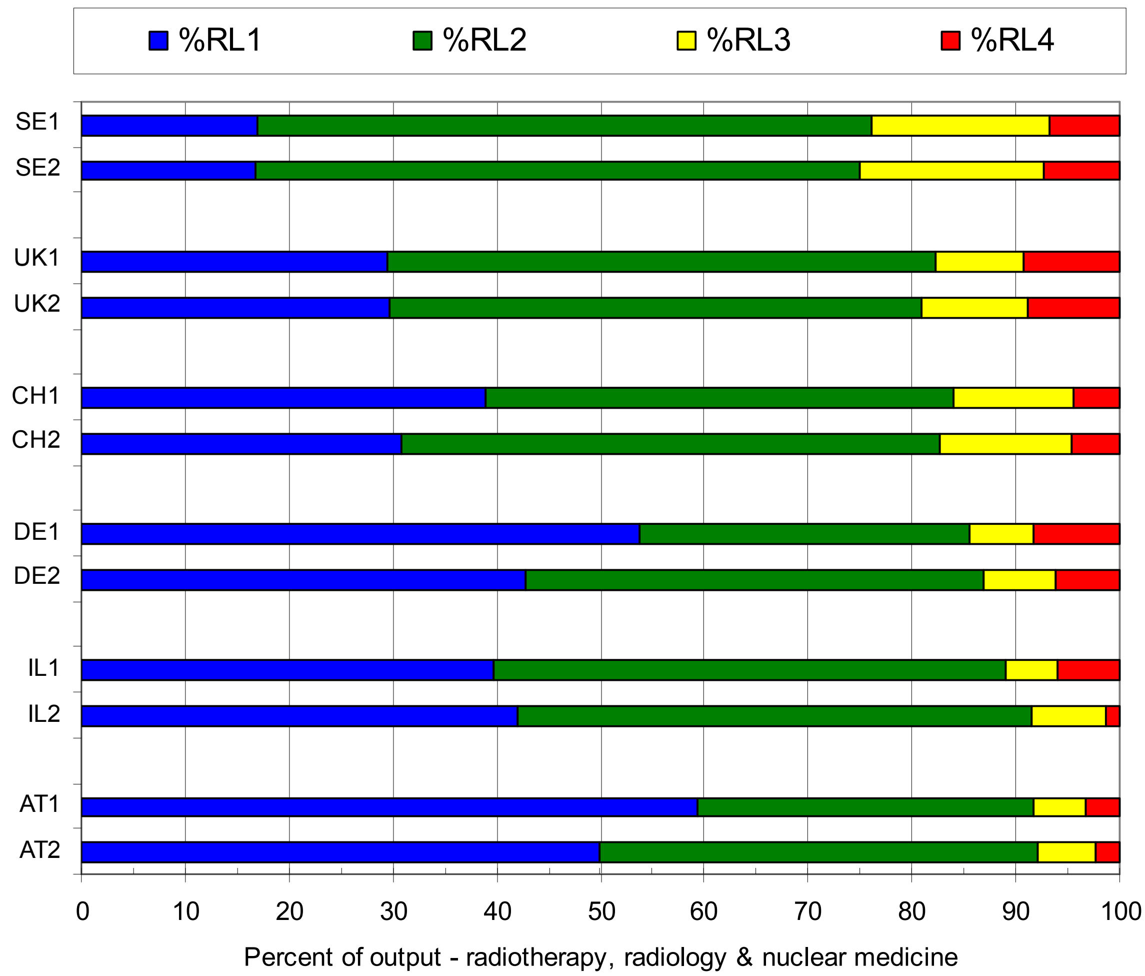


Table A3.29 Outputs in renal medicine (RENAL)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	92	102	154	52	400	AT	121	103	206	46	476
Switzerland	CH	101	124	289	175	689	CH	101	137	368	144	750
Germany	DE	554	718	1189	460	2921	DE	527	810	1828	615	3780
Israel	IL	84	151	141	44	420	IL	72	157	178	42	449
Sweden	SE	93	420	394	131	1038	SE	72	393	400	135	1000
UK	UK	642	850	1320	323	3135	UK	508	683	1294	357	2842

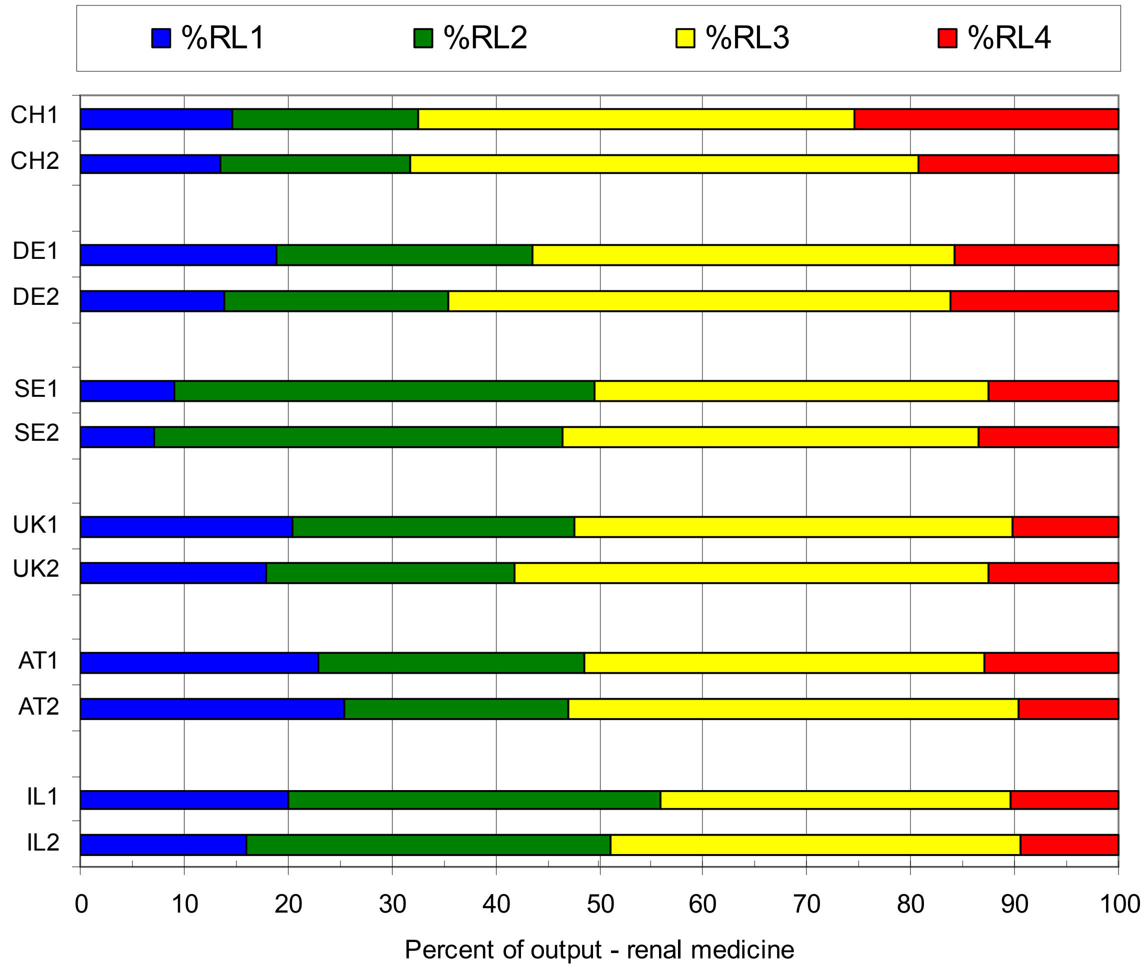


Table A3.30 Outputs in respiratory medicine (RESPI)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	179	182	73	27	461	AT	213	340	142	55	750
Switzerland	CH	341	313	241	139	1034	CH	437	452	321	165	1375
Germany	DE	748	983	760	547	3038	DE	1031	1421	1093	727	4272
Israel	IL	183	209	93	74	559	IL	212	238	95	58	603
Sweden	SE	397	498	427	199	1521	SE	460	694	453	224	1831
UK	UK	2124	2146	1495	956	6721	UK	2094	2389	1688	1000	7171

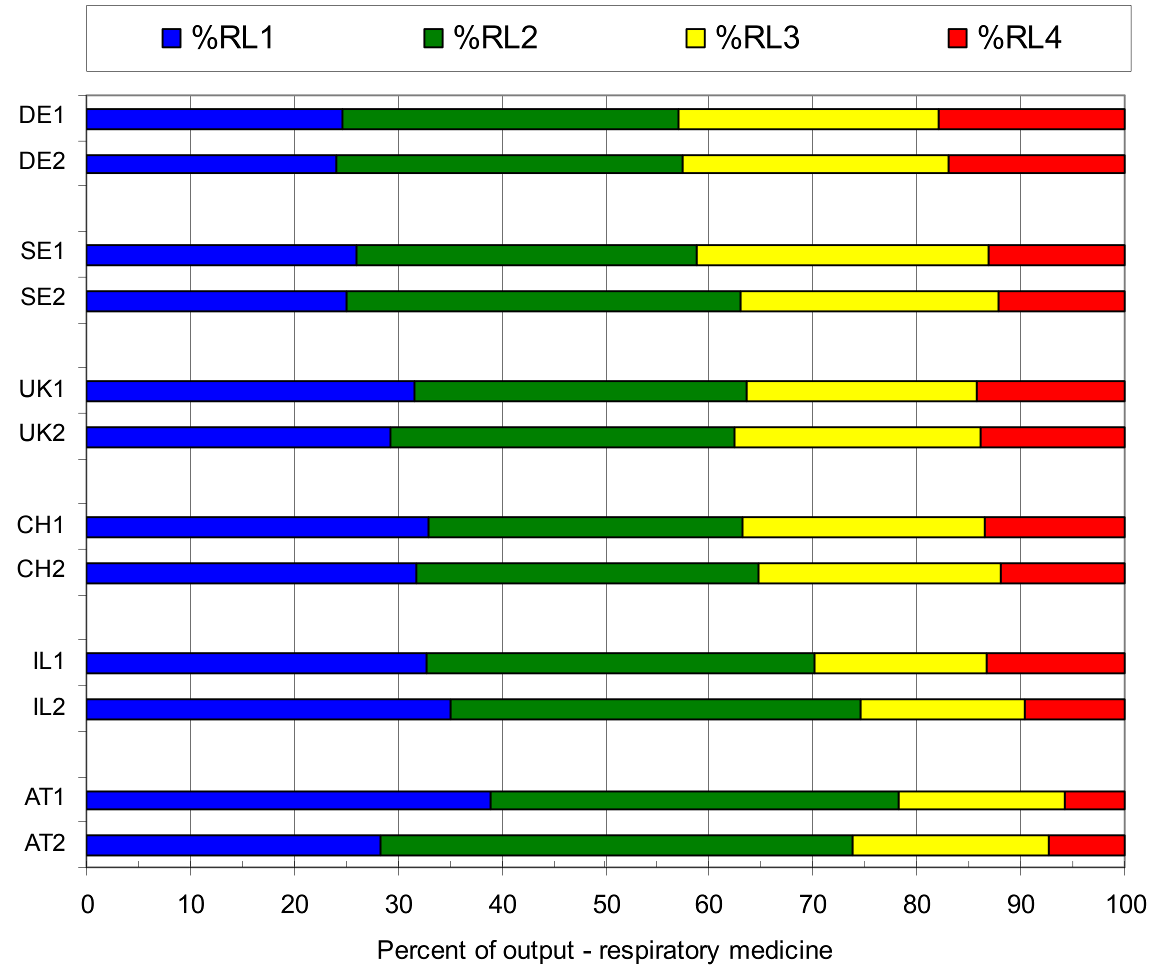


Table A3.31 Outputs in surgery research (SURGE)

	91-95	RL1	RL2	RL3	RL4	Total	96-00	RL1	RL2	RL3	RL4	Total
Austria	AT	589	111	85	3	788	AT	811	220	93	8	1132
Switzerland	CH	747	163	57	5	972	CH	1022	281	90	9	1402
Germany	DE	2929	580	480	11	4000	DE	4111	906	660	32	5709
Israel	IL	665	171	23	1	860	IL	760	201	71	6	1038
Sweden	SE	1260	759	235	25	2279	SE	1332	701	169	34	2236
UK	UK	5113	698	272	30	6113	UK	4816	629	301	44	5790

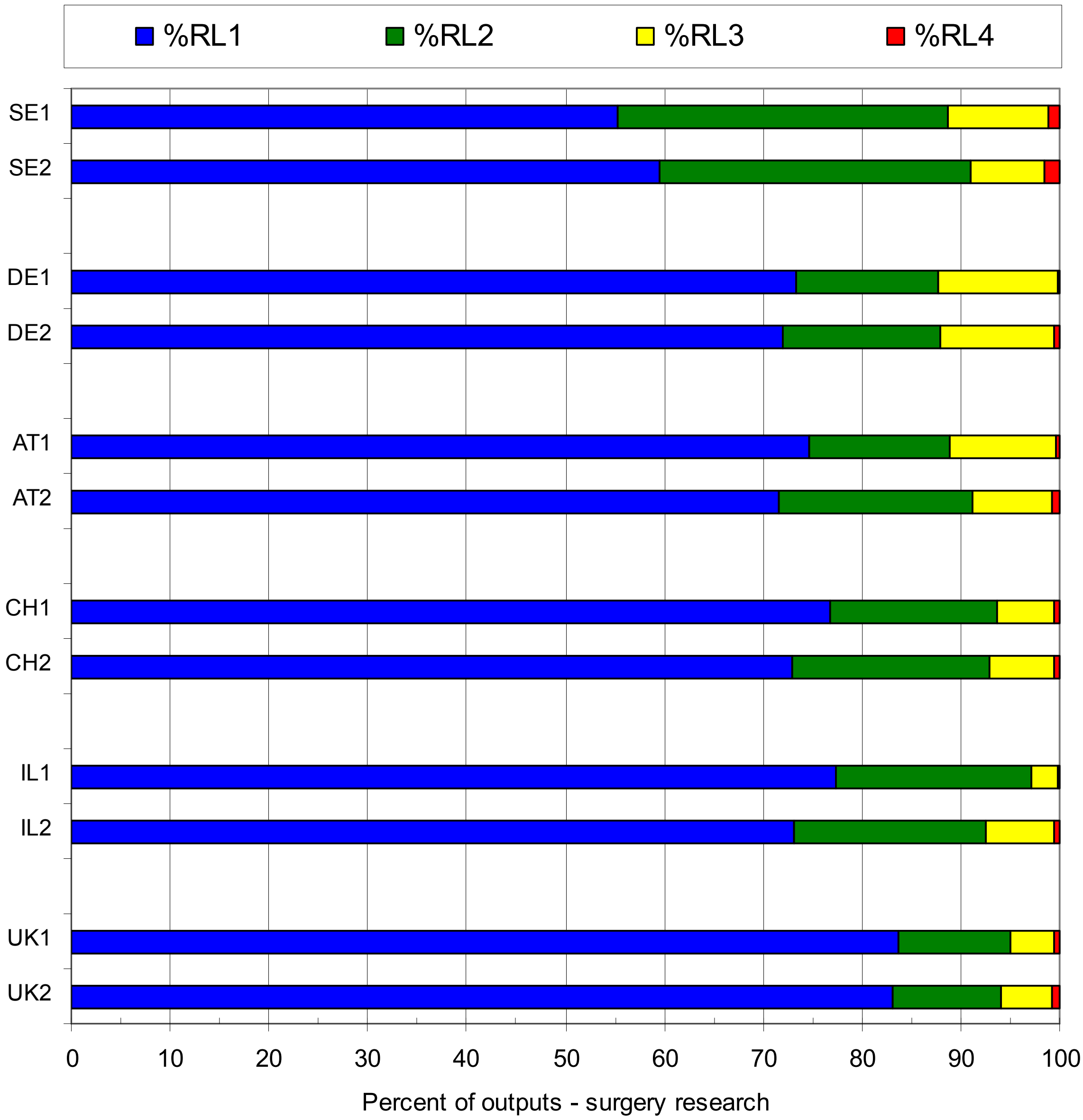
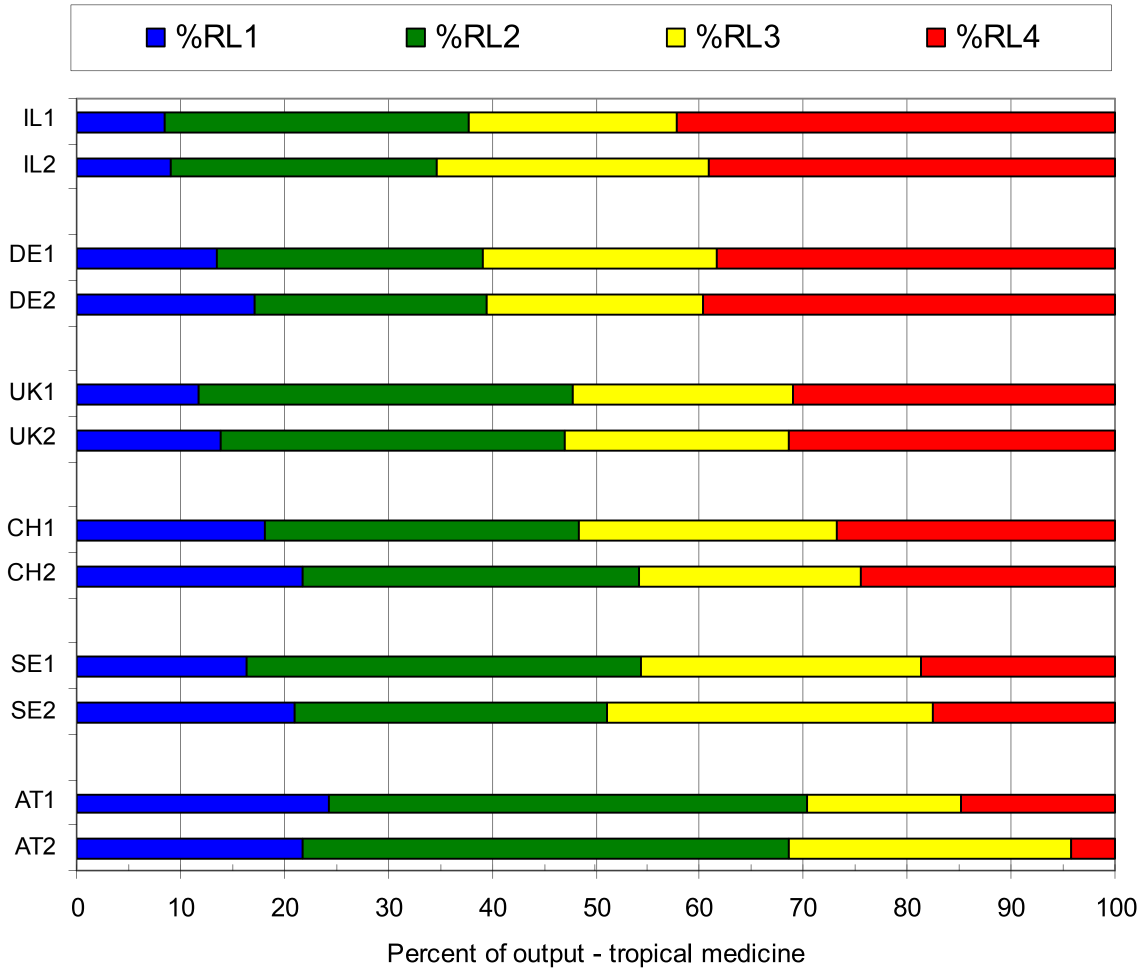


Table A3.32 Outputs in tropical medicine (TROPM)

	91-95	*RL1*	*RL2*	*RL3*	*RL4*	*Total*	*96-00*	*RL1*	*RL2*	*RL3*	*RL4*	*Total*
Austria	AT	18	34	11	11	74	AT	31	67	39	6	143
Switzerland	CH	122	205	167	181	675	CH	171	252	168	191	782
Germany	DE	126	238	210	357	931	DE	205	265	247	472	1189
Israel	IL	25	85	59	123	292	IL	17	48	49	73	187
Sweden	SE	72	167	119	82	440	SE	97	138	144	81	460
UK	UK	375	1144	673	982	3174	UK	502	1202	783	1139	3626



ANNEX 4 CATEGORIZATION OF PAPERS BY POTENTIAL IMPACT

A4.1 Outputs of six countries in 32 sub-fields

Table A4.1 Potential impact category distributions of papers in anatomy, morphology and physiology (ANAPH)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	98	49	44	6	197	AT	121	85	34	1	241
Switzerland	CH	147	197	138	41	523	CH	283	185	89	8	565
Germany	DE	635	767	483	147	2032	DE	1196	842	417	28	2483
Israel	IL	104	79	77	19	279	IL	182	83	37	5	307
Sweden	SE	415	552	140	54	1161	SE	480	435	96	2	1013
UK	UK	987	728	599	400	2714	UK	1294	798	1011	19	3122

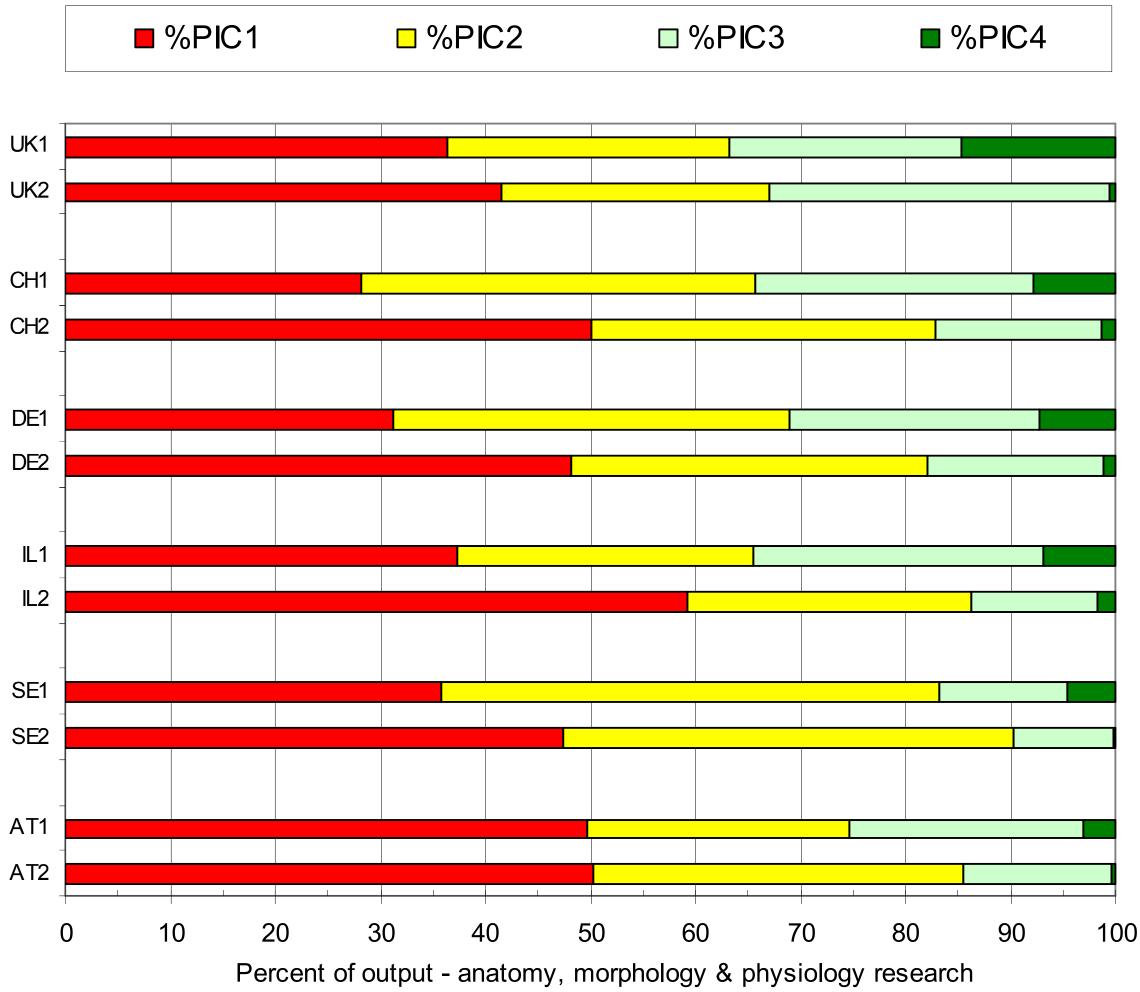


Table A4.2 Potential impact category distributions of papers in anaesthesia research (ANEST)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	161	90	39	5	295	AT	355	268	151	12	786
Switzerland	CH	285	156	84	14	539	CH	288	260	152	24	724
Germany	DE	1388	481	297	51	2217	DE	1613	985	640	70	3308
Israel	IL	121	121	61	19	322	IL	148	160	100	9	417
Sweden	SE	537	306	189	21	1053	SE	541	402	212	20	1175
UK	UK	1666	1744	617	120	4147	UK	1690	1552	725	121	4088

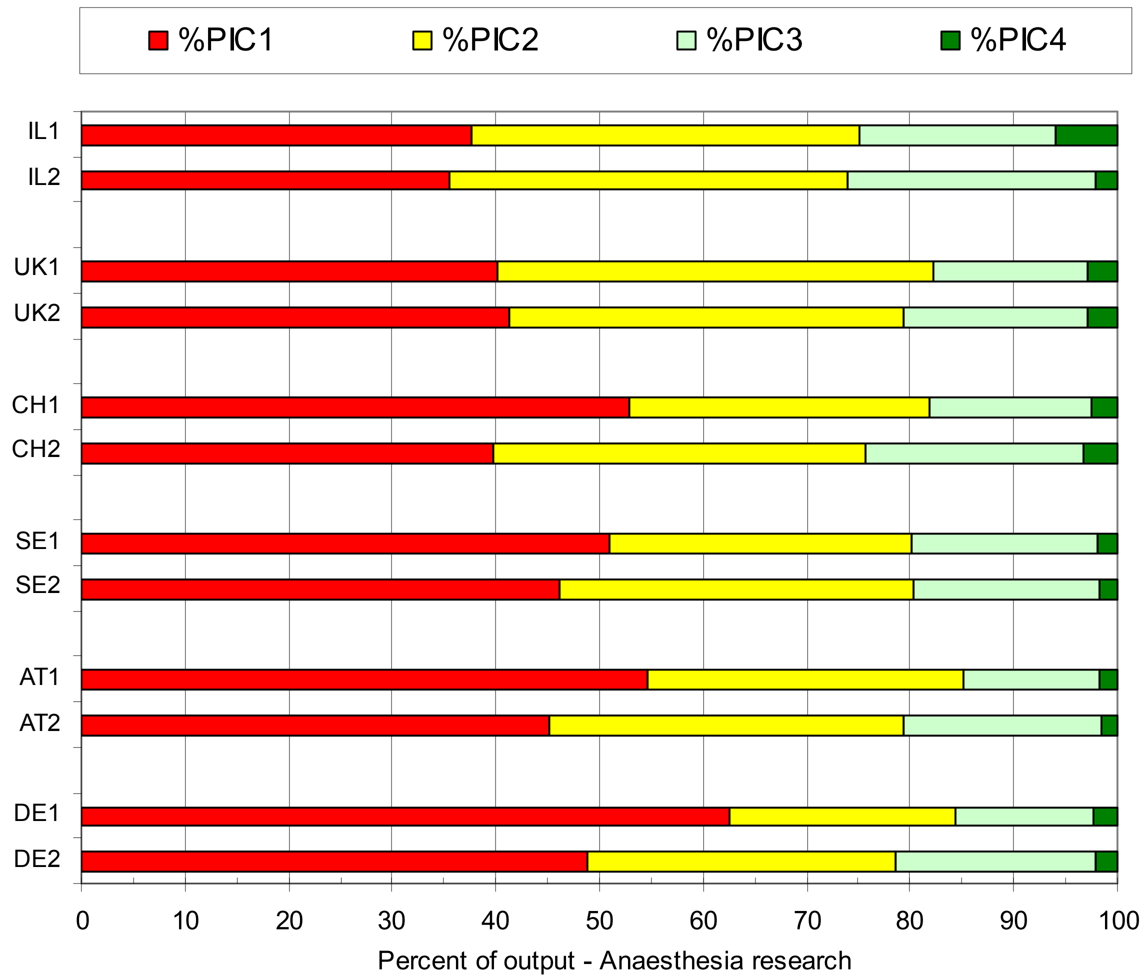


Table A4.3 Potential impact category distributions of papers in arthritis research (ARTHR)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	106	88	41	24	259	AT	157	129	60	49	395
Switzerland	CH	236	189	173	114	712	CH	284	327	164	163	938
Germany	DE	985	439	310	177	1911	DE	1250	827	455	294	2826
Israel	IL	152	265	134	56	607	IL	244	273	127	72	716
Sweden	SE	312	311	224	81	928	SE	358	490	235	168	1251
UK	UK	1144	2200	916	335	4595	UK	1094	1989	978	546	4607

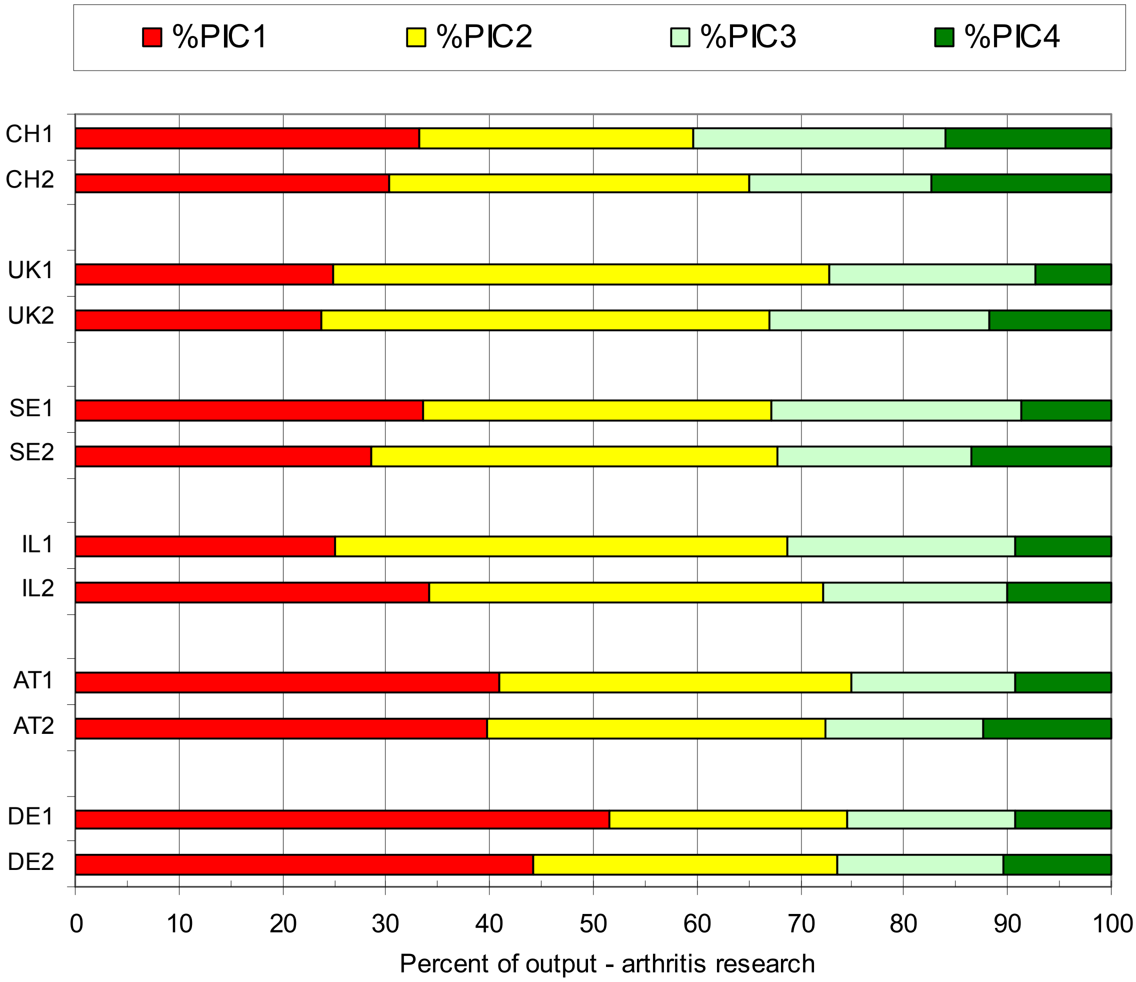


Table A4.4 Potential impact category distributions of papers in biochemistry & molecular biology research (BCMBI)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	122	190	386	268	966	AT	157	408	495	371	1431
Switzerland	CH	286	572	1295	1460	3613	CH	296	781	1276	1490	3843
Germany	DE	1894	2959	4590	3453	12896	DE	1951	3787	5428	4089	15255
Israel	IL	267	472	606	680	2025	IL	231	498	663	707	2099
Sweden	SE	542	928	1348	986	3804	SE	558	1128	1572	1036	4294
UK	UK	2772	3016	5226	3387	14401	UK	2592	3363	5102	4153	15210

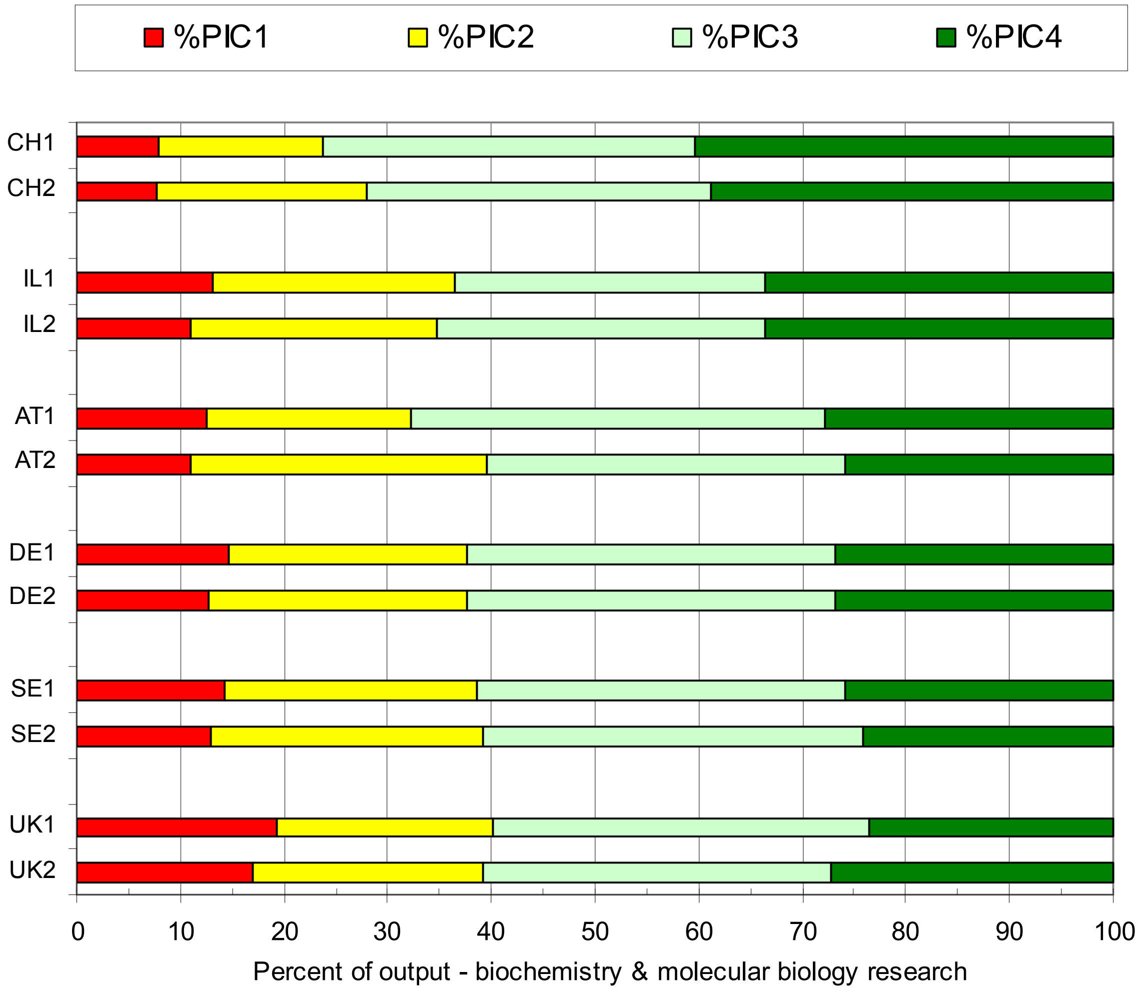


Table A4.5 Potential impact category distributions of papers in bioengineering (BIENG)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	87	38	13	2	140	AT	141	93	22	15	271
Switzerland	CH	96	77	37	19	229	CH	177	214	81	41	513
Germany	DE	545	263	91	47	946	DE	723	605	174	89	1591
Israel	IL	127	82	18	13	240	IL	125	116	22	16	279
Sweden	SE	278	177	72	19	546	SE	279	315	93	36	723
UK	UK	659	487	188	47	1381	UK	727	792	184	127	1830

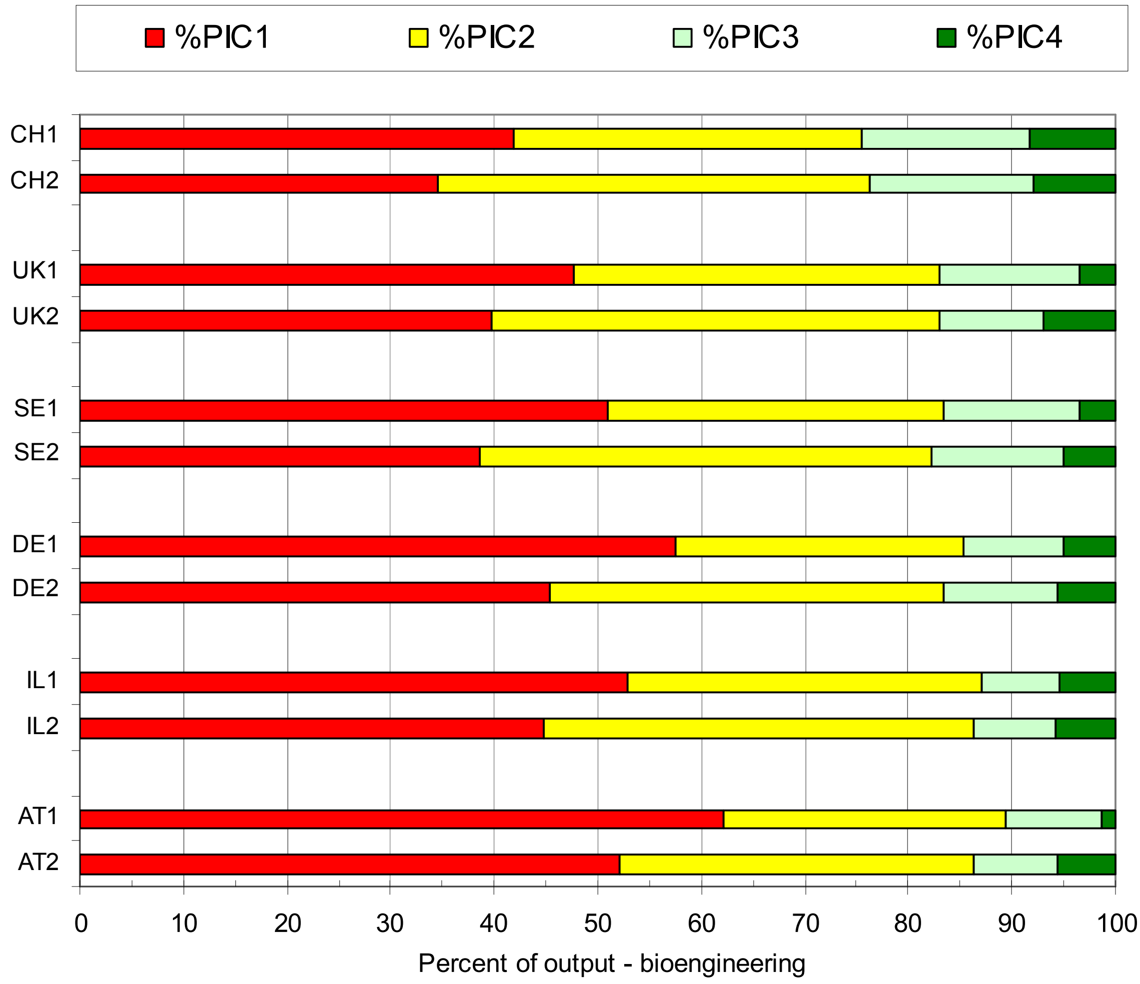


Table A4.6 Potential impact category distributions of papers in cardiology research (CARDI)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	804	367	245	119	1535	AT	843	505	369	231	1948
Switzerland	CH	1077	699	481	325	2582	CH	1141	790	626	431	2988
Germany	DE	5970	2584	1633	837	11024	DE	6527	3525	2339	1820	14211
Israel	IL	728	523	253	171	1675	IL	723	618	302	280	1923
Sweden	SE	1464	1292	609	323	3688	SE	1404	1349	733	464	3950
UK	UK	4197	4674	2882	1137	12890	UK	4067	4539	3105	1704	13415

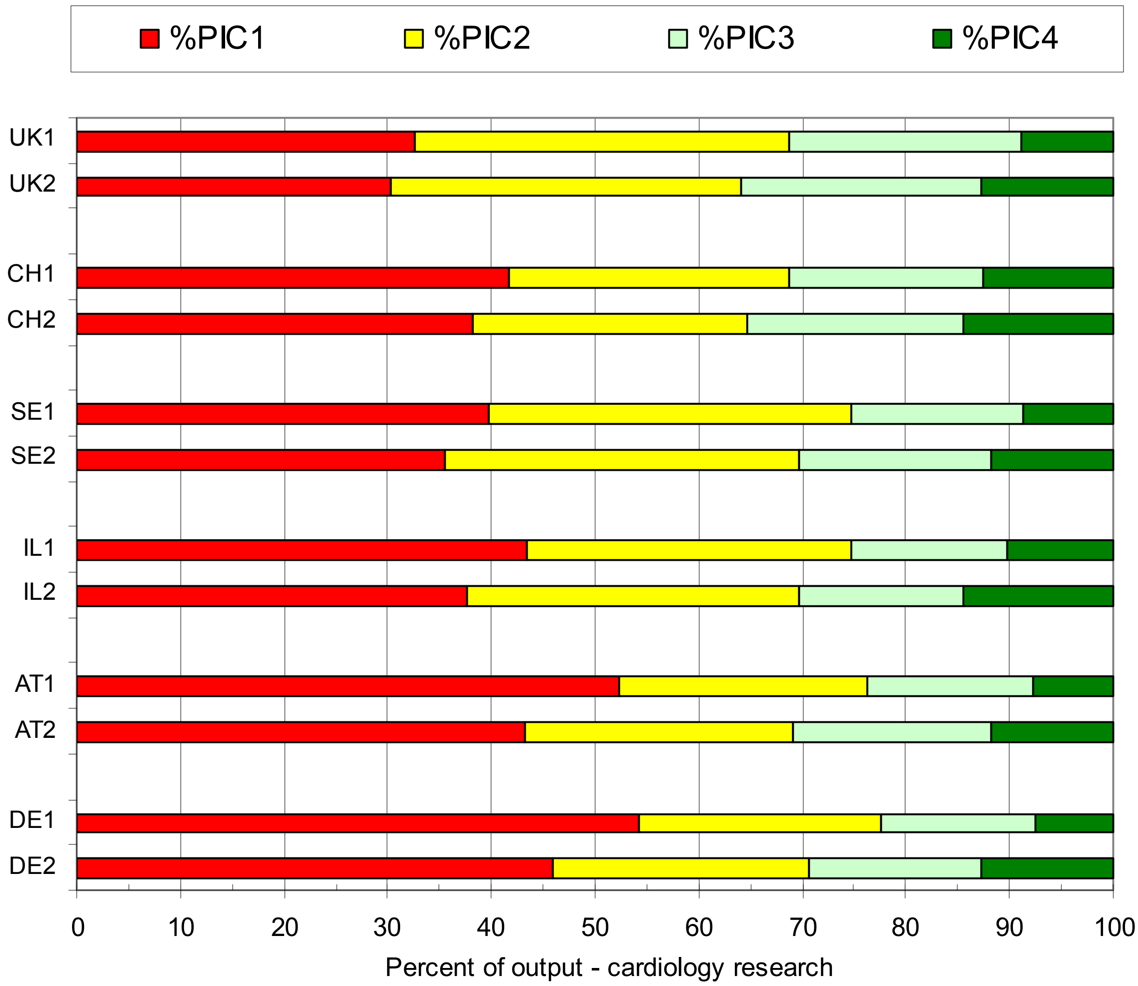


Table A4.7 Potential impact category distributions of papers in paediatrics & neonatology research (CHILD)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	447	125	53	29	654	AT	491	293	121	70	975
Switzerland	CH	728	255	135	92	1210	CH	674	510	186	123	1493
Germany	DE	2794	743	381	193	4111	DE	2960	1478	653	383	5474
Israel	IL	845	424	168	58	1495	IL	772	521	218	80	1591
Sweden	SE	1335	486	289	96	2206	SE	1174	808	367	148	2497
UK	UK	3934	3344	1239	494	9011	UK	3472	4016	1533	733	9754

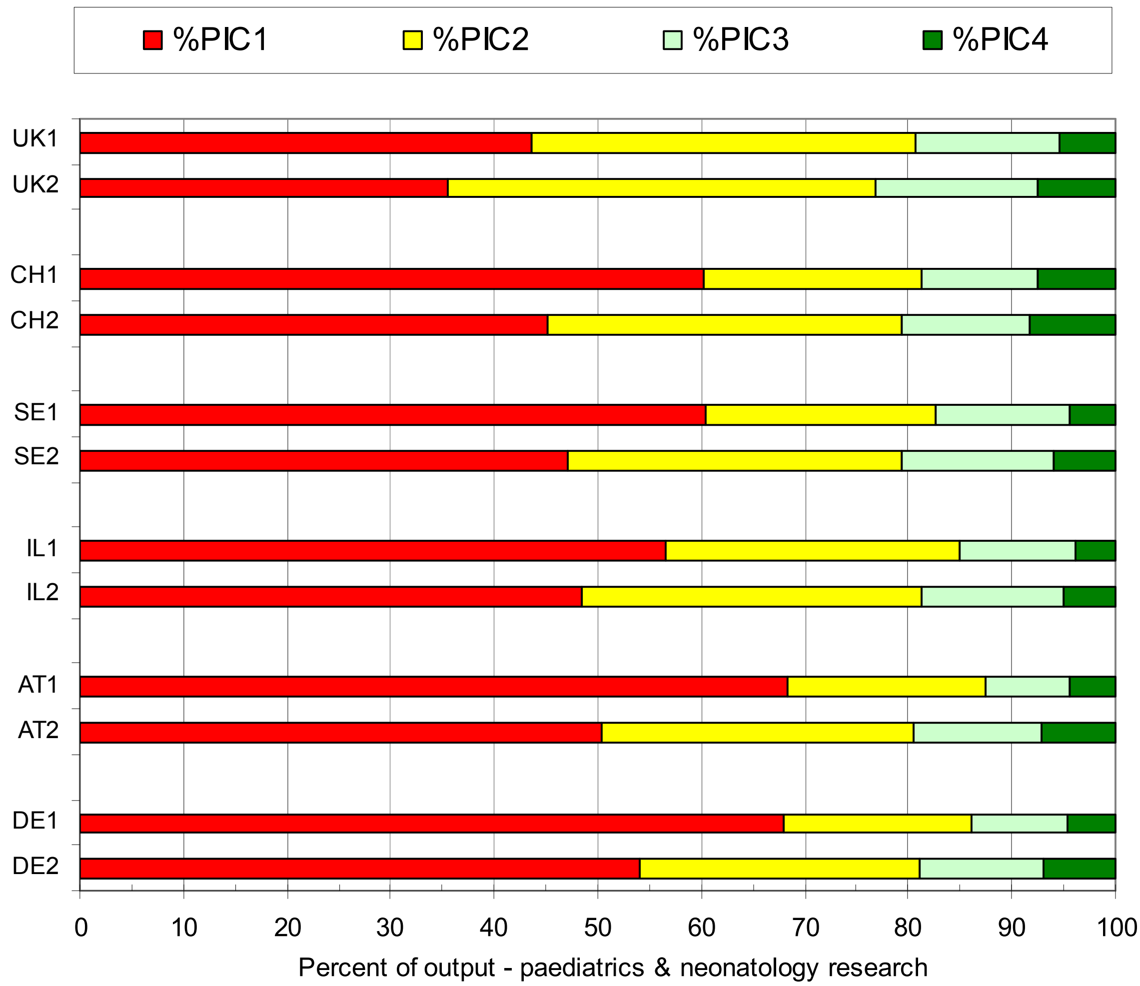


Table A4.8 Potential impact category distributions of papers in cell biology (CYTHI)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	71	70	113	105	359	AT	105	145	170	186	606
Switzerland	CH	120	159	361	411	1051	CH	145	275	414	596	1430
Germany	DE	781	664	1226	836	3507	DE	1000	1308	1586	1535	5429
Israel	IL	84	93	155	130	462	IL	123	146	188	214	671
Sweden	SE	186	198	334	174	892	SE	214	311	392	318	1235
UK	UK	665	824	1522	892	3903	UK	817	1124	1715	1465	5121

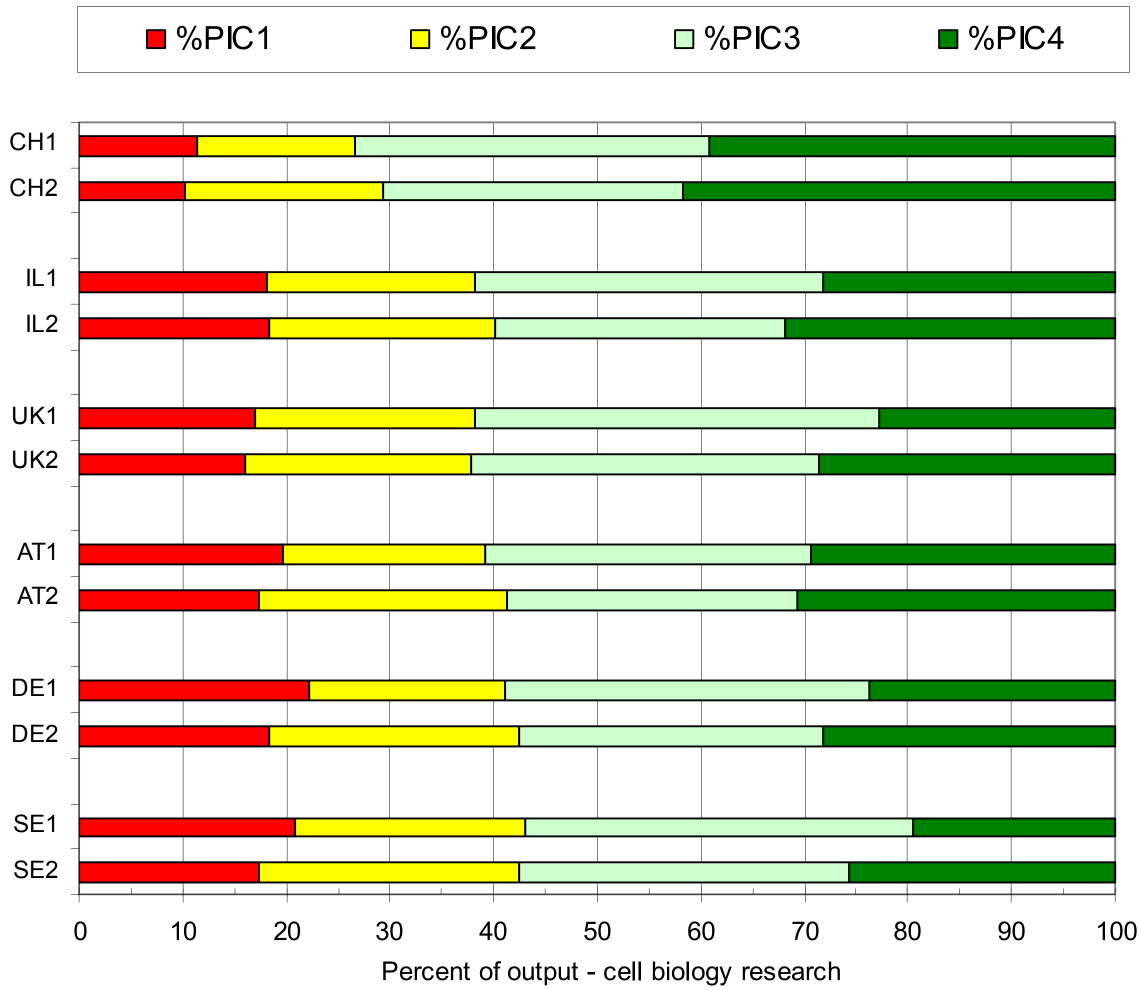


Table A4.9 Potential impact category distributions of papers in dentistry research (DENTA)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	73	11	2	0	86	AT	138	28	18	2	186
Switzerland	CH	151	111	11	2	275	CH	202	134	54	4	394
Germany	DE	449	116	26	4	595	DE	746	362	70	21	1199
Israel	IL	258	70	6	1	335	IL	306	117	24	1	448
Sweden	SE	882	220	26	5	1133	SE	712	346	86	10	1154
UK	UK	1930	449	76	29	2484	UK	2209	621	121	51	3002

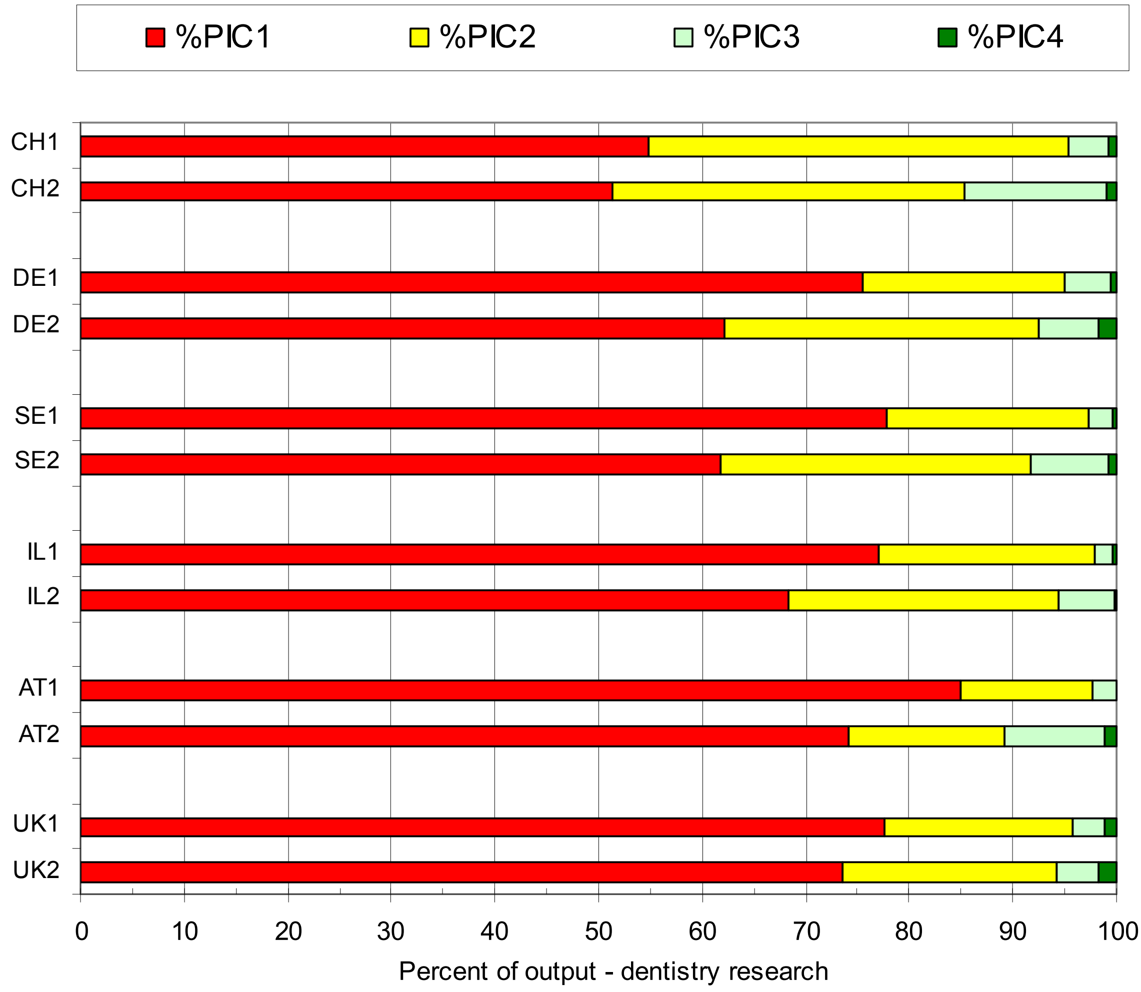


Table A4.10 Potential impact category distributions of papers in dermatology & venereology research (DERMA)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	253	127	105	39	524	AT	249	202	139	60	650
Switzerland	CH	461	194	178	76	909	CH	581	290	168	130	1169
Germany	DE	2158	659	608	277	3702	DE	2568	1244	847	491	5150
Israel	IL	358	183	65	37	643	IL	344	190	87	49	670
Sweden	SE	604	243	152	79	1078	SE	537	350	230	112	1229
UK	UK	2184	1554	908	358	5004	UK	1978	1857	783	486	5104

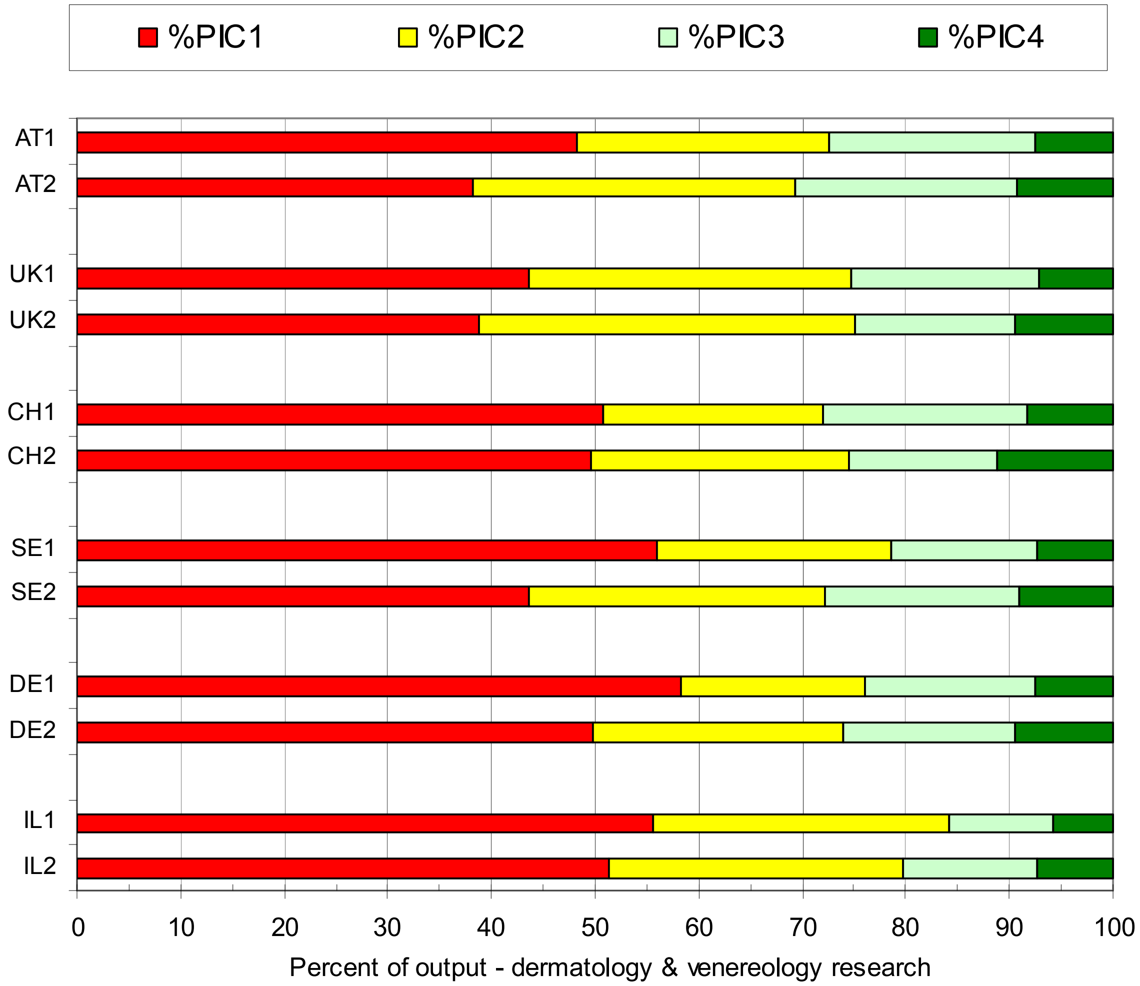


Table A4.11 Potential impact category distributions of papers in endocrinology research (ENDOC)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	543	333	297	152	1325	AT	665	600	371	239	1875
Switzerland	CH	919	822	857	454	3052	CH	867	917	788	571	3143
Germany	DE	4945	2632	2171	869	10617	DE	4841	3772	2689	1651	12953
Israel	IL	821	701	557	195	2274	IL	765	798	526	277	2366
Sweden	SE	1828	1756	1465	559	5608	SE	1713	2144	1481	853	6191
UK	UK	4549	5336	4375	1201	15461	UK	4252	5255	4268	2072	15847

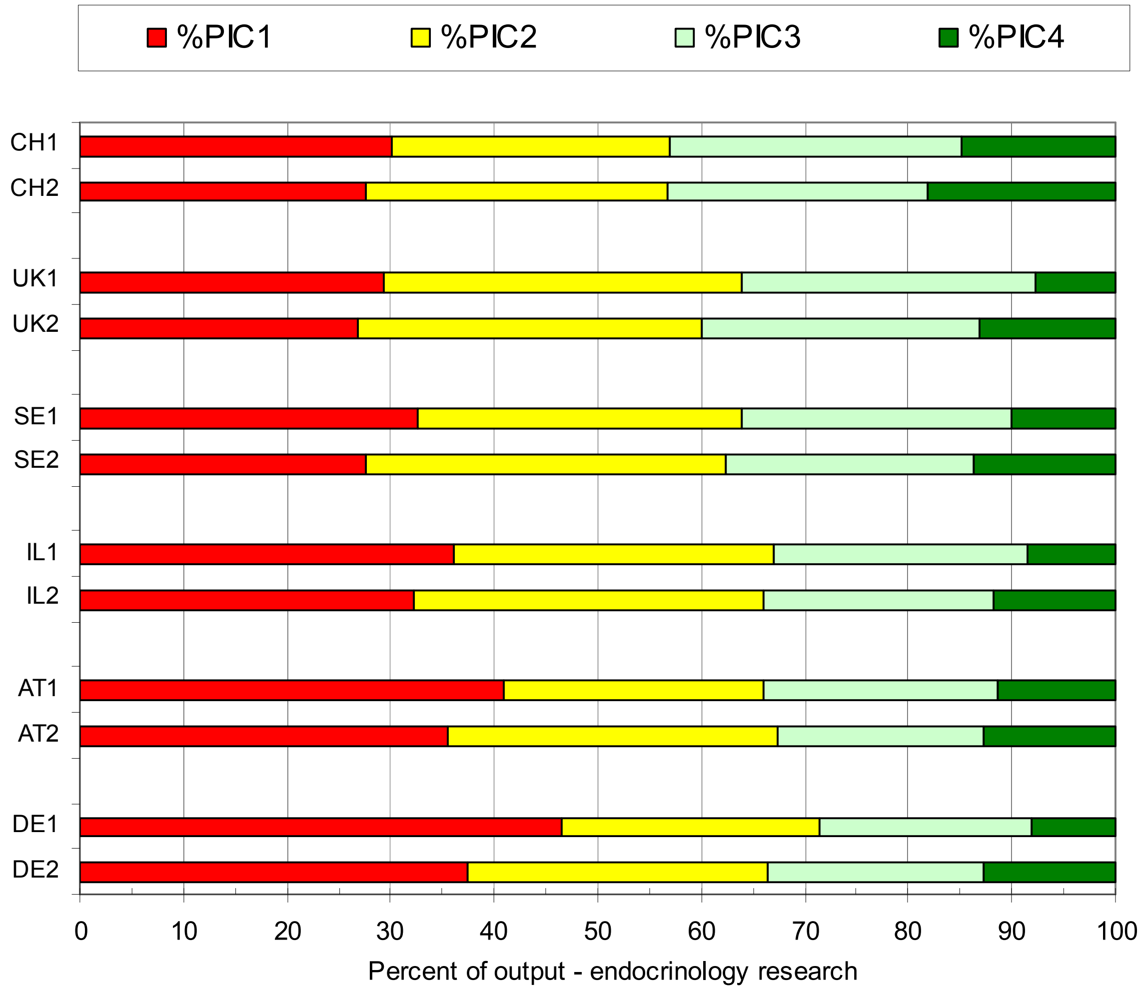


Table A4.12 Potential impact category distributions of papers in gastroenterology research (GASTR)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	380	196	154	63	793	AT	423	308	208	99	1038
Switzerland	CH	723	412	323	256	1714	CH	754	514	469	308	2045
Germany	DE	3901	1586	1114	623	7224	DE	4136	2170	1722	866	8894
Israel	IL	517	260	133	53	963	IL	529	342	166	83	1120
Sweden	SE	1169	945	607	244	2965	SE	1009	1128	675	279	3091
UK	UK	3393	3074	2595	745	9807	UK	3013	2846	2501	865	9225

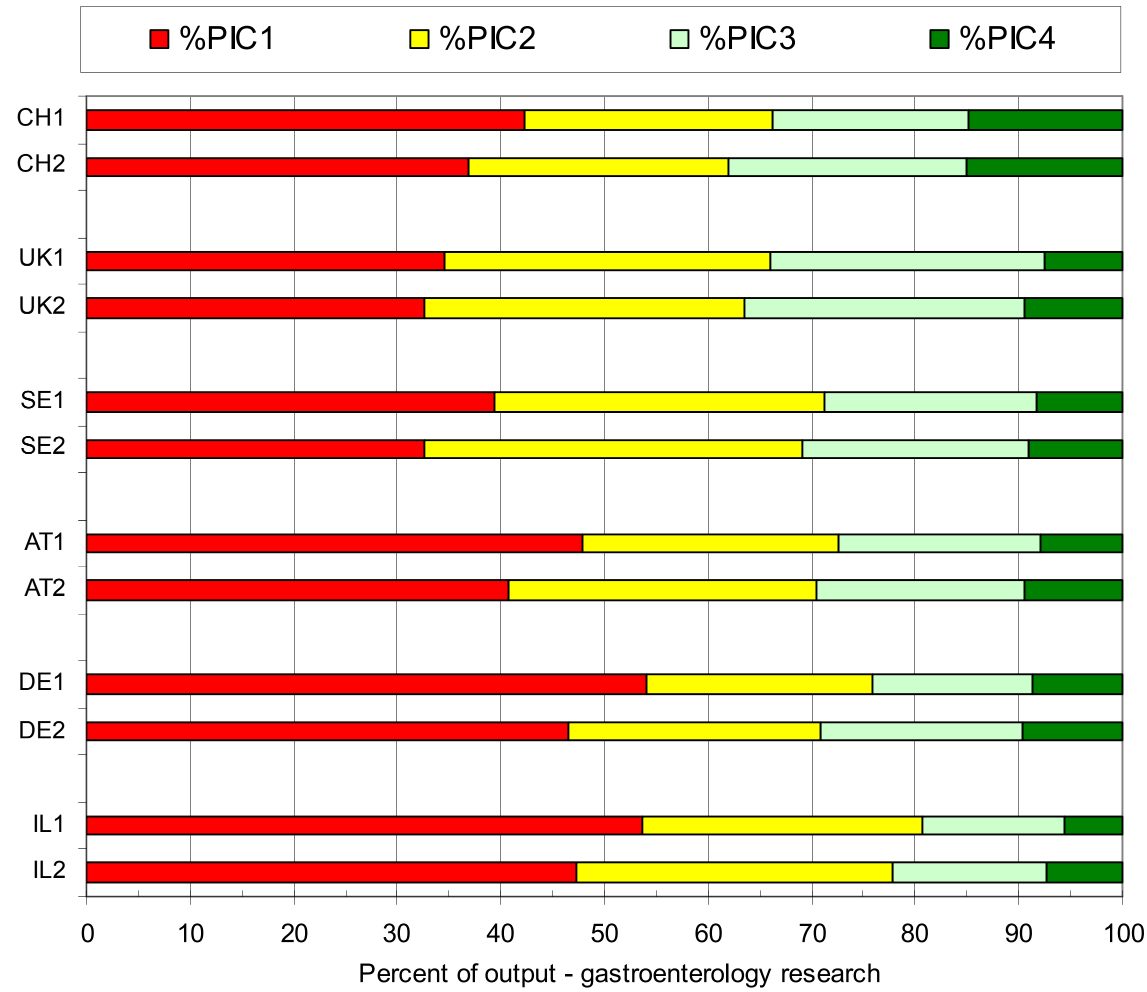


Table A4.13 Potential impact category distributions of papers in genetics (GENET)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	132	227	288	264	911	AT	267	454	363	382	1466
Switzerland	CH	394	619	1038	1099	3150	CH	636	1094	1112	1374	4216
Germany	DE	2397	2974	4125	2927	12423	DE	3513	5200	4689	4108	17510
Israel	IL	379	441	468	492	1780	IL	454	667	523	631	2275
Sweden	SE	791	893	1174	821	3679	SE	948	1395	1449	998	4790
UK	UK	2545	4390	5144	3859	15938	UK	3215	6282	5255	5102	19854

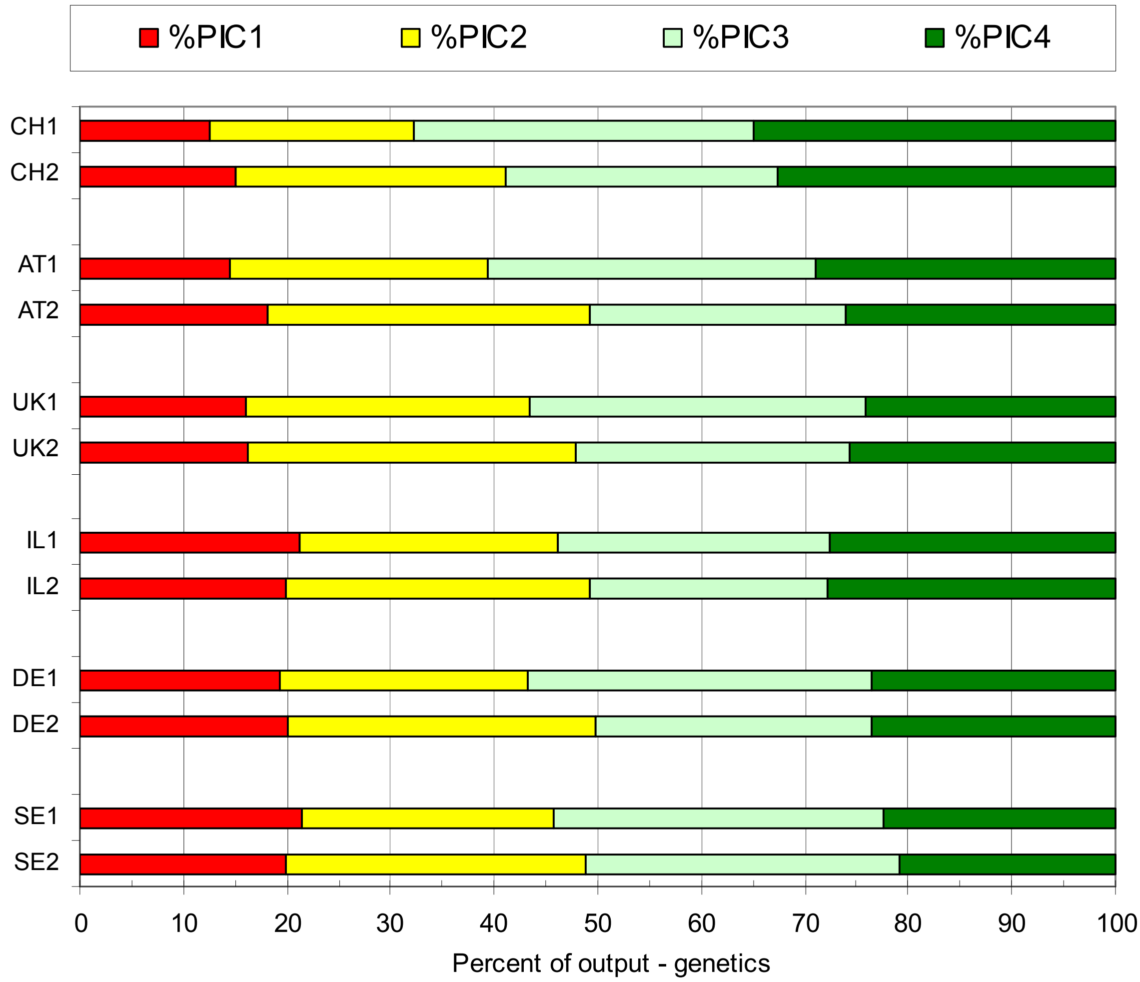


Table A4.14 Potential impact category distributions of papers in gerontology research (GERON)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	155	96	49	16	316	AT	185	266	76	63	590
Switzerland	CH	274	117	102	31	524	CH	386	261	141	109	897
Germany	DE	1013	442	347	90	1892	DE	1436	930	445	470	3281
Israel	IL	228	147	88	22	485	IL	274	199	95	56	624
Sweden	SE	542	375	219	65	1201	SE	663	584	304	190	1741
UK	UK	1605	1177	765	193	3740	UK	1693	1678	1076	683	5130

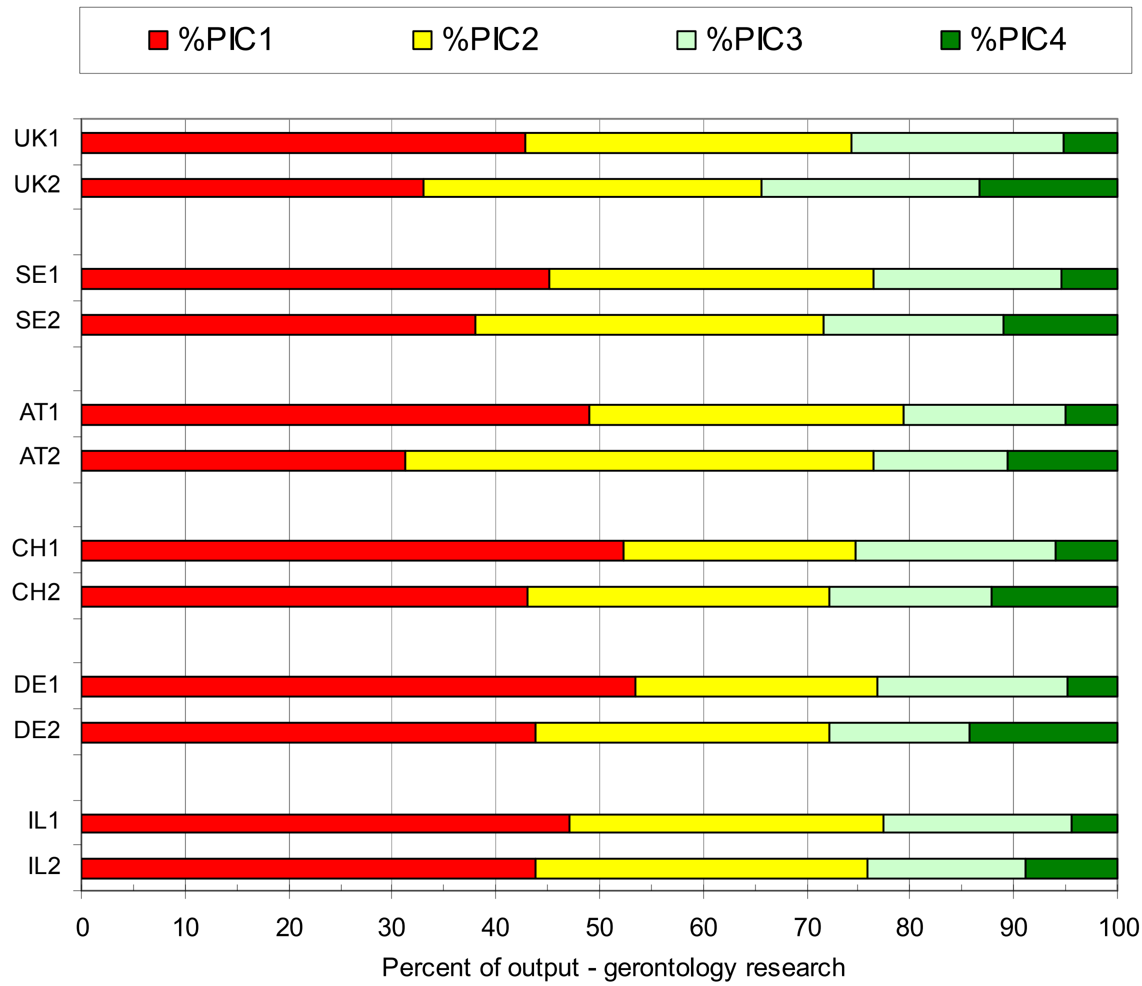


Table A4.15 Potential impact category distributions of papers in haematology research (HAEMA)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	414	244	228	190	1076	AT	478	346	369	250	1443
Switzerland	CH	542	366	404	367	1679	CH	529	406	503	456	1894
Germany	DE	3135	1536	1204	876	6751	DE	3166	1869	1870	1489	8394
Israel	IL	450	350	288	220	1308	IL	511	313	298	235	1357
Sweden	SE	777	689	429	294	2189	SE	777	597	665	356	2395
UK	UK	2311	2679	2046	1098	8134	UK	2313	2127	2400	1453	8293

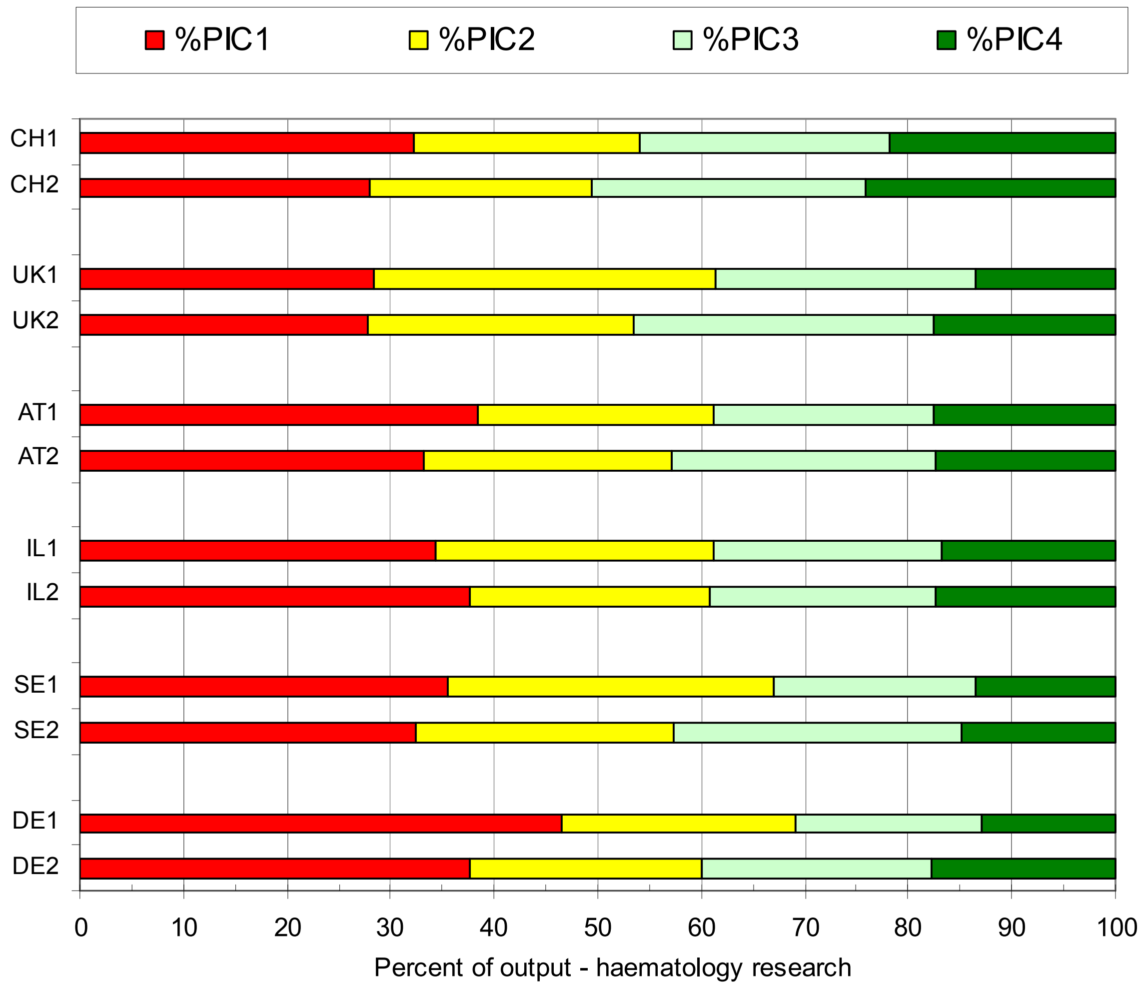


Table A4.16 Potential impact category distributions of papers in human genetics (HUGEN)

	91-95	PIC1	PIC2	PIC3	PIC4	Total	96-00	PIC1	PIC2	PIC3	PIC4	Total
Austria	AT	5	16	18	2	41	AT	14	35	28	20	97
Switzerland	CH	19	9	27	31	86	CH	25	43	23	38	129
Germany	DE	74	71	78	56	279	DE	121	170	154	123	568
Israel	IL	11	12	8	7	38	IL	10	19	29	32	90
Sweden	SE	24	32	42	35	133	SE	41	73	47	72	233
UK	UK	117	213	203	171	704	UK	139	345	285	289	1058

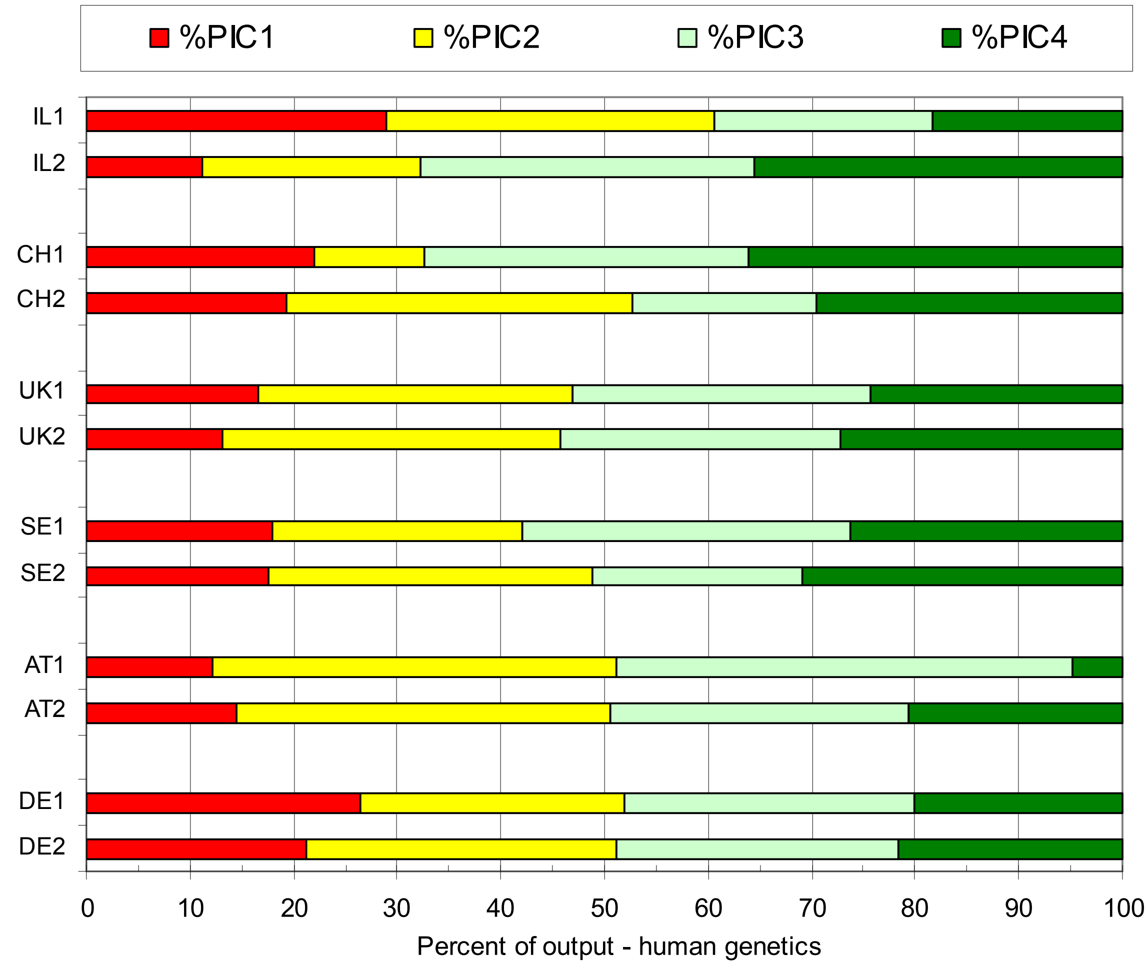


Table A4.17 Potential impact category distributions of papers in immunology & allergology research (IMMAL)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	351	342	327	255	1275	AT	384	578	342	363	1667
Switzerland	CH	669	737	763	1101	3270	CH	591	995	583	1303	3472
Germany	DE	3176	2185	2039	1663	9063	DE	2992	3275	2269	2527	11063
Israel	IL	442	531	354	303	1630	IL	468	550	338	322	1678
Sweden	SE	939	1098	879	488	3404	SE	899	1648	729	633	3909
UK	UK	2607	3445	3360	1890	11302	UK	2498	4405	2351	2629	11883

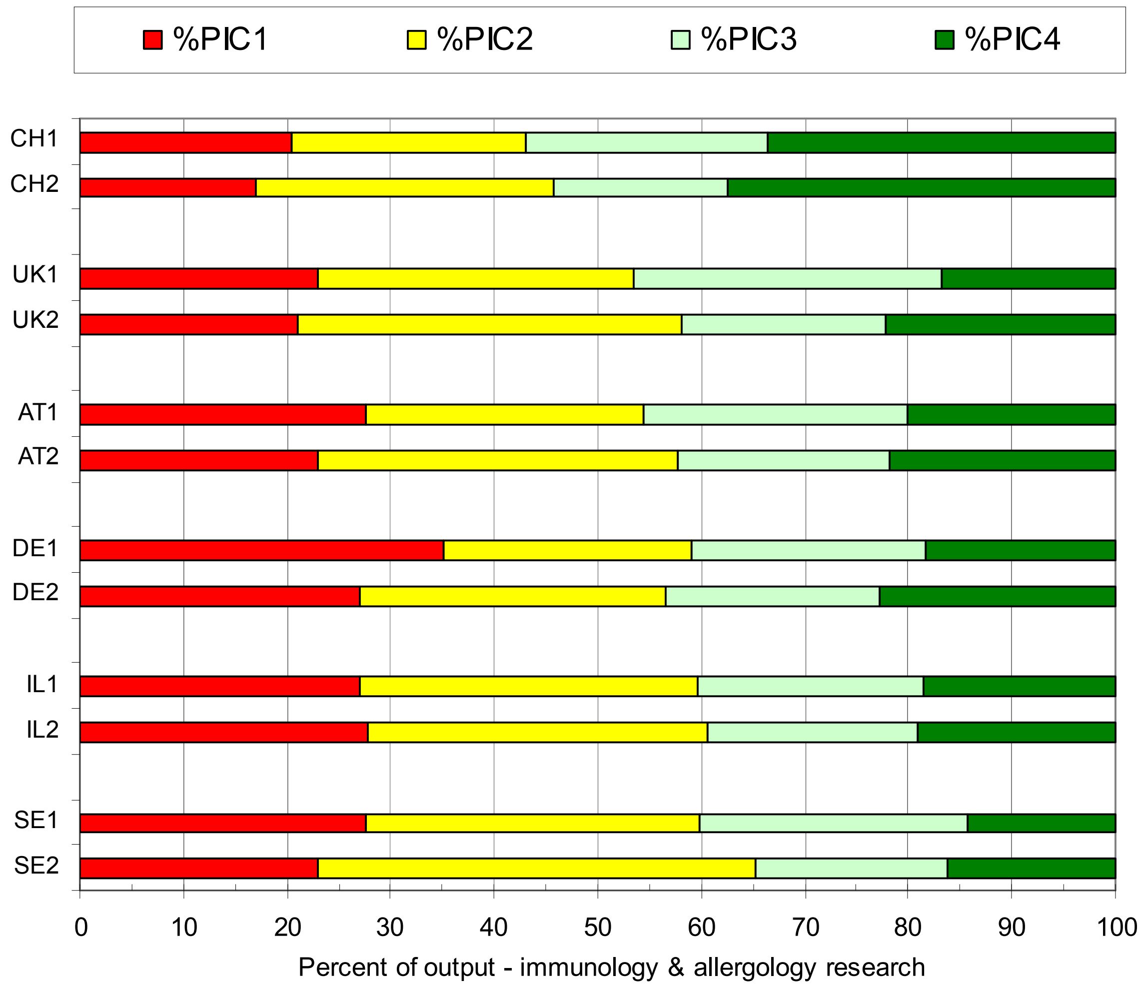


Table A4.18 Potential impact category distributions of papers in infectious disease research (INFEC)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	405	275	279	148	1107	AT	441	507	330	242	1520
Switzerland	CH	1138	804	1026	609	3577	CH	1143	1420	1102	918	4583
Germany	DE	4948	2925	3407	1607	12887	DE	4724	4367	3753	2552	15396
Israel	IL	863	569	525	268	2225	IL	740	683	466	297	2186
Sweden	SE	1505	1097	1170	481	4253	SE	1373	1432	1087	733	4625
UK	UK	7540	6118	4690	1780	20128	UK	5795	7880	4288	2852	20815

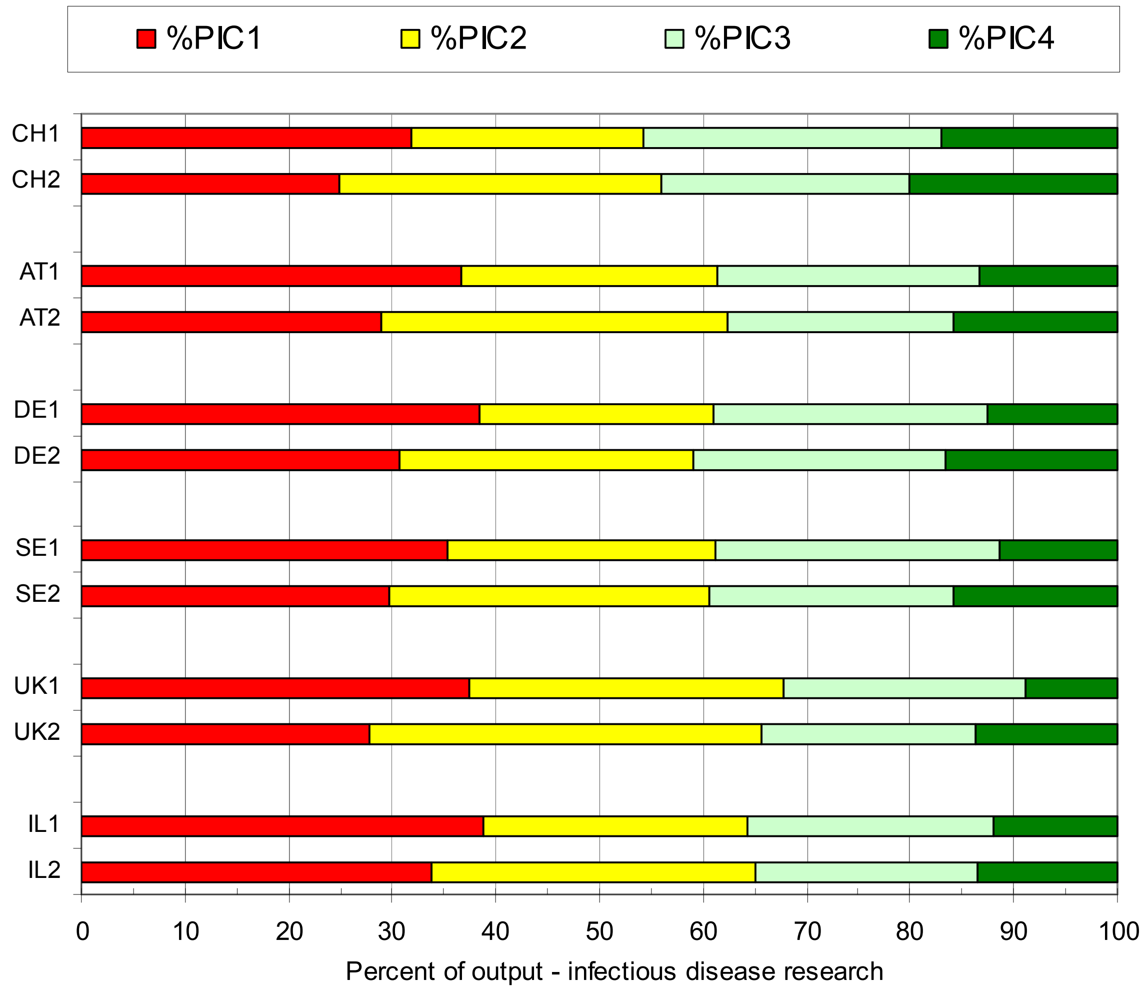


Table A4.19 Potential impact category distributions of papers in mental health research (MENTH)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	164	85	51	5	305	AT	221	203	61	31	516
Switzerland	CH	359	171	119	24	673	CH	480	273	130	61	944
Germany	DE	2186	697	319	70	3272	DE	2745	1270	554	217	4786
Israel	IL	411	209	101	32	753	IL	483	358	153	67	1061
Sweden	SE	463	384	197	47	1091	SE	719	574	288	80	1661
UK	UK	2244	1661	1336	145	5386	UK	3358	1783	1839	444	7424

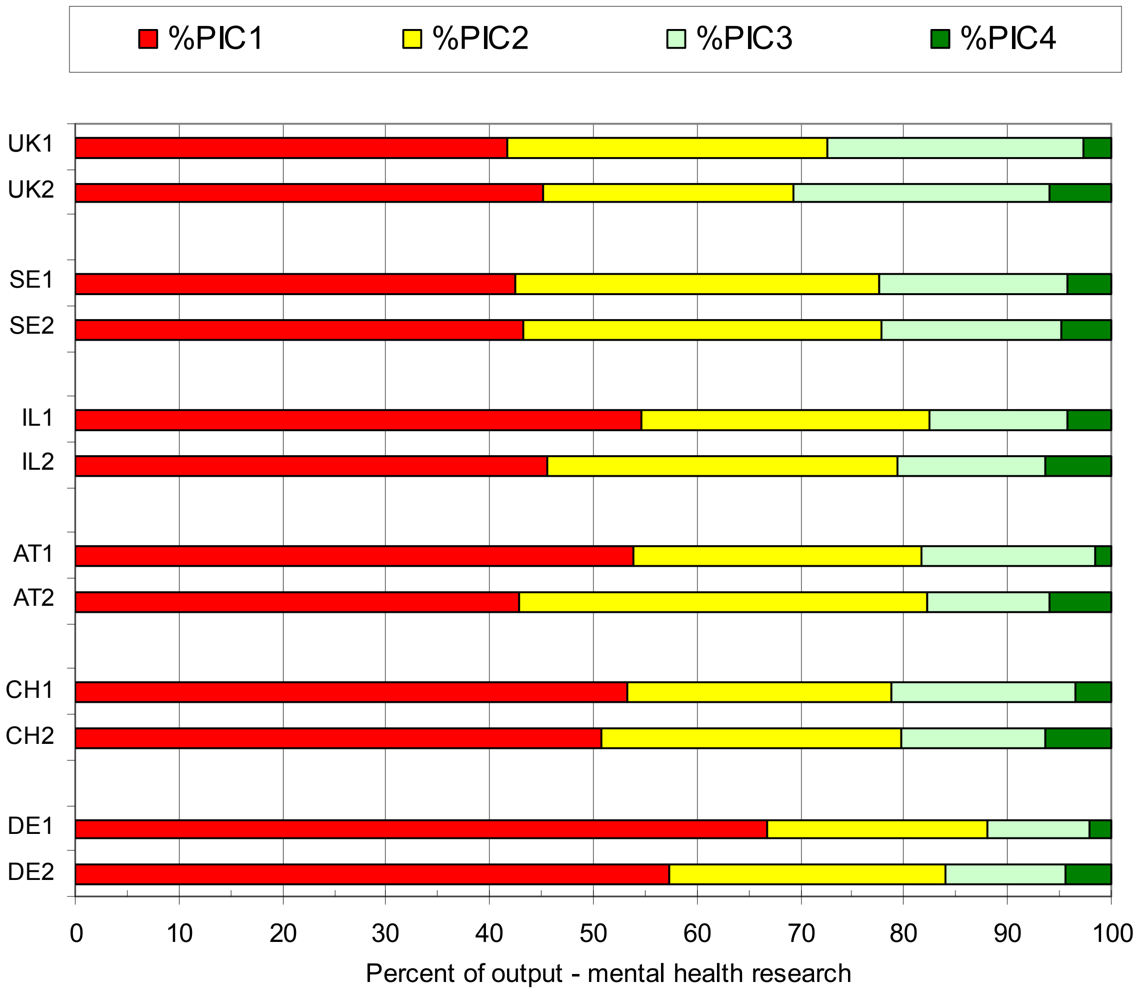


Table A4.20 Potential impact category distributions of papers in neuroscience (NEUSC)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	179	264	268	66	777	AT	249	426	285	159	1119
Switzerland	CH	412	617	934	402	2365	CH	445	809	1069	582	2905
Germany	DE	1898	2809	3070	1138	8915	DE	2075	4495	4072	2000	12642
Israel	IL	270	416	515	209	1410	IL	287	583	533	332	1735
Sweden	SE	835	1312	1510	417	4074	SE	668	1565	1470	437	4140
UK	UK	1783	3476	4240	1433	10932	UK	1714	3905	4698	2174	12491

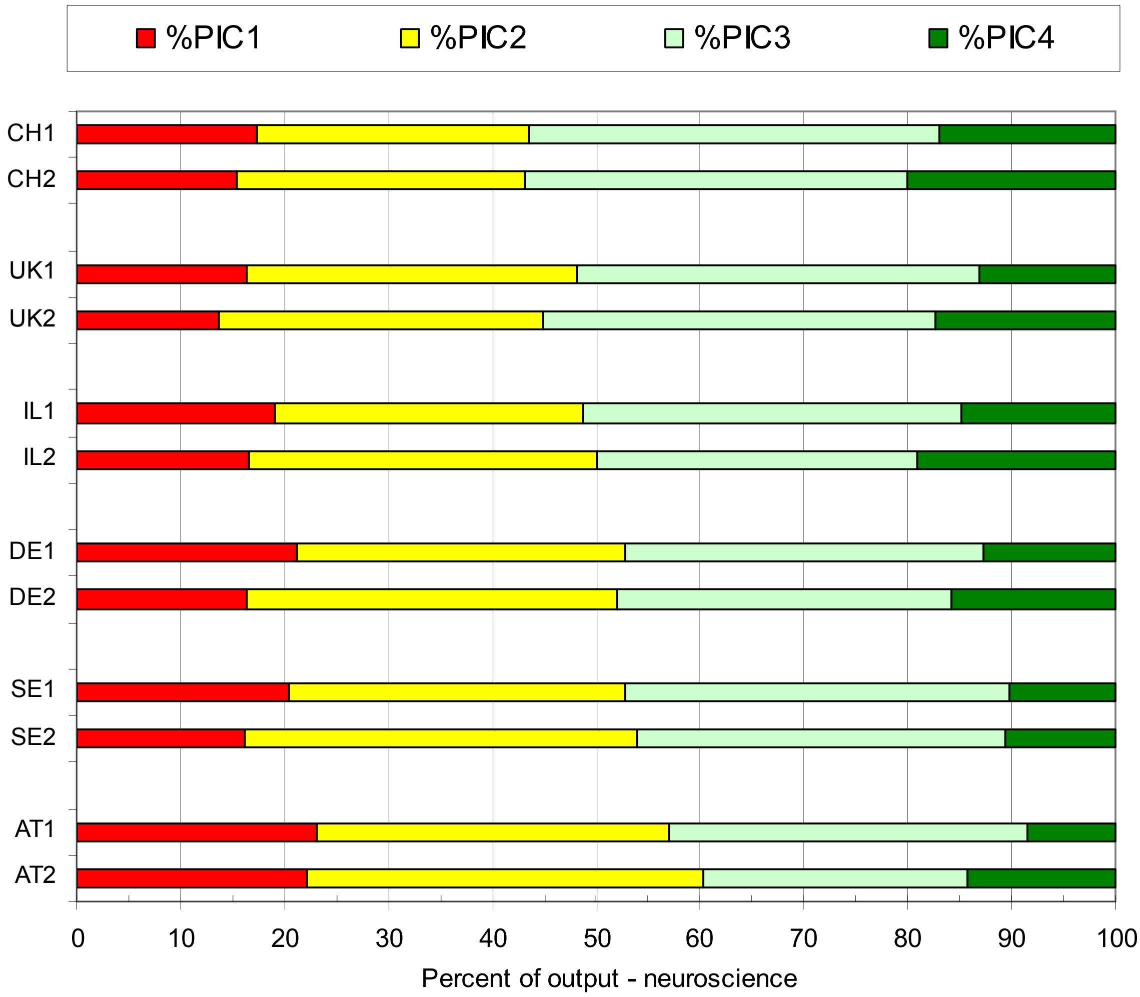


Table A4.21 Potential impact category distributions of papers in obstetrics & gynaecology research (OBSGY)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	523	167	97	26	813	AT	420	358	121	51	950
Switzerland	CH	508	264	171	71	1014	CH	354	297	126	76	853
Germany	DE	3611	911	552	158	5232	DE	2454	1464	608	373	4899
Israel	IL	750	650	242	36	1678	IL	661	689	258	77	1685
Sweden	SE	988	576	269	93	1926	SE	1009	817	398	196	2420
UK	UK	2488	3764	1397	411	8060	UK	2378	3971	1454	734	8537

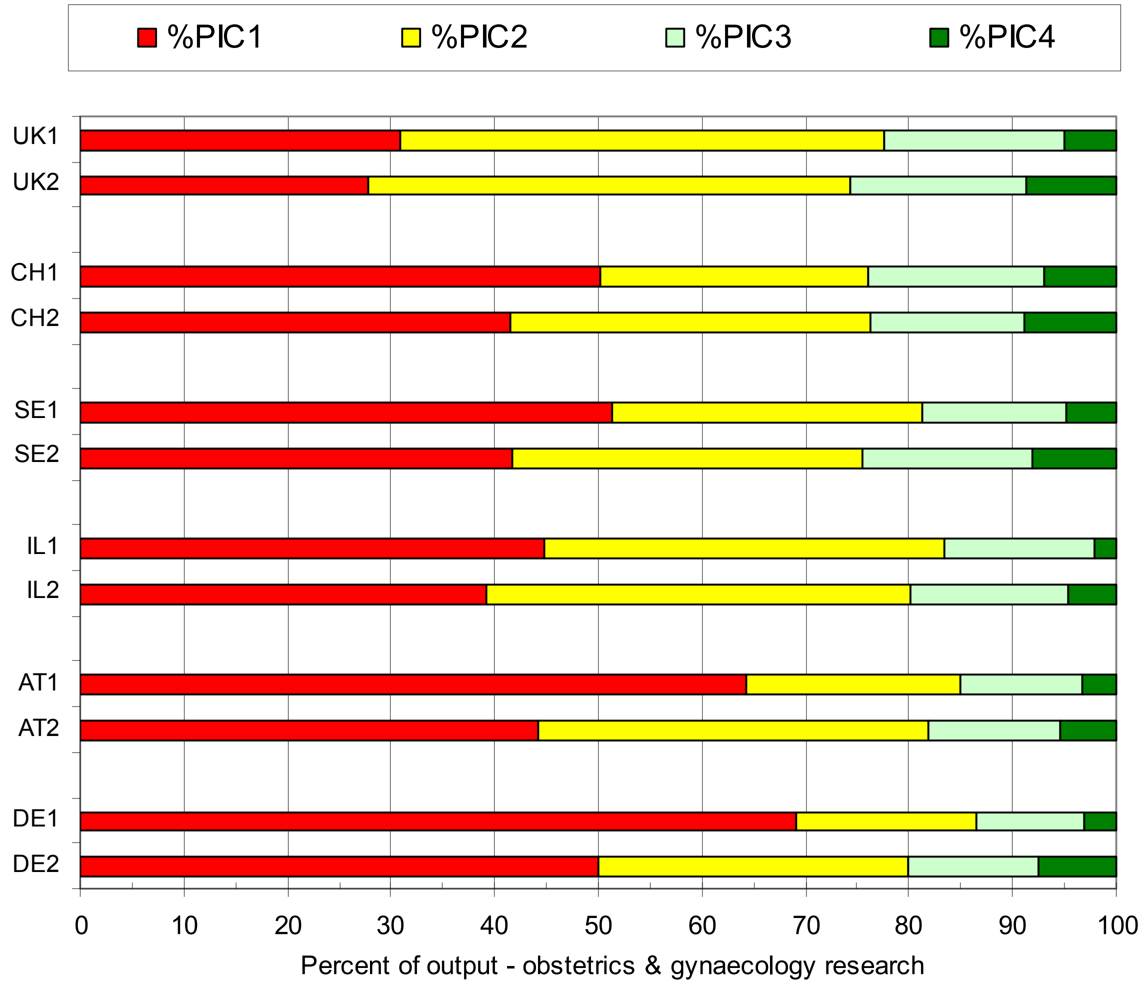


Table A4.22 Potential impact category distributions of papers in oncology research (ONCOL)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	711	339	297	199	1546	AT	866	660	450	304	2280
Switzerland	CH	885	630	588	445	2548	CH	903	831	733	693	3160
Germany	DE	5473	2143	1814	1427	10857	DE	6236	3597	2912	2275	15020
Israel	IL	745	447	330	298	1820	IL	777	535	406	379	2097
Sweden	SE	1361	925	824	522	3632	SE	1381	1169	1164	604	4318
UK	UK	4329	4078	3434	1772	13613	UK	4086	3884	3925	2431	14326

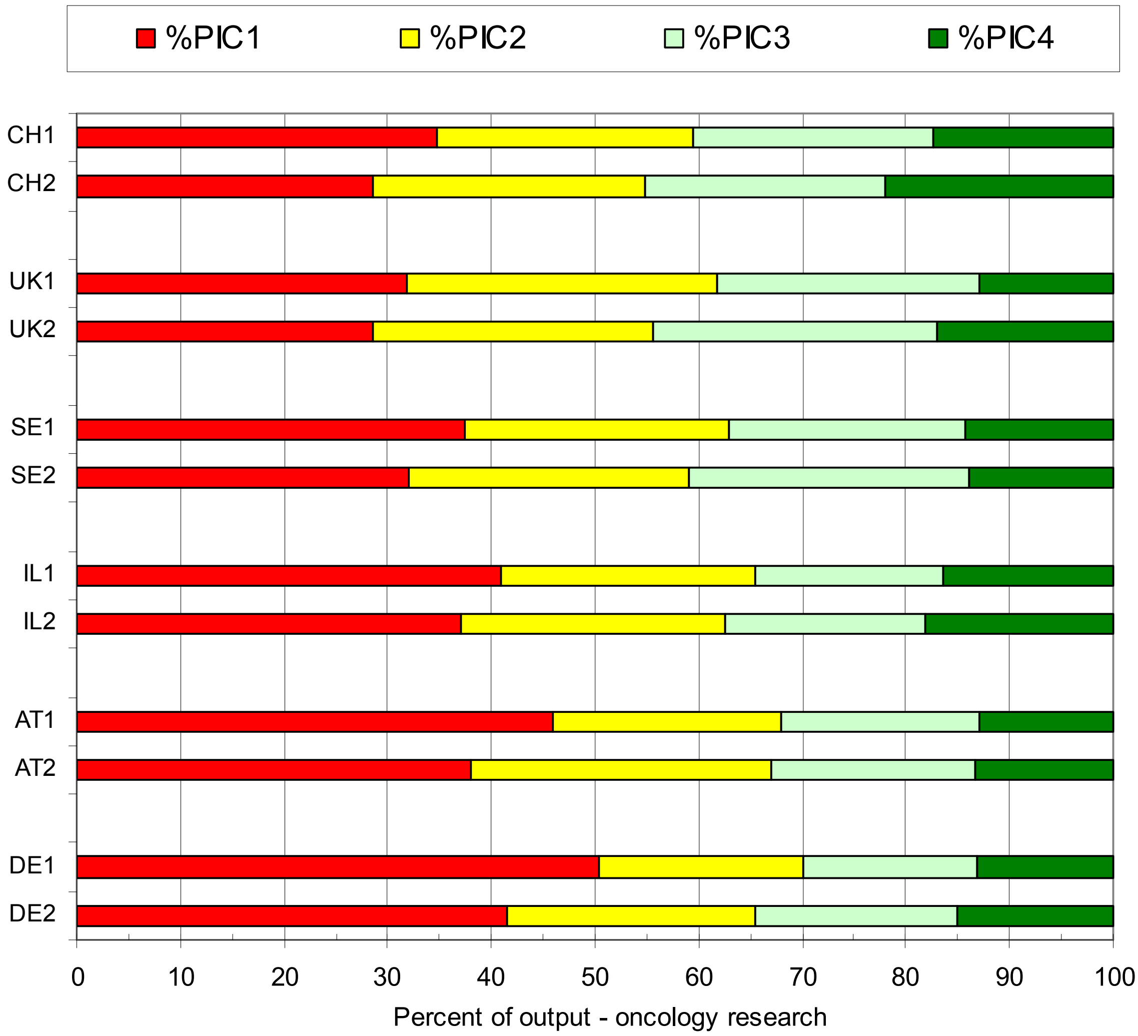


Table A4.23 Potential impact category distributions of papers in ophthalmology research (OPHTH)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	152	45	21	4	222	AT	143	98	48	14	303
Switzerland	CH	522	121	85	40	768	CH	501	182	137	63	883
Germany	DE	1427	703	440	250	2820	DE	2168	1058	726	332	4284
Israel	IL	226	139	69	44	478	IL	195	181	112	34	522
Sweden	SE	344	144	68	30	586	SE	396	183	92	31	702
UK	UK	1899	844	528	258	3529	UK	1306	1466	783	340	3895

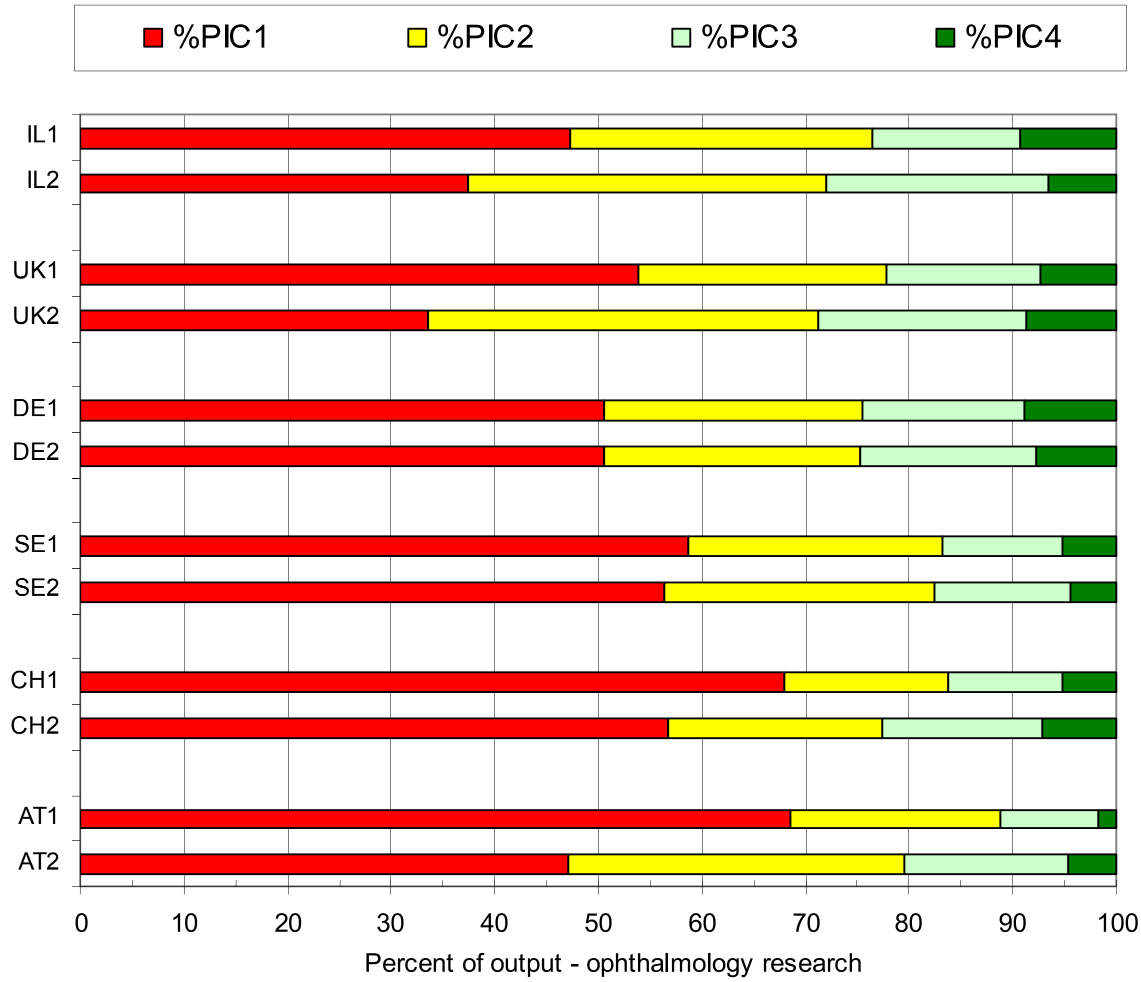


Table A4.24 Potential impact category distributions of papers in otorhinolaryngology research (OTORH)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	142	35	11	4	192	AT	262	98	27	3	390
Switzerland	CH	178	61	40	10	289	CH	295	93	71	30	489
Germany	DE	811	278	112	32	1233	DE	1200	540	241	129	2110
Israel	IL	298	71	24	7	400	IL	303	90	32	24	449
Sweden	SE	547	137	71	13	768	SE	557	176	89	26	848
UK	UK	2073	401	208	84	2766	UK	2286	469	259	171	3185

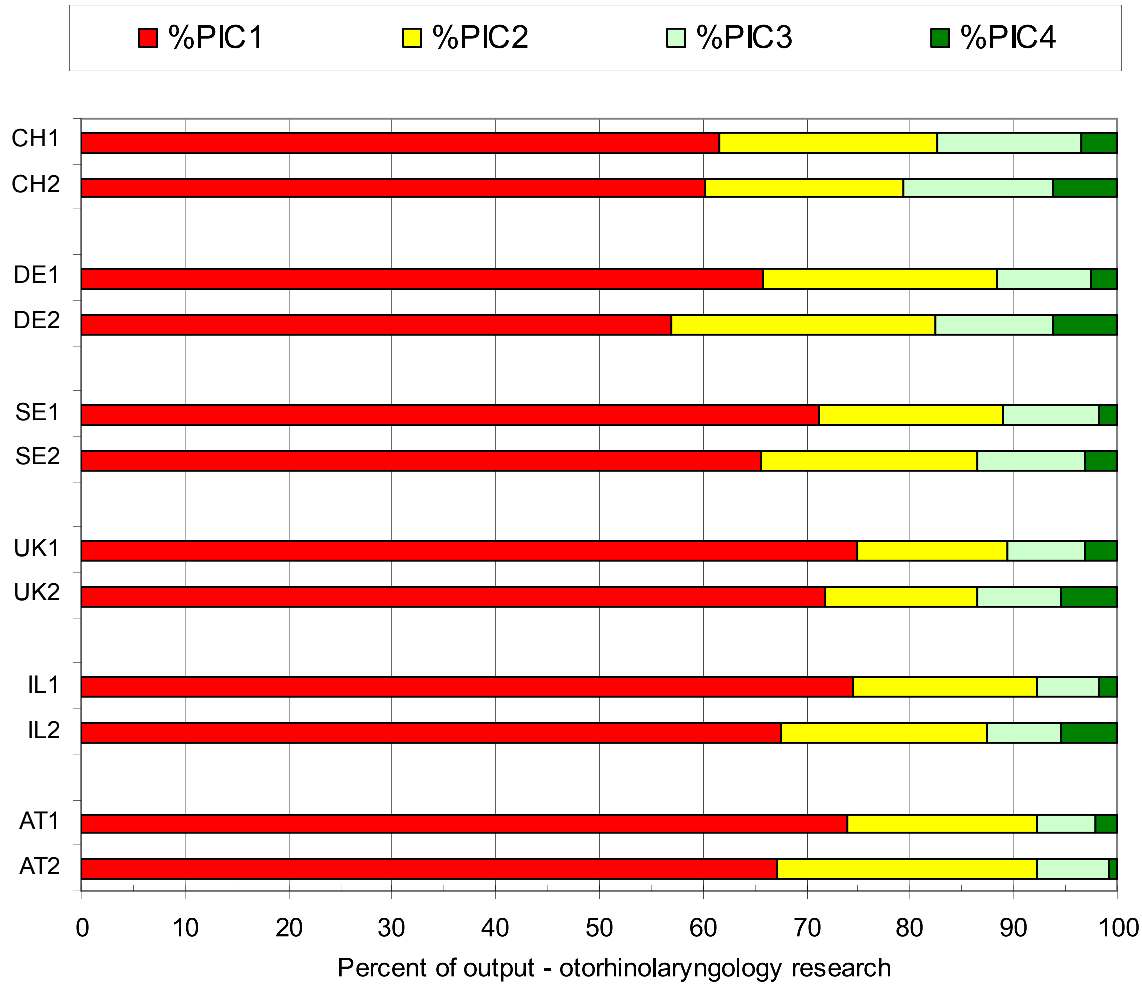


Table A4.25 Potential impact category distributions of papers in pathology research (PATHO)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	335	269	230	83	917	AT	448	404	245	150	1247
Switzerland	CH	469	377	513	130	1489	CH	527	446	367	243	1583
Germany	DE	2623	1294	1423	344	5684	DE	3077	2145	1347	835	7404
Israel	IL	363	219	240	53	875	IL	358	264	176	98	896
Sweden	SE	747	579	655	160	2141	SE	722	781	572	345	2420
UK	UK	2805	3168	2167	374	8514	UK	2813	2538	1884	983	8218

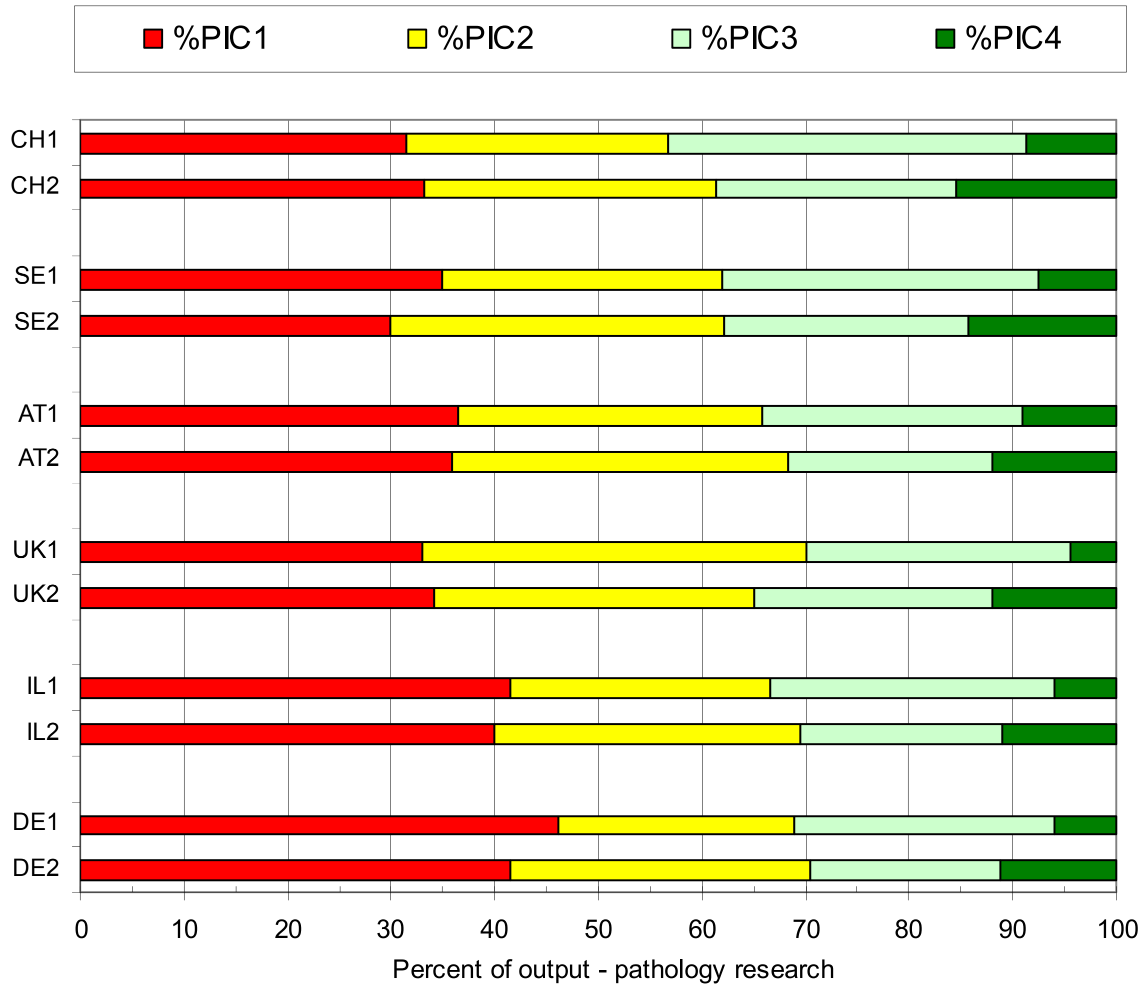


Table A4.26 Potential impact category distributions of papers in pharmacology & toxicology research (PHATO)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	194	165	168	20	547	AT	259	246	167	29	701
Switzerland	CH	602	494	401	54	1551	CH	446	623	463	96	1628
Germany	DE	3188	1435	1024	119	5766	DE	2318	2340	1239	220	6117
Israel	IL	278	183	170	23	654	IL	190	383	142	26	741
Sweden	SE	905	625	562	37	2129	SE	610	854	479	68	2011
UK	UK	2791	2698	3090	278	8857	UK	2048	3185	2858	418	8509

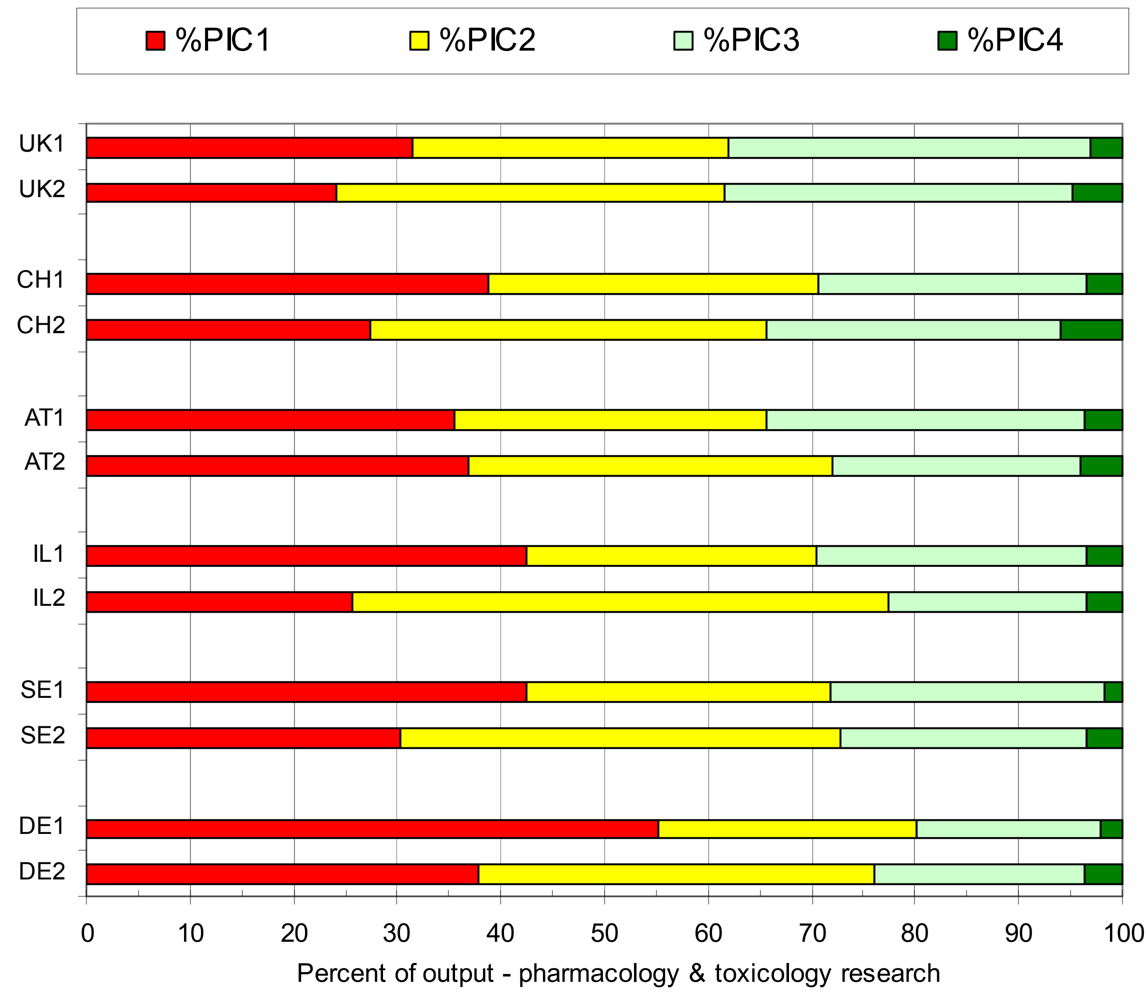


Table A4.27 Potential impact category distributions of papers in public health & epidemiology research (PUBEP)

	91-95	PIC1	PIC2	PIC3	PIC4	Total	96-00	PIC1	PIC2	PIC3	PIC4	Total
Austria	AT	192	85	56	20	353	AT	250	159	108	34	551
Switzerland	CH	329	265	149	53	796	CH	387	417	264	97	1165
Germany	DE	1279	542	259	100	2180	DE	1649	1009	647	260	3565
Israel	IL	372	230	101	35	738	IL	402	275	162	52	891
Sweden	SE	924	604	285	73	1886	SE	1004	1018	577	174	2773
UK	UK	2390	2012	1063	206	5671	UK	3250	3095	1846	551	8742

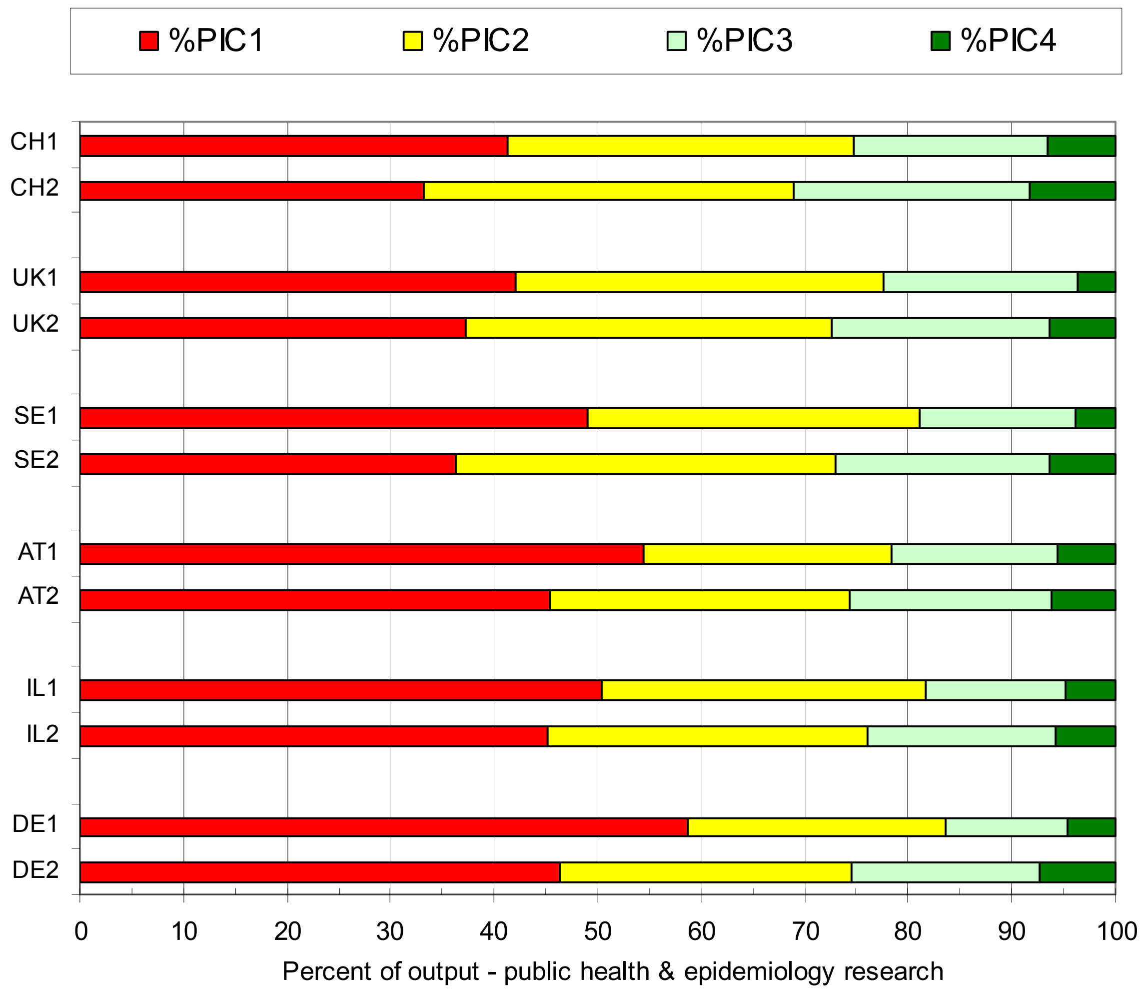


Table A4.28 Potential impact category distributions of papers in radiotherapy, radiology & nuclear medicine (RADIO)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	249	63	45	9	366	AT	366	206	62	9	643
Switzerland	CH	220	121	54	17	412	CH	306	243	71	24	644
Germany	DE	1829	417	297	47	2590	DE	2361	1041	226	124	3752
Israel	IL	182	62	45	11	300	IL	178	101	26	14	319
Sweden	SE	554	187	95	32	868	SE	507	327	87	29	950
UK	UK	1587	844	418	88	2937	UK	1412	1066	268	97	2843

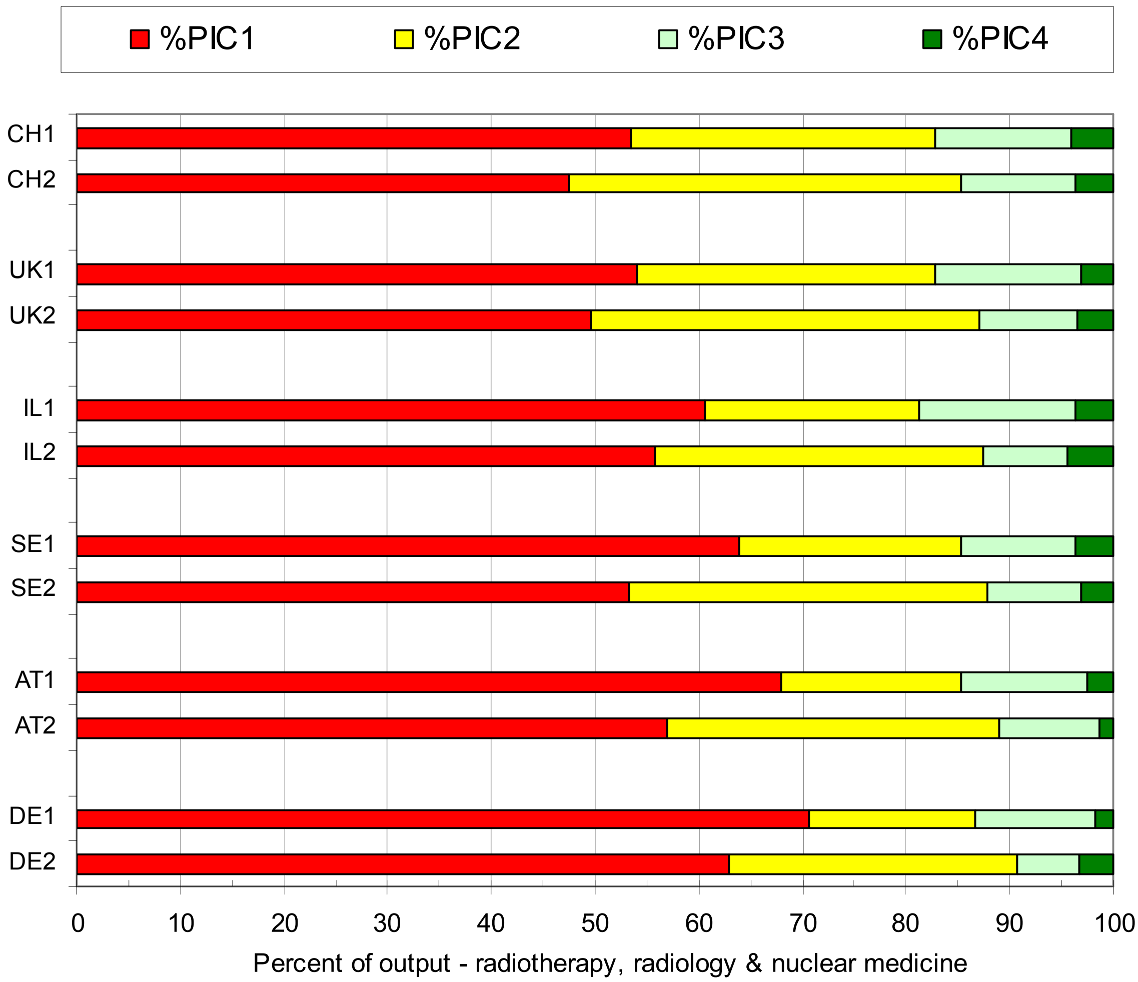


Table A4.29 Potential impact category distributions of papers in renal medicine (RENAL)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	197	98	84	21	400	AT	176	125	146	29	476
Switzerland	CH	230	182	221	56	689	CH	234	192	243	82	751
Germany	DE	1498	701	601	125	2925	DE	1518	1004	1080	206	3808
Israel	IL	210	123	75	12	420	IL	200	148	86	18	452
Sweden	SE	558	269	185	26	1038	SE	442	290	232	44	1008
UK	UK	1306	1033	656	142	3137	UK	945	1006	720	192	2863

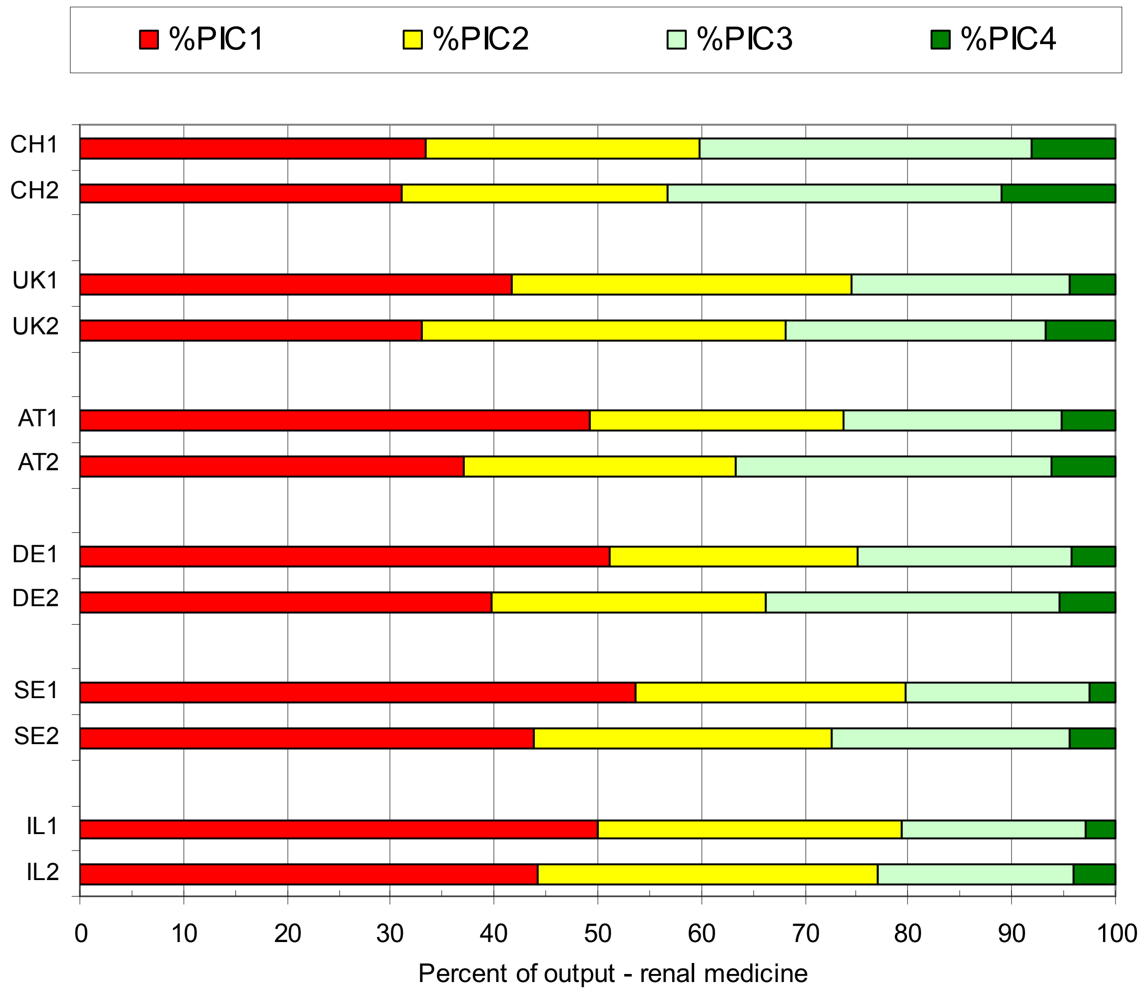


Table A4.30 Potential impact category distributions of papers in respiratory medicine (RESPI)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	221	127	101	12	461	AT	260	307	161	22	750
Switzerland	CH	426	267	259	82	1034	CH	453	488	337	128	1406
Germany	DE	1659	680	580	120	3039	DE	1746	1449	865	292	4352
Israel	IL	236	184	105	35	560	IL	224	261	83	42	610
Sweden	SE	646	509	329	37	1521	SE	603	829	356	93	1881
UK	UK	2324	2436	1631	333	6724	UK	2091	3148	1547	497	7283

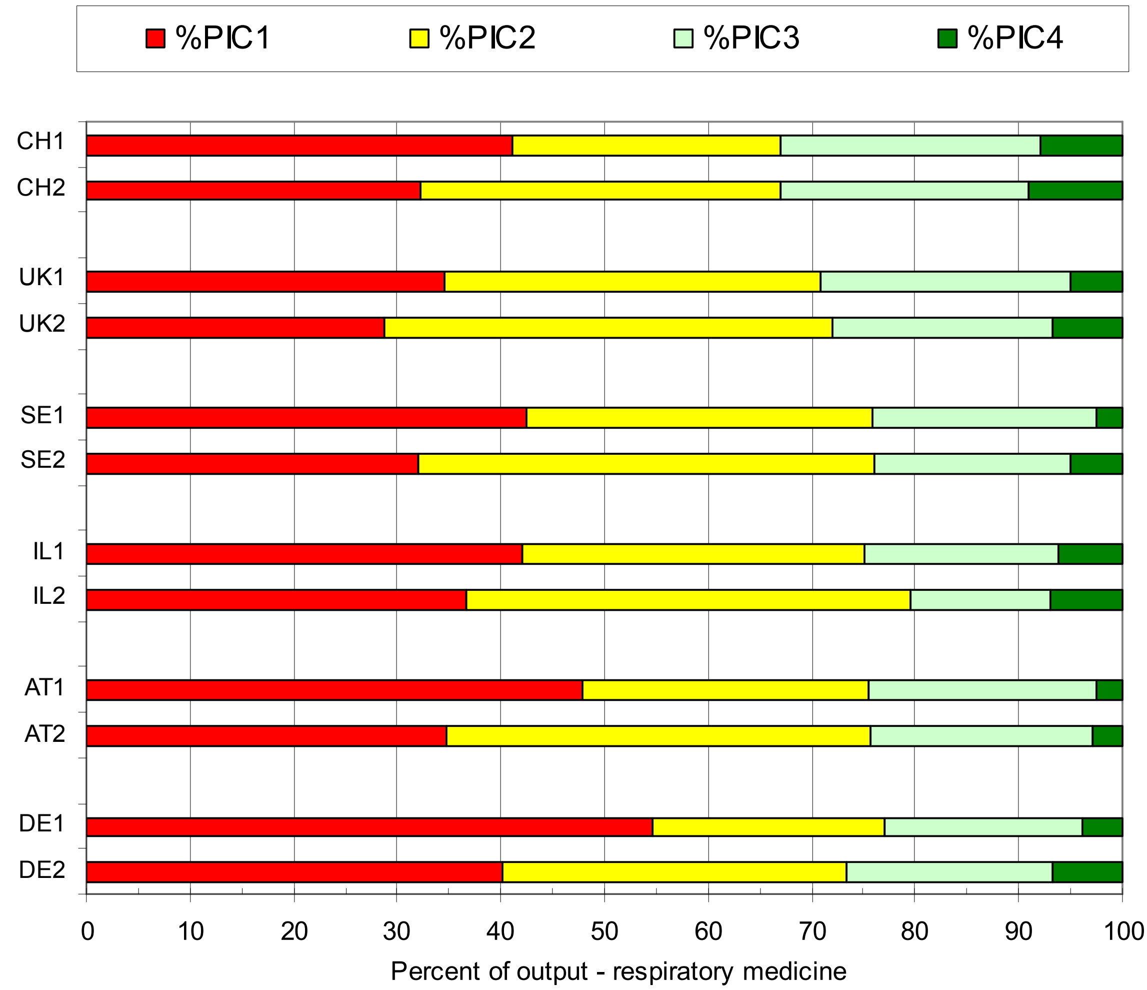


Table A4.31 Potential impact category distributions of papers in surgery research (SURGE)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	548	175	55	10	788	AT	640	365	108	19	1132
Switzerland	CH	651	242	66	13	972	CH	816	457	173	44	1490
Germany	DE	2946	789	218	48	4001	DE	3706	1542	530	138	5916
Israel	IL	582	228	44	6	860	IL	679	319	59	8	1065
Sweden	SE	1629	517	120	14	2280	SE	1523	623	165	45	2356
UK	UK	3368	2324	348	75	6115	UK	3503	1803	529	111	5946

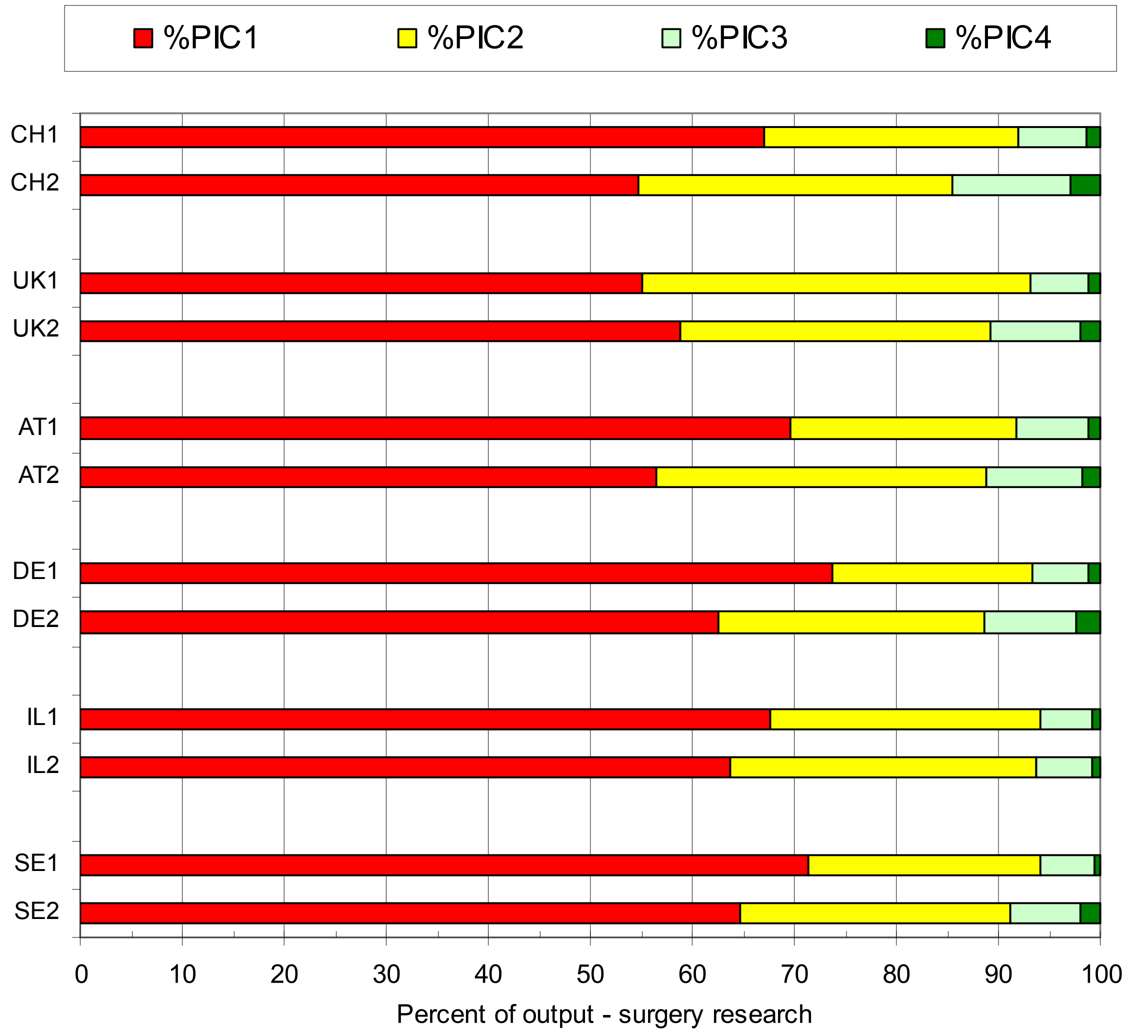
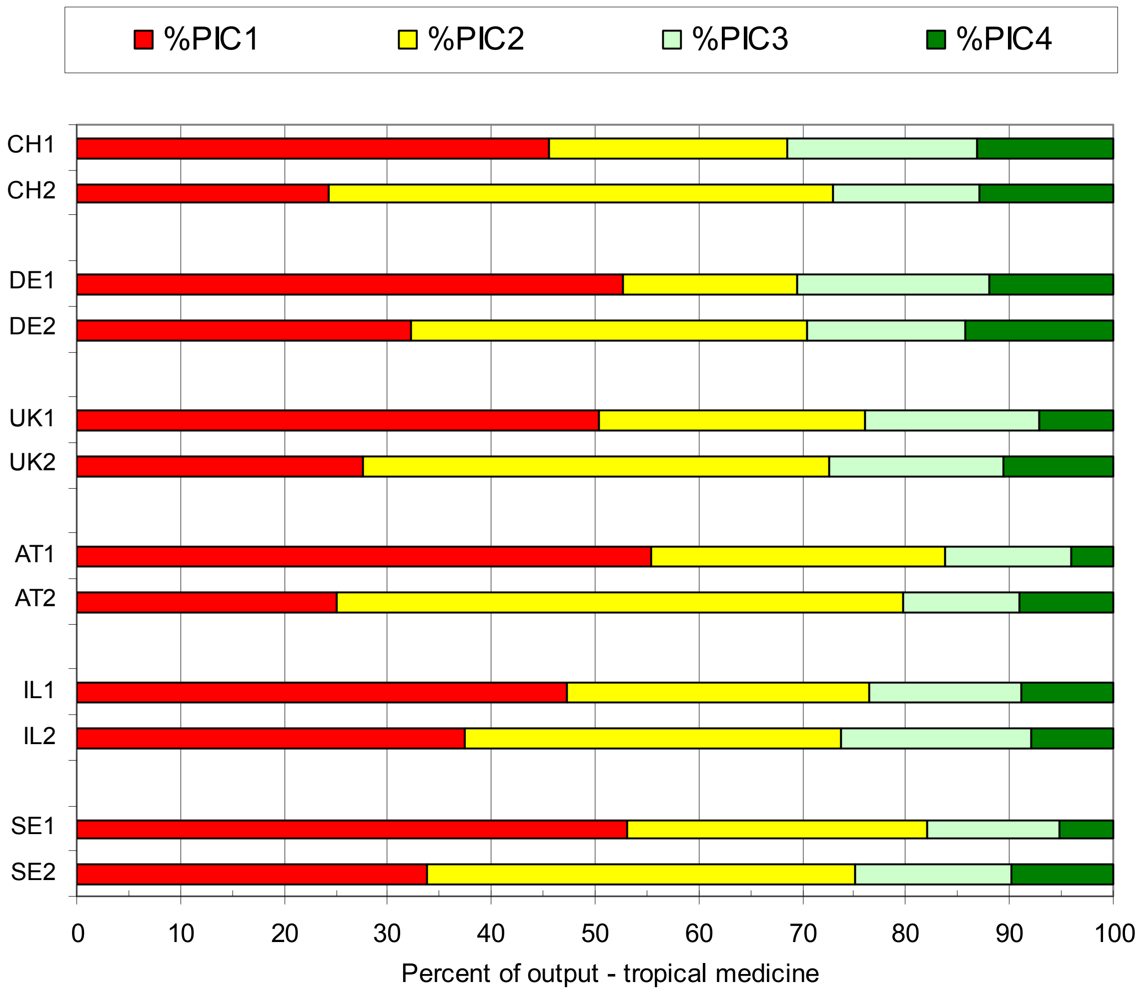


Table A4.32 Potential impact category distributions of papers in tropical medicine (TROPM)

	91-95	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*	*96-00*	*PIC1*	*PIC2*	*PIC3*	*PIC4*	*Total*
Austria	AT	41	21	9	3	74	AT	36	78	16	13	143
Switzerland	CH	308	154	125	88	675	CH	193	386	111	103	793
Germany	DE	492	155	174	111	932	DE	391	464	184	173	1212
Israel	IL	138	85	43	26	292	IL	71	69	35	15	190
Sweden	SE	234	127	56	23	440	SE	161	197	72	47	477
UK	UK	1600	815	530	229	3174	UK	1019	1667	620	393	3699



ANNEX 5 CATEGORIZATION OF PAPERS BY CITATION SCORES

A5.1 Outputs of six countries in 32 sub-fields

Table A5.1 Citations in five years to 1991-97 papers in anatomy, morphology and physiology (ANAPH)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	56	125	51	44	15	7	0	298
Switzerland	CH	24	71	36	34	25	7	3	200
Germany	DE	28	65	34	37	25	7	4	200
Israel	IL	49	80	29	23	8	7	4	200
Sweden	SE	26	81	38	35	17	2	1	200
UK	UK	32	71	41	34	9	10	3	200

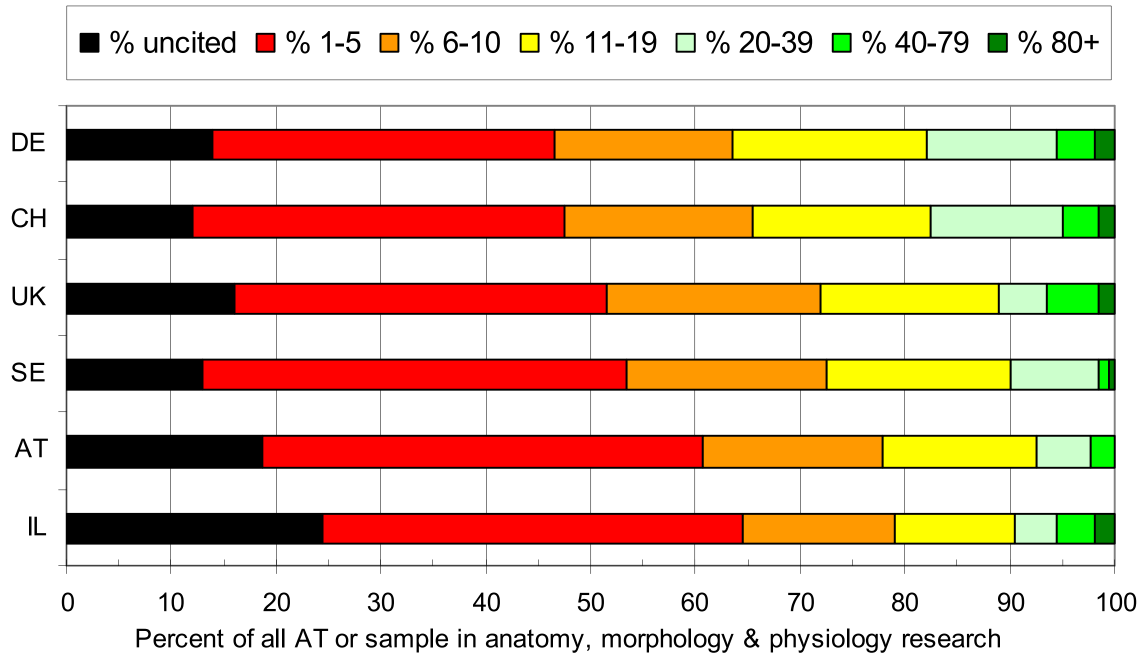


Table A5.2 Citations in five years to 1991-97 papers in anaesthesia research (ANEST)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	128	220	89	56	38	8	2	541
Switzerland	CH	31	87	33	30	13	5		199
Germany	DE	40	79	40	20	17	2	2	200
Israel	IL	33	93	39	20	9	6		200
Sweden	SE	22	83	41	34	15	2	3	200
UK	UK	20	93	38	25	17	5	2	200

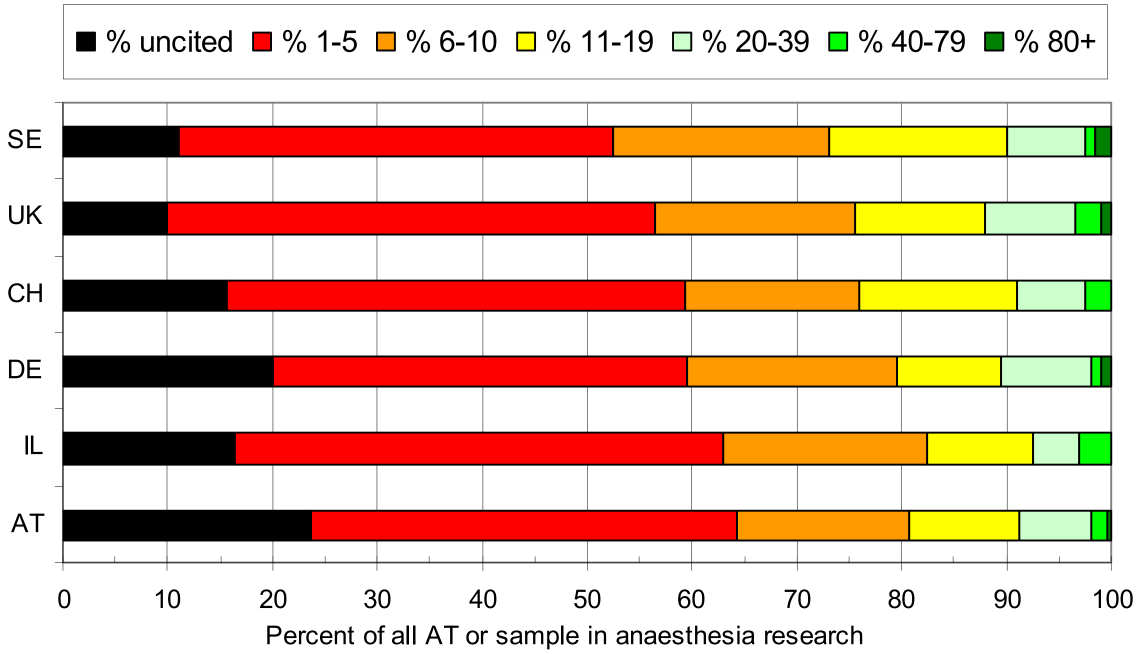


Table A5.3 Citations in five years to 1991-97 papers in arthritis research (ARTHR)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	58	149	77	61	44	13	7	409
Switzerland	CH	28	64	31	36	29	8	4	200
Germany	DE	37	82	30	26	18	6	1	200
Israel	IL	22	74	47	29	19	6	3	200
Sweden	SE	24	63	42	41	20	7	3	200
UK	UK	25	64	44	38	18	10	1	200

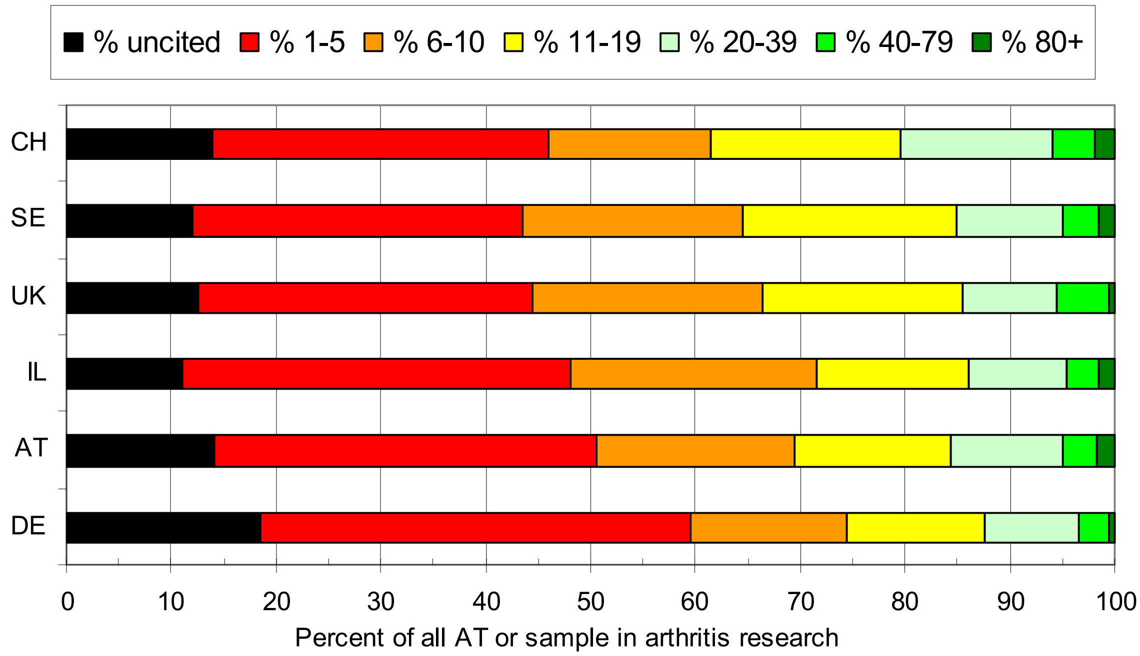


Table A5.4 Citations in five years to 1991-97 papers in biochemistry & molecular biology research (BCMBI)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	63	377	289	348	264	111	61	1513
Switzerland	CH	7	48	34	38	35	23	15	200
Germany	DE	10	49	35	47	39	14	6	200
Israel	IL	15	60	48	33	23	11	10	200
Sweden	SE	13	71	40	41	23	8	4	200
UK	UK	12	60	39	42	25	17	5	200

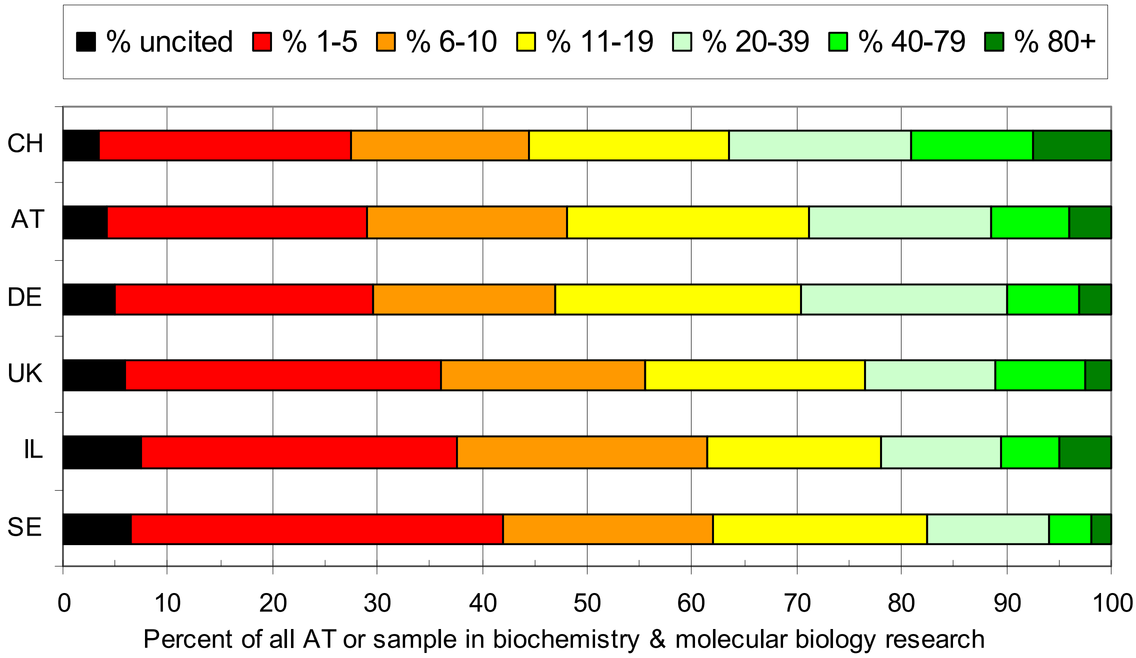


Table A5.5 Citations in five years to 1991-97 papers in bioengineering (BIENG)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	37	91	53	36	10	1	0	228
Switzerland	CH	20	63	48	38	23	7	1	200
Germany	DE	23	94	34	25	16	4	4	200
Israel	IL	36	95	36	20	8	5	0	200
Sweden	SE	20	73	49	33	20	4	1	200
UK	UK	40	80	31	32	12	4	1	200

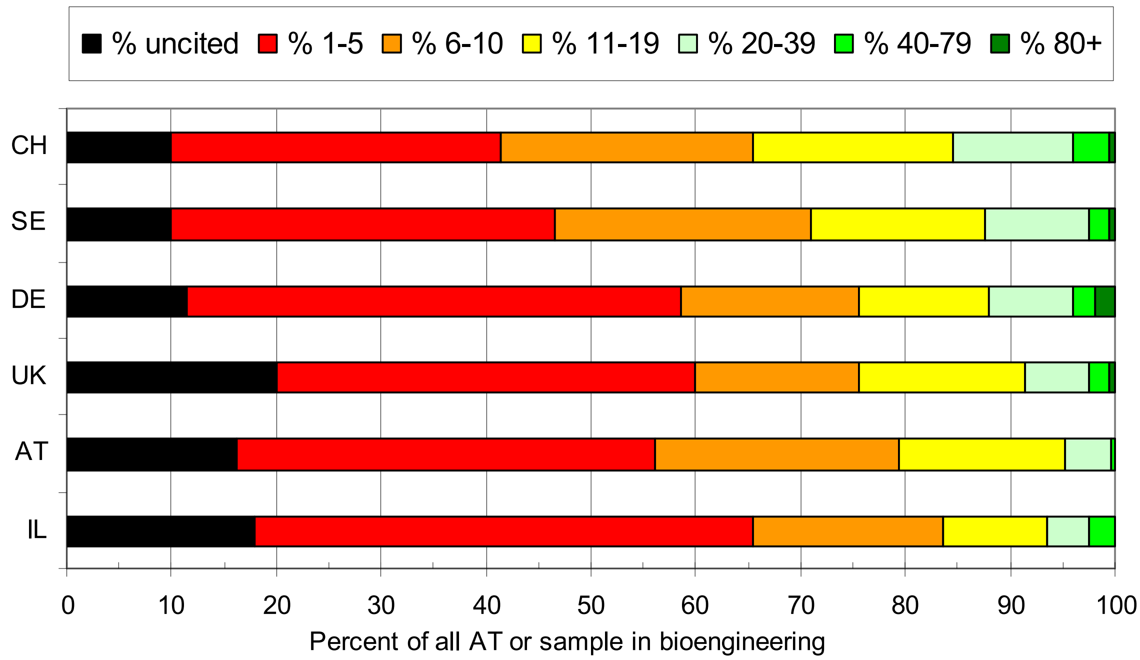


Table A5.6 Citations in five years to 1991-97 papers in cardiology research (CARDI)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	439	883	376	285	194	63	28	2268
Switzerland	CH	32	75	33	25	22	10	3	200
Germany	DE	31	87	33	26	15	6	2	200
Israel	IL	23	99	32	22	16	6	2	200
Sweden	SE	20	94	31	25	19	7	4	200
UK	UK	20	85	26	37	20	9	3	200

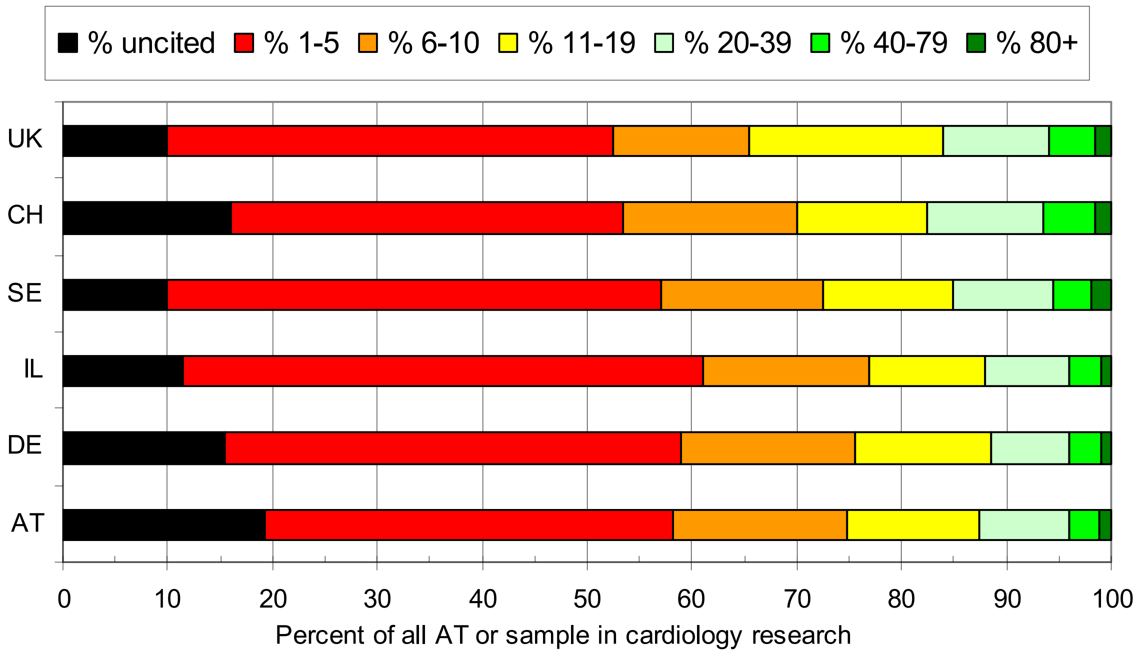


Table A5.7 Citations in five years to 1991-97 papers in paediatrics & neonatology research (CHILD)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	213	438	161	103	56	20	3	994
Switzerland	CH	40	87	35	19	11	5	3	200
Germany	DE	45	87	34	13	15	5	1	200
Israel	IL	43	116	14	14	9	3	1	200
Sweden	SE	28	88	38	27	16	1	2	200
UK	UK	19	97	32	27	16	4	6	201

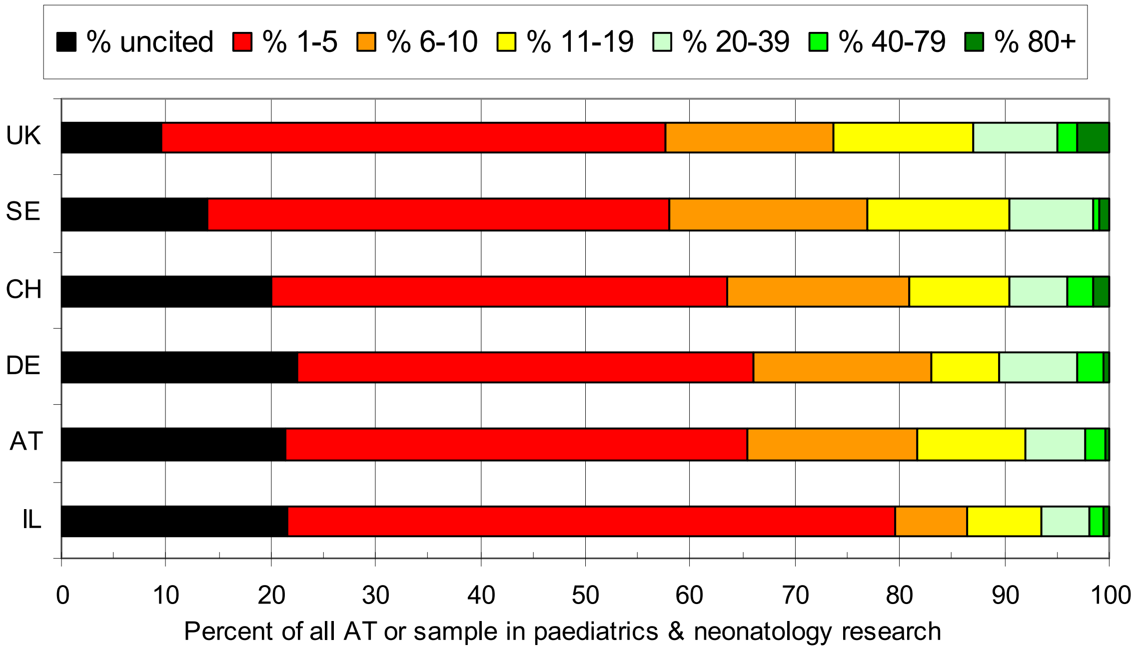


Table A5.8 Citations in five years to 1991-97 papers in cell biology (CYTHI)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	29	135	108	110	103	55	41	581
Switzerland	CH	10	31	35	44	33	33	15	201
Germany	DE	24	41	43	42	29	13	9	201
Israel	IL	15	56	27	41	30	17	14	200
Sweden	SE	10	55	42	33	34	20	6	200
UK	UK	9	52	29	39	40	20	10	199

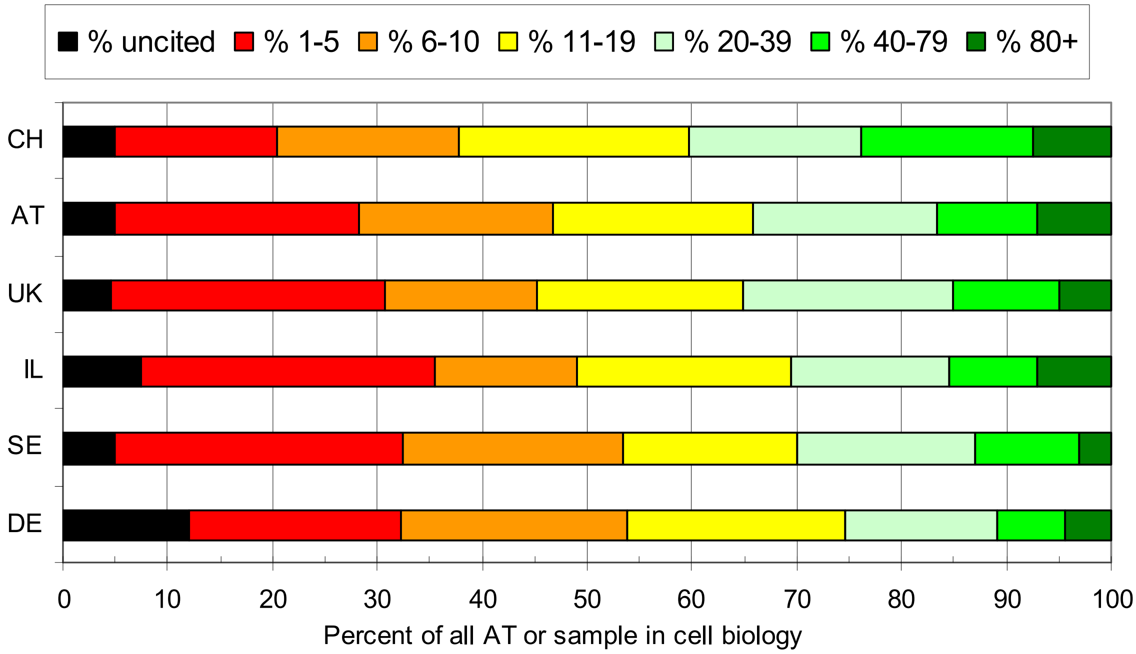


Table A5.9 Citations in five years to 1991-97 papers in dentistry research (DENTA)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	33	72	27	7	0	0	1	140
Switzerland	CH	27	82	42	31	11	6	2	201
Germany	DE	32	103	35	19	9	2	0	200
Israel	IL	44	111	30	13	1	1	0	200
Sweden	SE	17	112	44	20	5	2	0	200
UK	UK	41	112	28	15	3	1	0	200

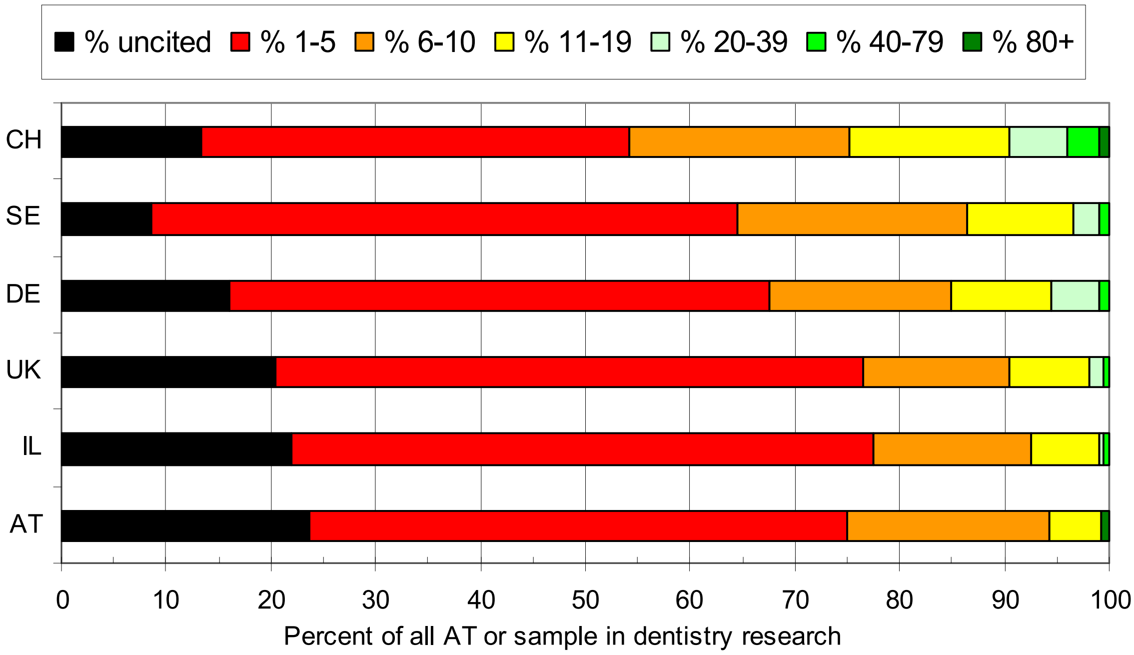


Table A5.10 Citations in five years to 1991-97 papers in dermatology & venereology research (DERMA)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	115	287	150	113	91	36	9	801
Switzerland	CH	35	85	29	19	22	7	2	199
Germany	DE	33	92	35	16	19	3	2	200
Israel	IL	41	96	26	25	9	2	1	200
Sweden	SE	23	83	40	31	18	5	0	200
UK	UK	34	79	33	34	15	4	3	202

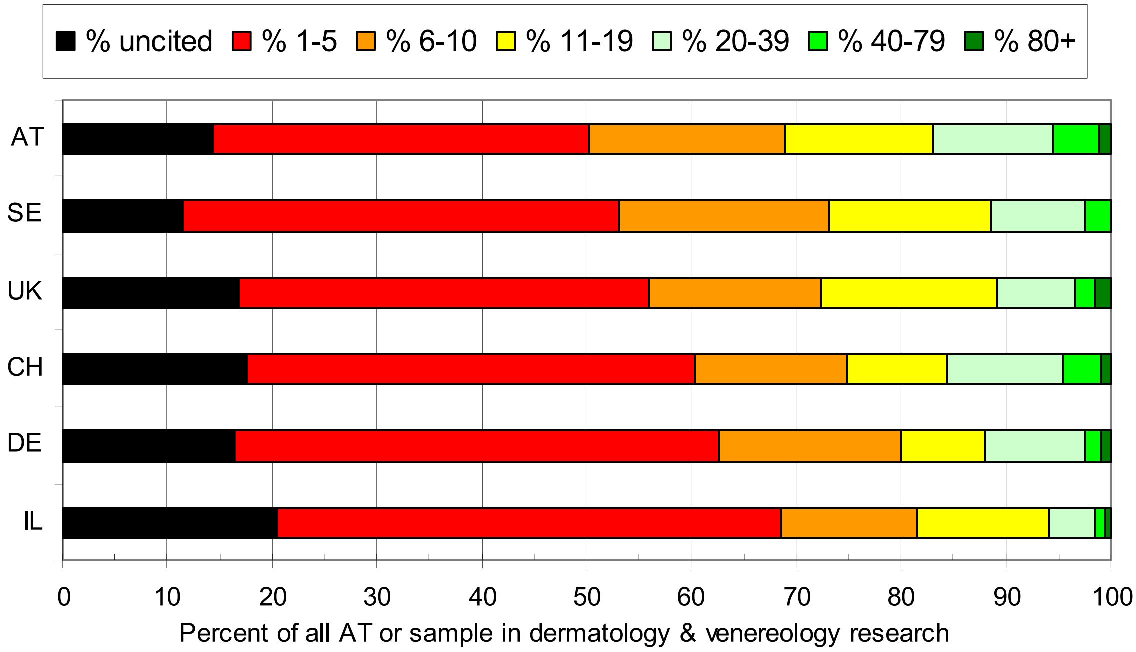


Table A5.11 Citations in five years to 1991-97 papers in endocrinology research (ENDOC)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	281	761	362	341	188	79	24	2036
Switzerland	CH	22	69	35	37	23	13	2	201
Germany	DE	24	88	43	27	11	7	0	200
Israel	IL	15	98	40	28	14	4	2	201
Sweden	SE	19	61	53	37	21	9	0	200
UK	UK	28	64	40	34	25	6	2	199

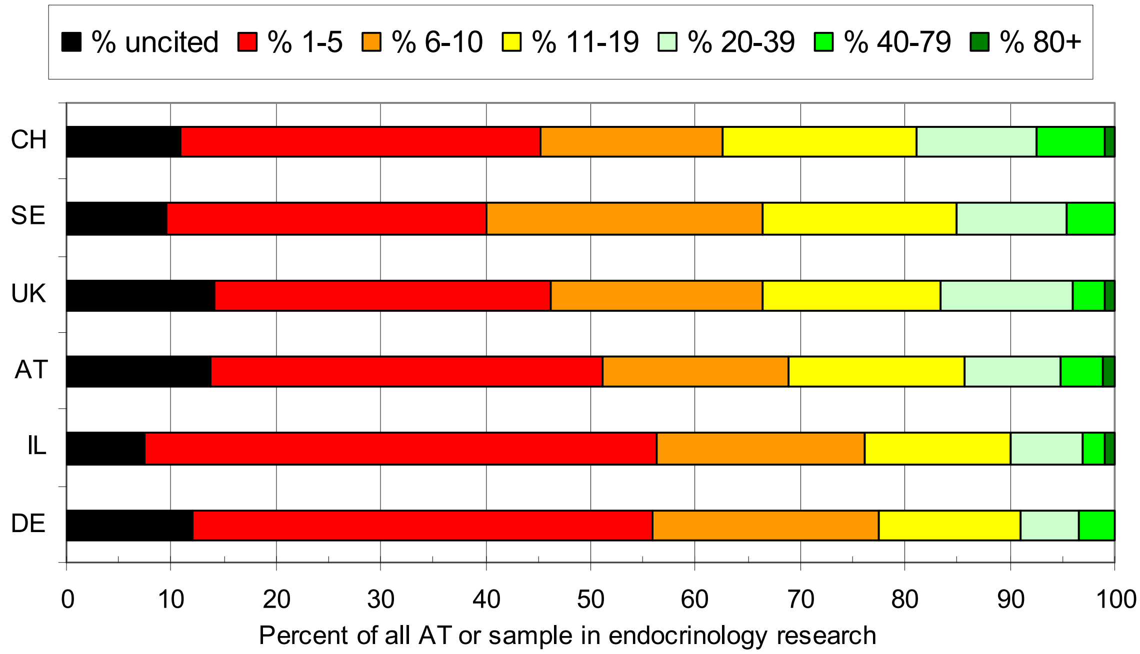


Table A5.12 Citations in five years to 1991-97 papers in gastroenterology research (GASTR)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	201	461	208	178	94	38	13	1193
Switzerland	CH	27	75	30	26	25	10	7	200
Germany	DE	42	79	33	25	14	6	1	200
Israel	IL	45	100	30	14	7	4	0	200
Sweden	SE	15	77	43	34	24	3	4	200
UK	UK	22	70	43	33	21	6	5	200

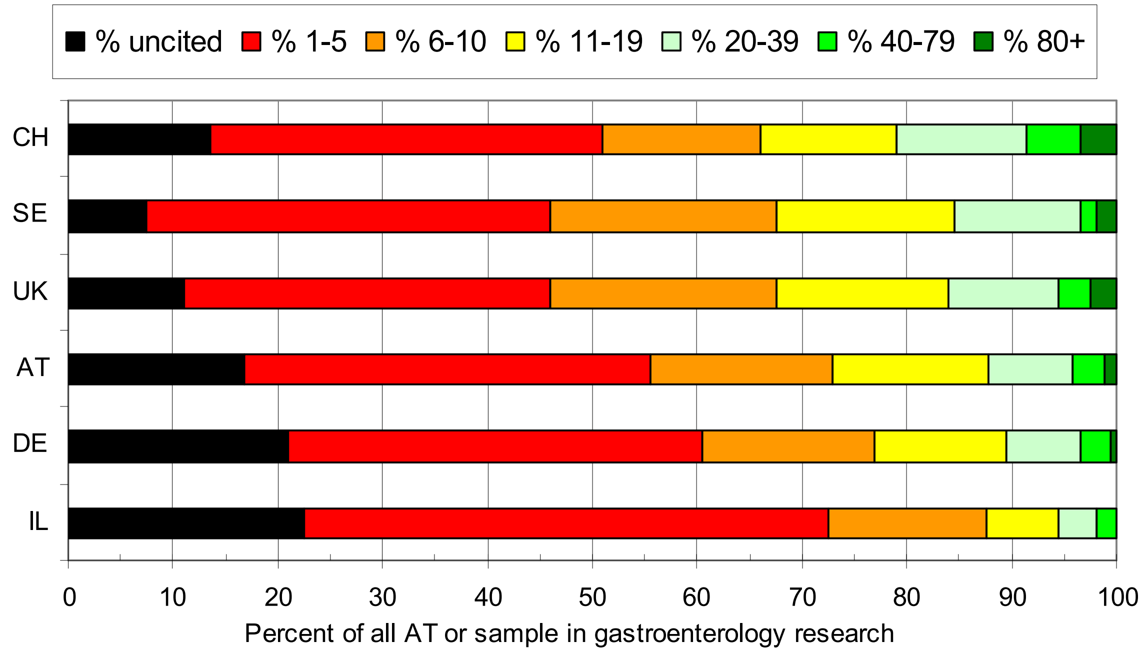


Table A5.13 Citations in five years to 1991-97 papers in genetics (GENET)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	90	341	302	288	228	127	56	1432
Switzerland	CH	8	49	31	44	34	25	9	200
Germany	DE	13	62	36	47	28	7	7	200
Israel	IL	18	65	30	34	32	15	6	200
Sweden	SE	10	51	35	37	46	16	5	200
UK	UK	8	52	37	48	34	15	5	199

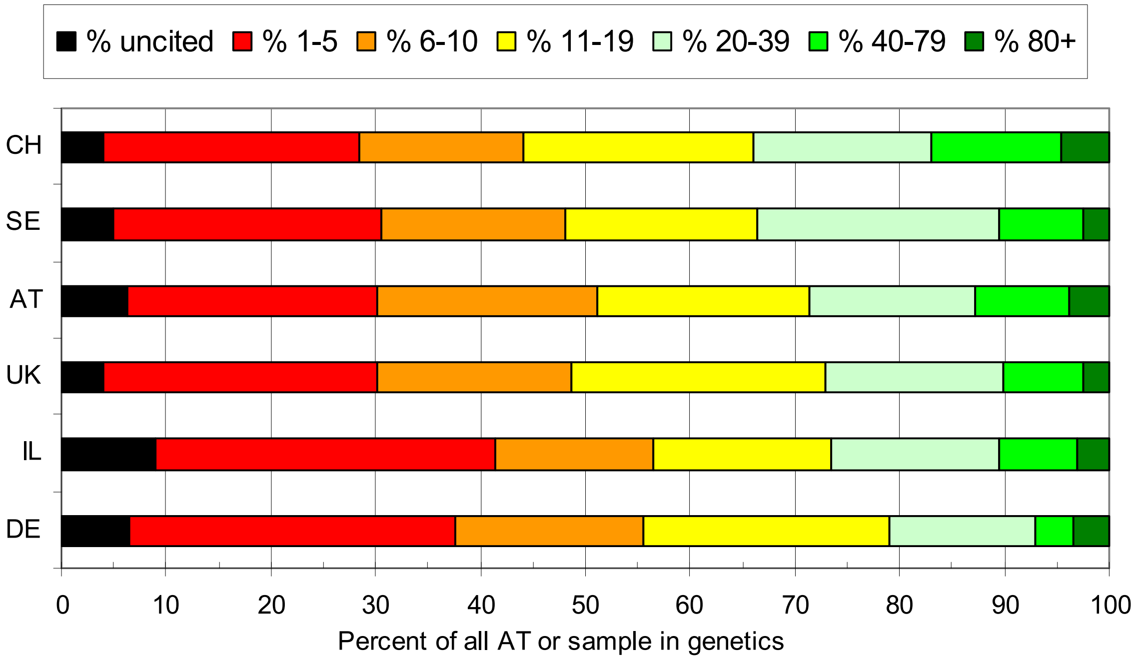


Table A5.14 Citations in five years to 1991-97 papers in gerontology research (GERON)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	84	173	86	86	55	12	7	503
Switzerland	CH	24	75	32	28	29	12	1	201
Germany	DE	28	79	33	31	21	8	0	200
Israel	IL	27	93	27	28	17	4	4	200
Sweden	SE	21	69	38	30	25	13	4	200
UK	UK	12	85	38	34	21	6	4	200

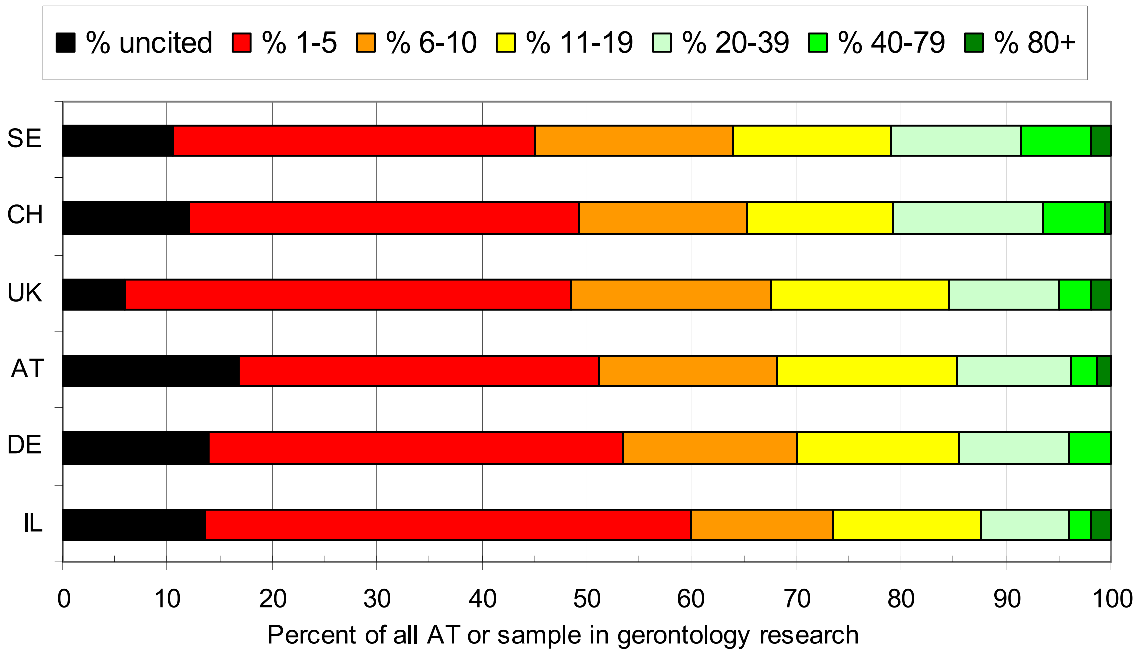


Table A5.15 Citations in five years to 1991-97 papers in haematology research (HAEMA)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	196	536	290	272	206	80	33	1613
Switzerland	CH	19	53	41	40	25	16	6	200
Germany	DE	20	90	39	27	13	6	5	200
Israel	IL	28	96	35	18	13	7	3	200
Sweden	SE	7	72	48	27	22	17	7	200
UK	UK	15	73	32	34	33	11	2	200

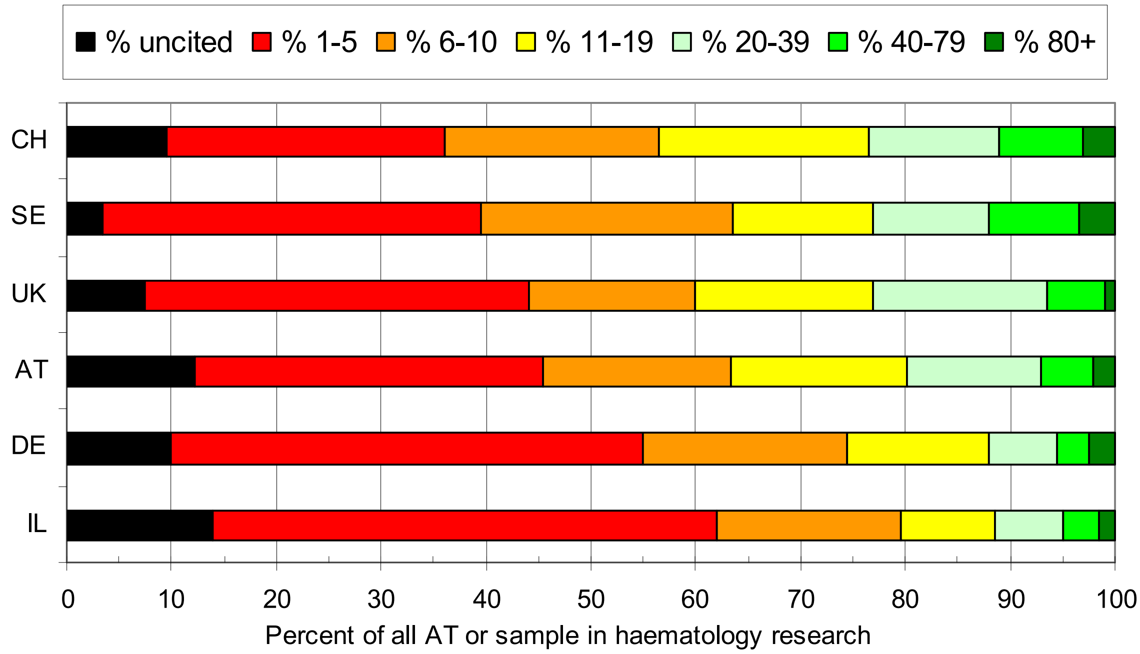


Table A5.16 Citations in five years to 1991-97 papers in human genetics (HUGEN)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	5	10	14	15	16	7	1	68
Switzerland	CH	8	27	26	24	22	13	9	129
Germany	DE	14	64	33	43	28	11	7	200
Israel	IL	6	20	10	9	12	6	1	64
Sweden	SE	7	57	50	46	27	7	6	200
UK	UK	9	47	38	38	38	21	9	200

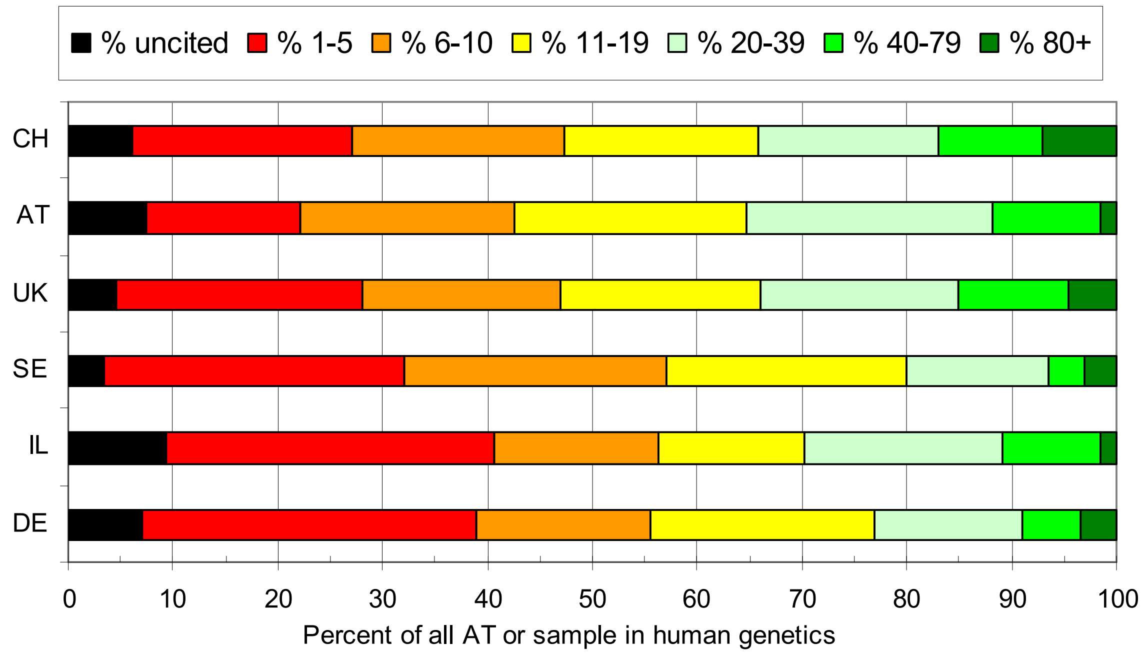


Table A5.17 Citations in five years to 1991-97 papers in immunology & allergology research (IMMAL)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	165	586	372	365	279	132	50	1949
Switzerland	CH	9	43	38	41	30	29	11	201
Germany	DE	19	66	33	36	27	11	6	198
Israel	IL	14	86	38	34	15	7	6	200
Sweden	SE	15	72	40	40	23	7	3	200
UK	UK	13	54	52	42	20	11	8	200

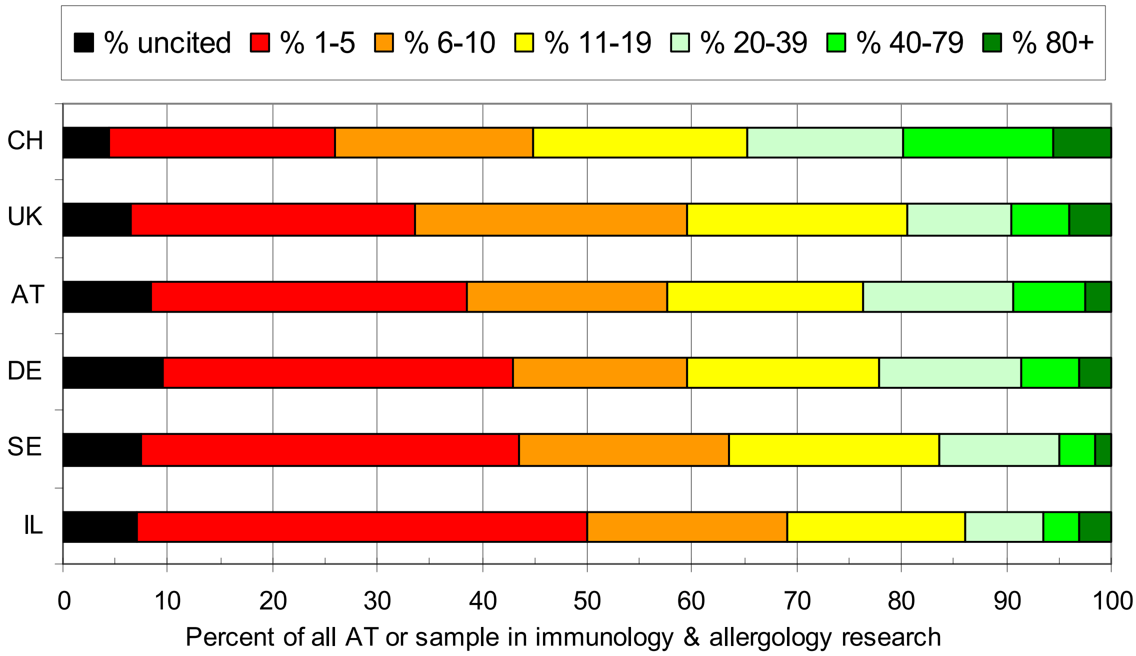


Table A5.18 Citations in five years to 1991-97 papers in infectious disease research (INFEC)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	184	573	335	303	213	69	21	1698
Switzerland	CH	14	79	40	28	23	11	5	200
Germany	DE	18	78	36	35	20	12	1	200
Israel	IL	38	79	29	31	16	4	2	199
Sweden	SE	12	67	42	34	30	12	3	200
UK	UK	20	79	31	37	21	9	3	200

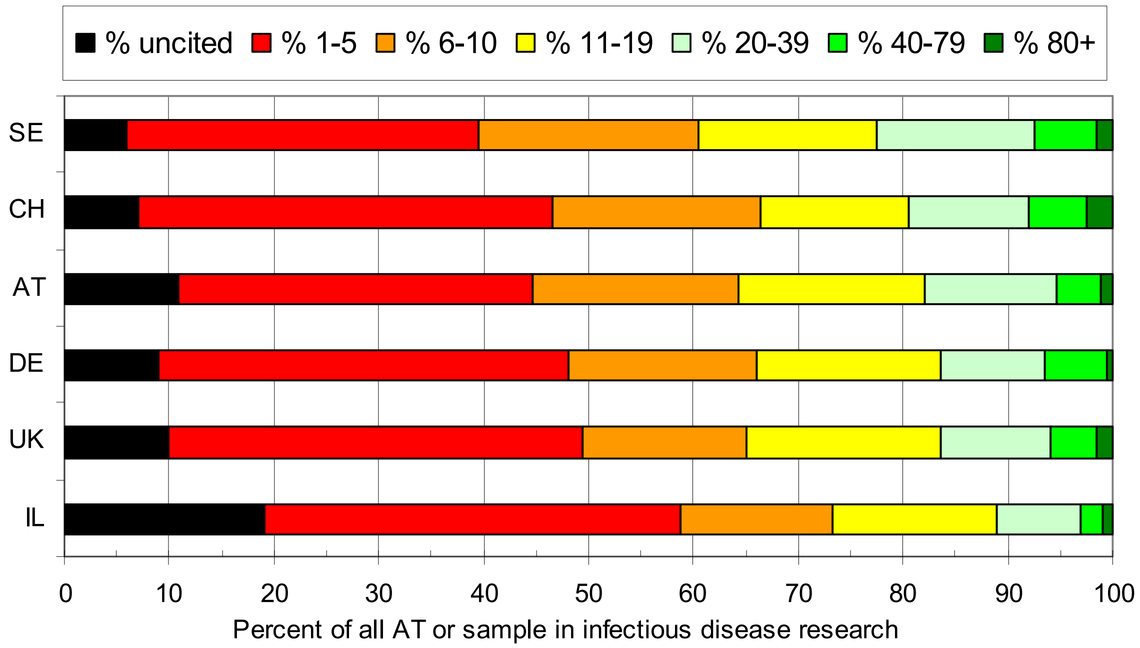


Table A5.19 Citations in five years to 1991-97 papers in mental health research (MENTH)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	115	218	92	68	37	8	5	543
Switzerland	CH	37	85	29	23	17	8	2	201
Germany	DE	47	90	28	22	6	5	2	200
Israel	IL	36	103	31	15	15	0	0	200
Sweden	SE	24	75	37	33	23	8	0	200
UK	UK	29	79	45	21	15	10	1	200

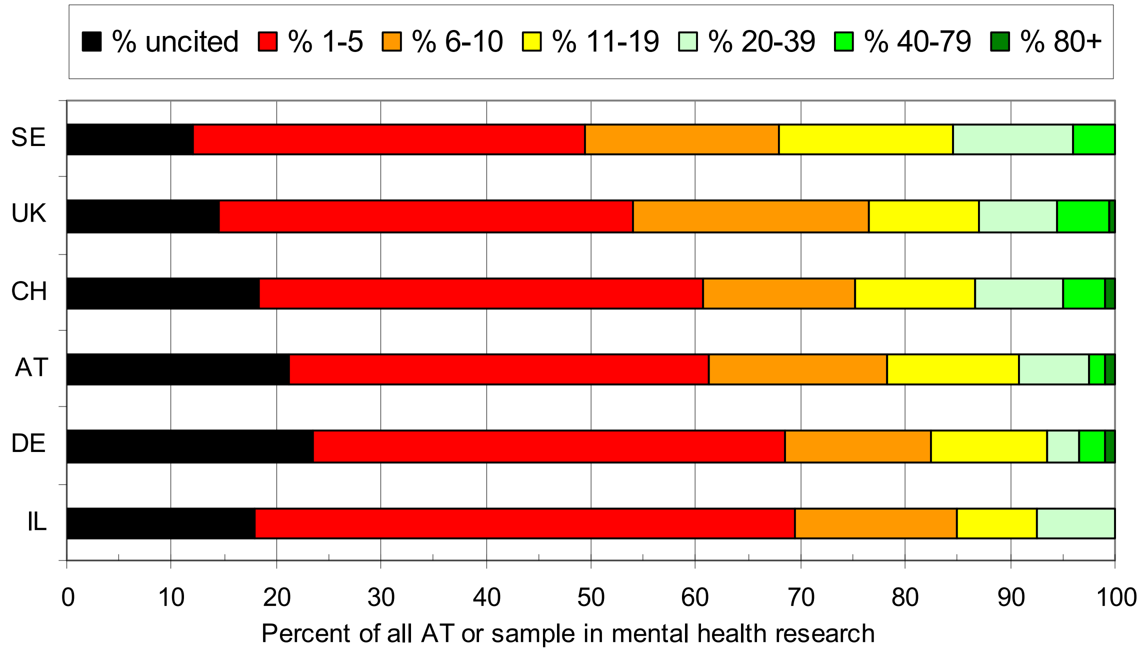


Table A5.20 Citations in five years to 1991-97 papers in neuroscience (NEUSC)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	127	344	242	232	156	62	24	1187
Switzerland	CH	12	36	44	49	35	14	10	200
Germany	DE	16	59	48	35	24	11	8	201
Israel	IL	14	73	32	40	27	12	2	200
Sweden	SE	8	64	44	43	29	10	2	200
UK	UK	8	59	48	42	28	9	5	199

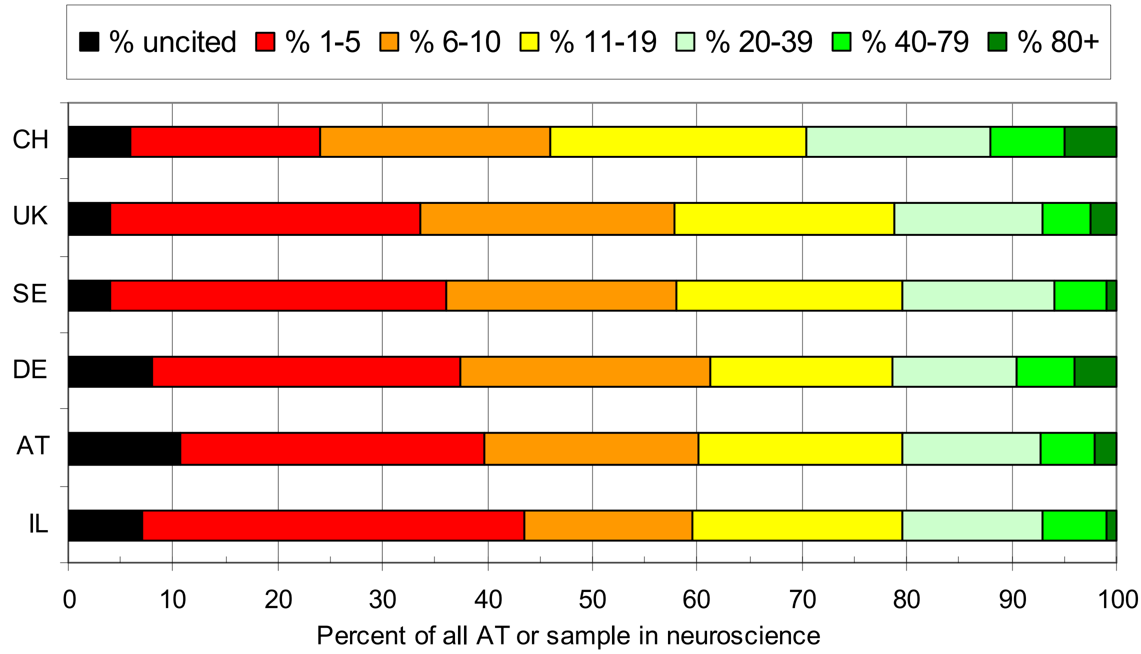


Table A5.21 Citations in five years to 1991-97 papers in obstetrics & gynaecology research (OBSGY)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	343	479	177	122	50	16	4	1191
Switzerland	CH	52	70	21	25	21	11	0	200
Germany	DE	60	71	38	20	7	3	1	200
Israel	IL	20	103	38	21	16	2	0	200
Sweden	SE	27	84	47	25	11	3	3	200
UK	UK	21	75	44	33	18	9	0	200

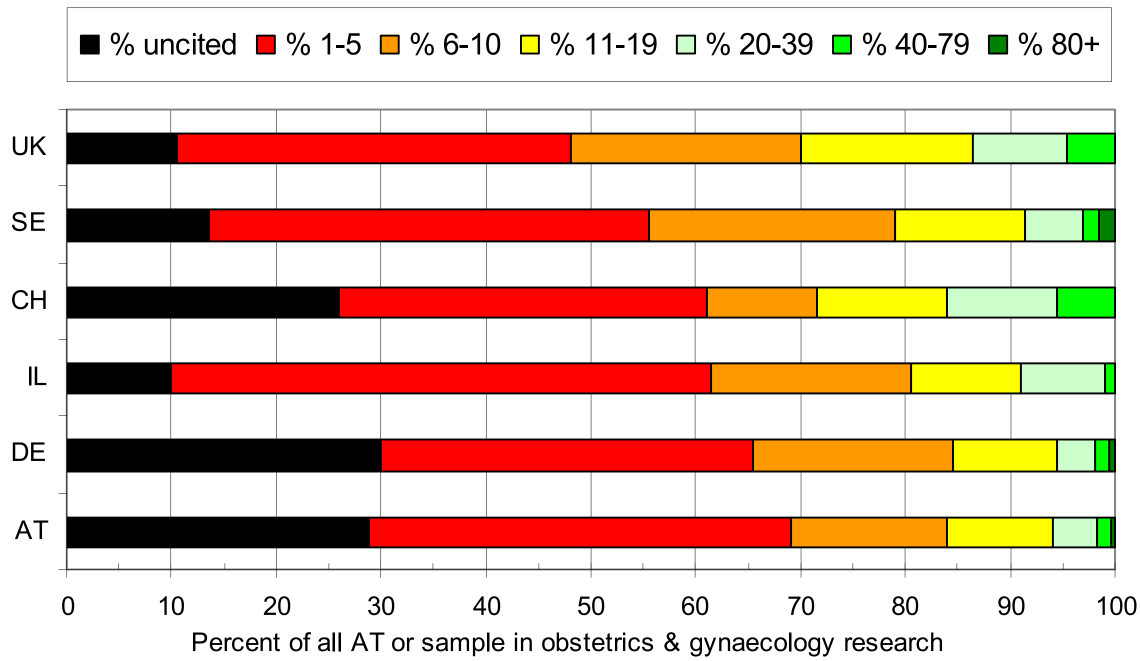


Table A5.22 Citations in five years to 1991-97 papers in oncology research (ONCOL)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	387	841	418	359	237	106	33	2381
Switzerland	CH	26	65	31	31	24	15	7	199
Germany	DE	36	82	30	22	15	11	4	200
Israel	IL	34	77	29	30	16	9	5	200
Sweden	SE	24	78	38	35	16	9	0	200
UK	UK	23	69	39	33	21	9	6	200

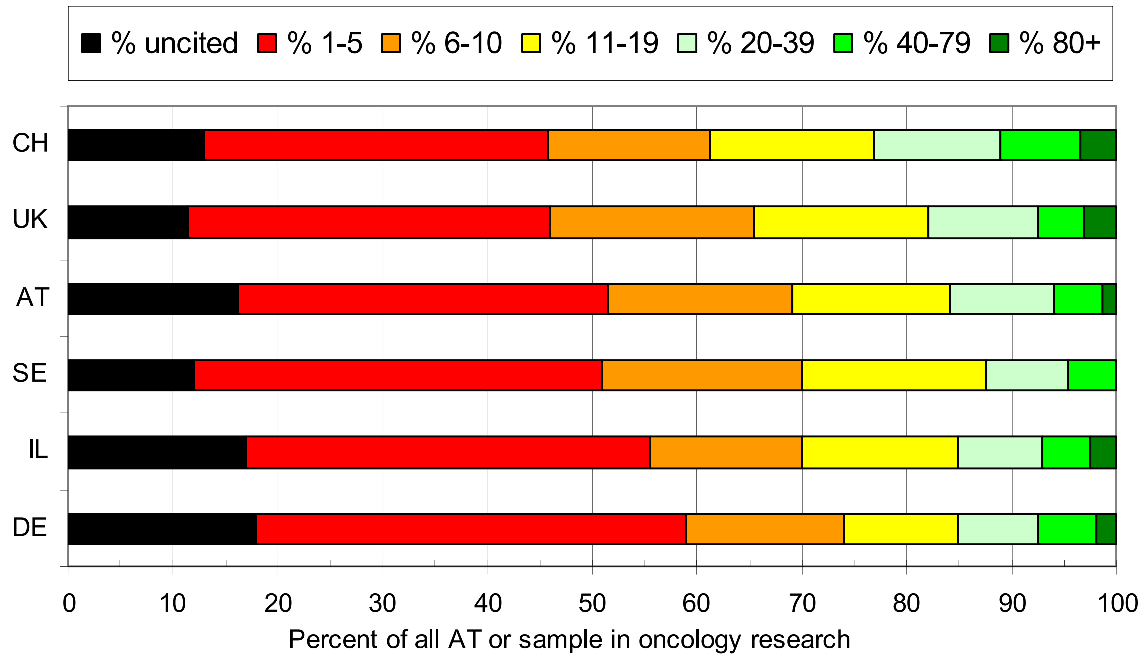


Table A5.23 Citations in five years to 1991-97 papers in ophthalmology research (OPHTH)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	79	154	36	39	12	1	1	322
Switzerland	CH	55	76	28	25	10	4	2	200
Germany	DE	38	82	28	22	24	4	2	200
Israel	IL	47	86	26	20	13	6	3	201
Sweden	SE	14	88	52	29	11	5	1	200
UK	UK	18	99	38	26	12	6	1	200

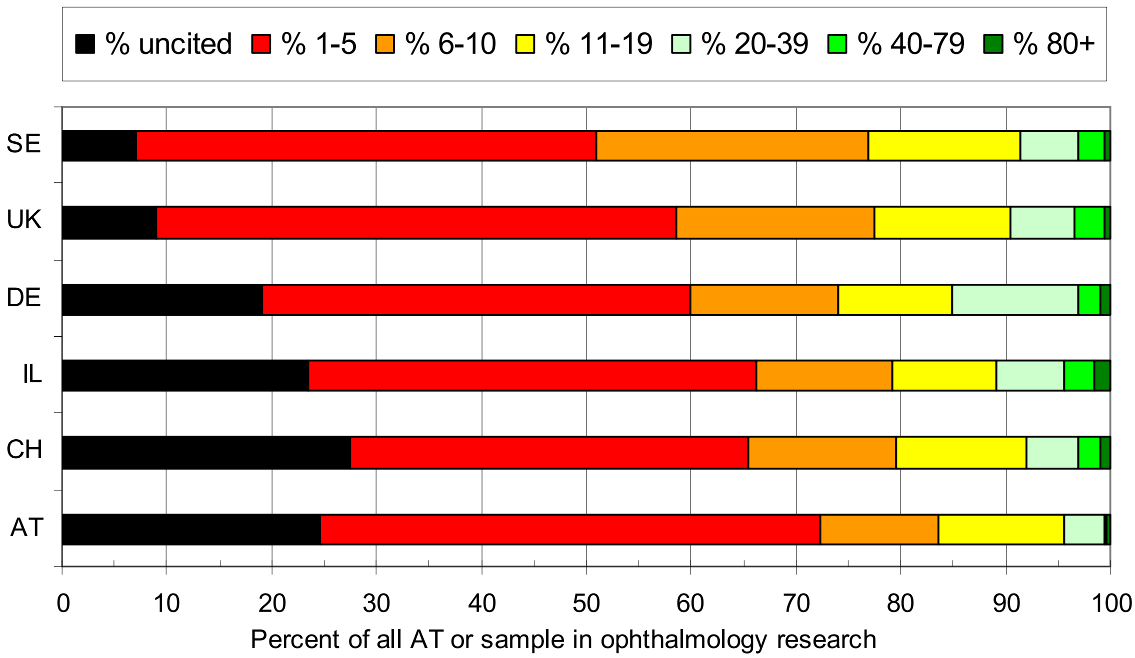


Table A5.24 Citations in five years to 1991-97 papers in otorhinolaryngology research (OTORH)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	70	153	38	35	15	2	0	313
Switzerland	CH	45	81	28	27	14	2	3	200
Germany	DE	40	86	40	22	8	4	0	200
Israel	IL	43	111	26	10	4	3	3	200
Sweden	SE	38	97	33	23	6	3	0	200
UK	UK	53	96	31	12	3	3	2	200

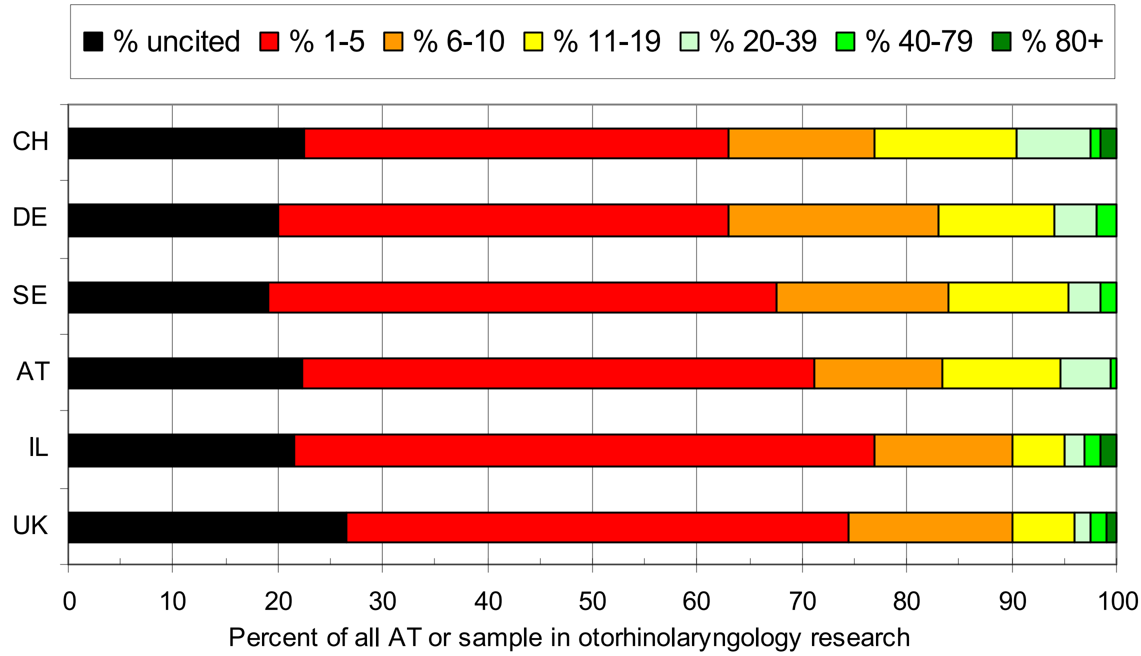


Table A5.25 Citations in five years to 1991-97 papers in pathology research (PATHO)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	150	499	273	239	157	55	22	1395
Switzerland	CH	25	69	34	37	23	9	3	200
Germany	DE	27	75	37	26	25	8	2	200
Israel	IL	28	93	32	25	15	7	0	200
Sweden	SE	21	65	44	37	18	11	2	198
UK	UK	23	84	37	30	21	5	0	200

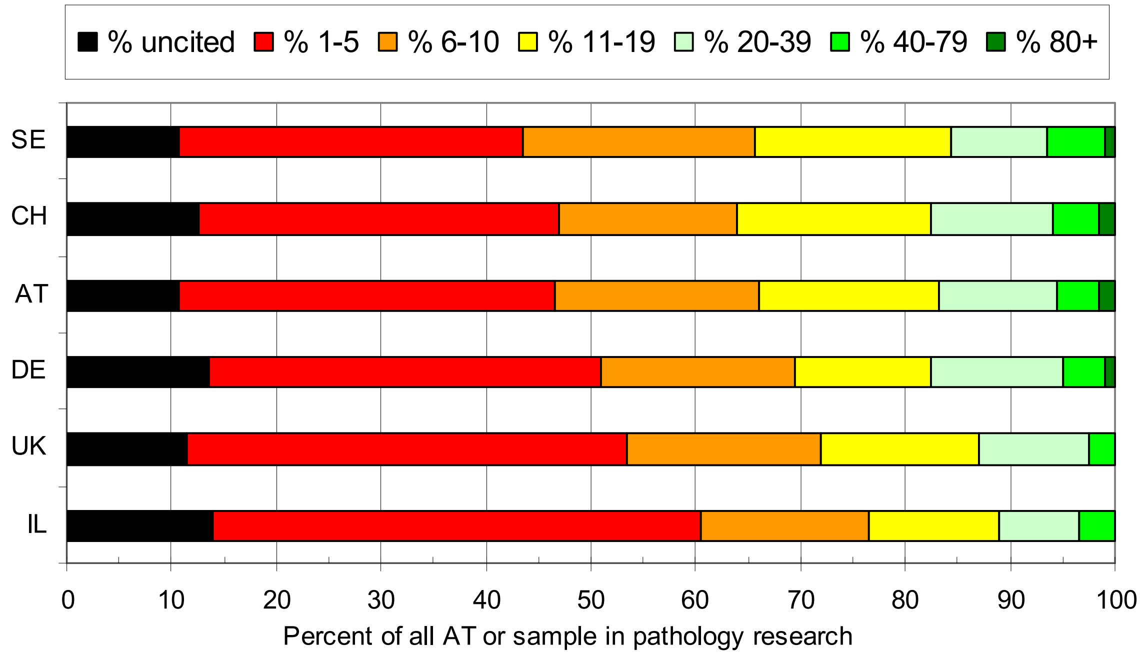


Table A5.26 Citations in five years to 1991-97 papers in pharmacology & toxicology research (PHATO)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	110	342	156	147	67	16	12	850
Switzerland	CH	37	65	41	33	17	5	2	200
Germany	DE	35	79	33	32	17	3	1	200
Israel	IL	19	97	41	23	16	4	0	200
Sweden	SE	14	87	42	32	16	10	0	201
UK	UK	19	66	49	25	26	13	2	200

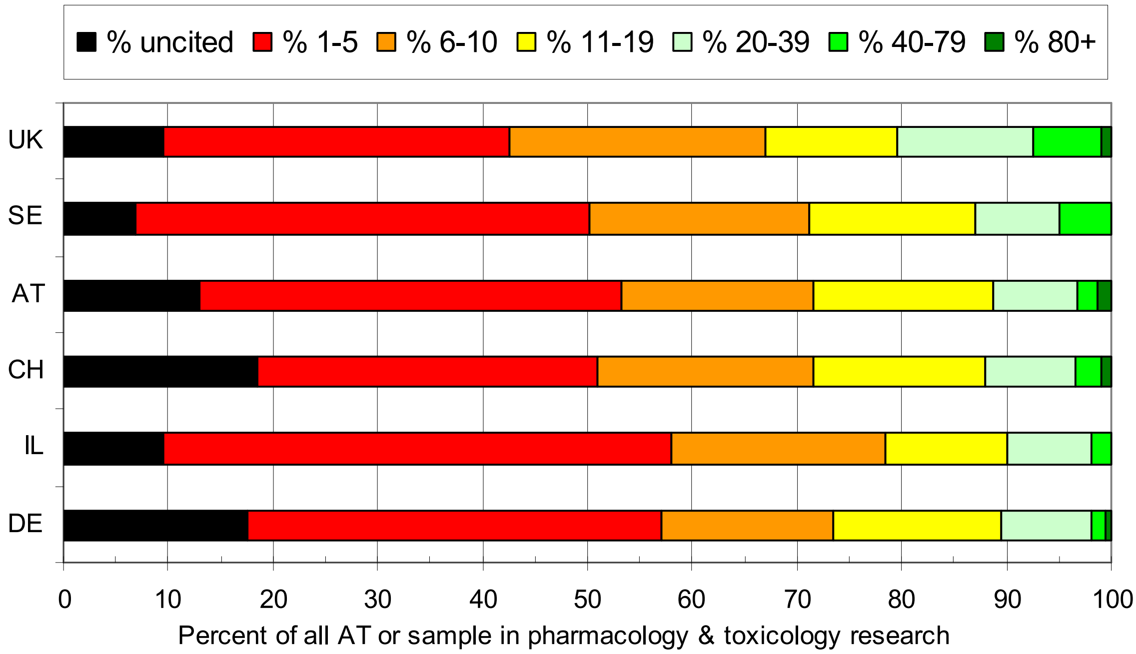


Table A5.27 Citations in five years to 1991-97 papers in public health & epidemiology research (PUBEP)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	92	216	88	84	45	22	4	551
Switzerland	CH	38	61	40	29	15	10	5	198
Germany	DE	33	79	43	24	17	6	0	202
Israel	IL	27	99	32	25	6	8	3	200
Sweden	SE	19	76	46	32	18	7	2	200
UK	UK	18	78	44	33	19	4	4	200

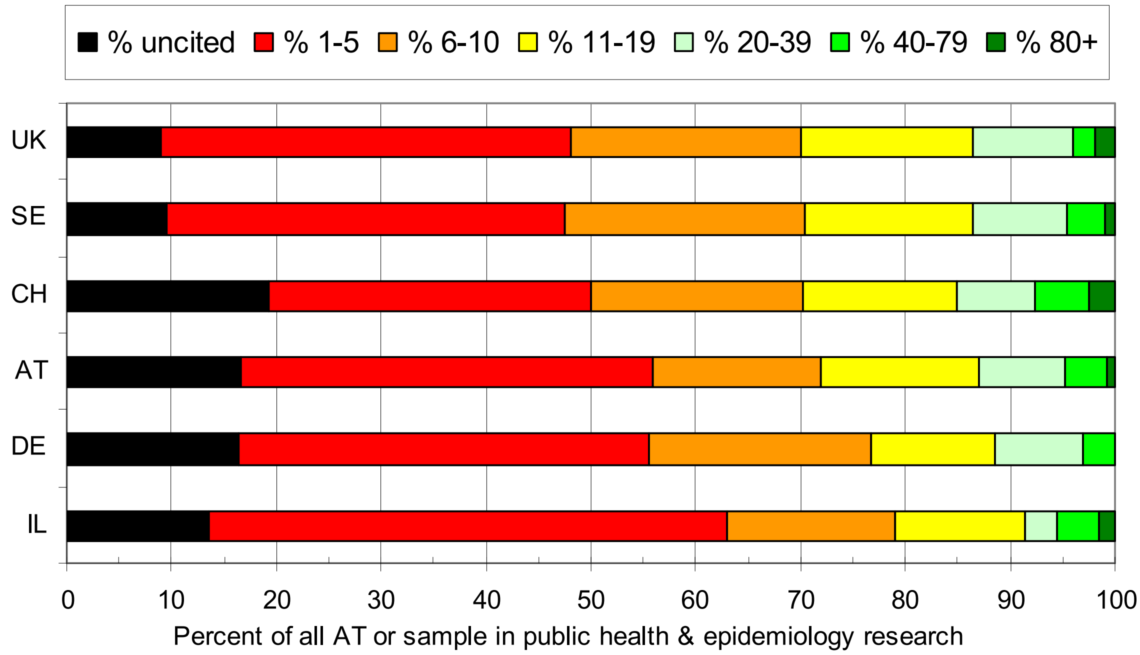


Table A5.28 Citations in five years to 1991-97 papers in radiotherapy, radiology & nuclear medicine (RADIO)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	193	225	84	62	27	3	1	595
Switzerland	CH	30	79	38	28	15	6	4	200
Germany	DE	67	68	21	20	18	3	2	199
Israel	IL	57	93	22	16	11	1	0	200
Sweden	SE	31	82	28	33	18	7	1	200
UK	UK	28	80	31	36	19	5	1	200

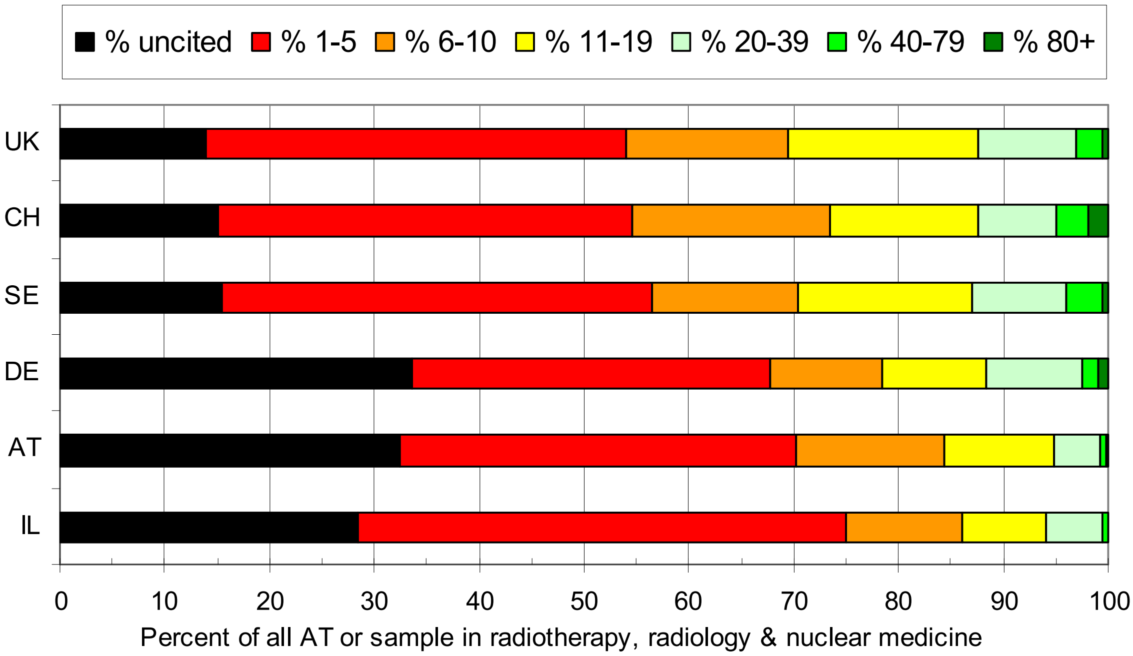


Table A5.29 Citations in five years to 1991-97 papers in renal medicine (RENAL)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	94	235	114	85	46	14	5	593
Switzerland	CH	17	61	35	37	31	18	1	200
Germany	DE	33	69	45	20	23	8	1	199
Israel	IL	39	98	34	19	8	2	1	201
Sweden	SE	22	83	39	31	17	6	2	200
UK	UK	30	90	26	21	23	8	1	199

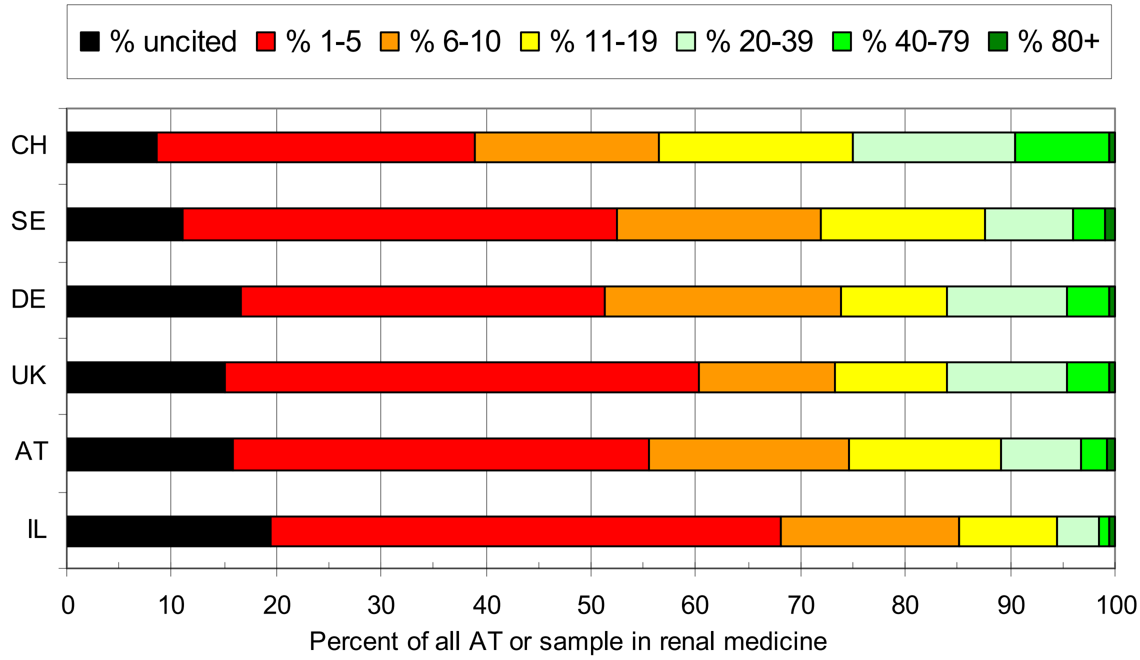


Table A5.30 Citations in five years to 1991-97 papers in respiratory medicine (RESPI)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	114	302	119	88	61	17	3	704
Switzerland	CH	30	63	24	30	36	12	5	200
Germany	DE	44	76	35	30	9	6	0	200
Israel	IL	34	91	34	25	7	5	4	200
Sweden	SE	12	75	45	35	20	8	5	200
UK	UK	29	82	39	28	15	4	3	200

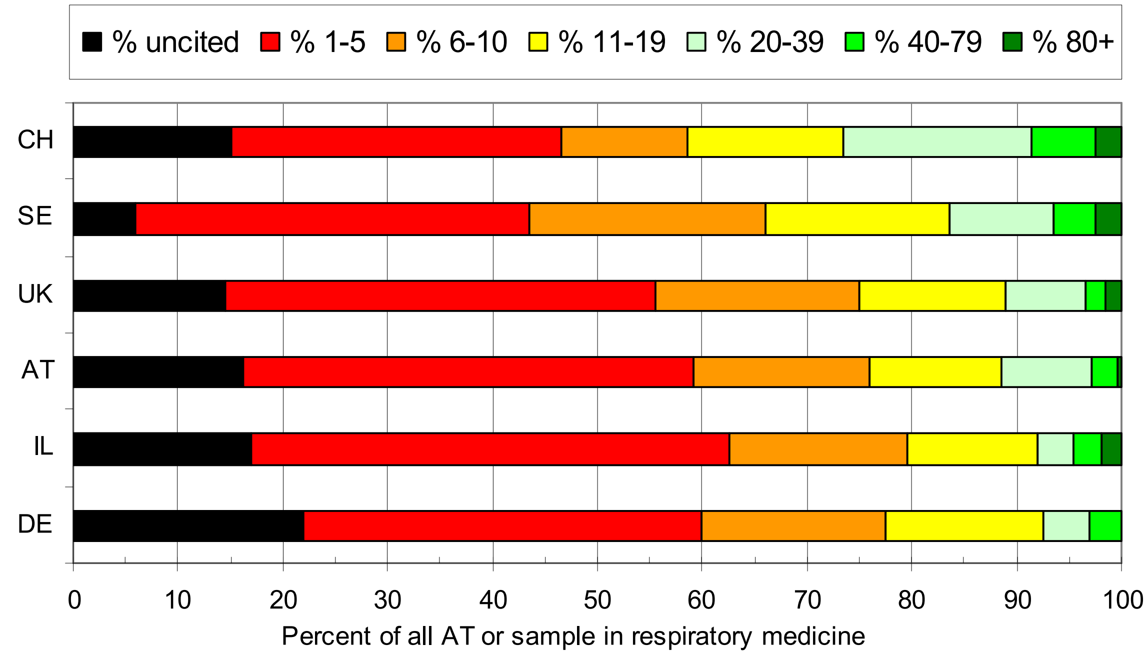


Table A5.31 Citations in five years to 1991-97 papers in surgery research (SURGE)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	239	543	187	110	58	9	2	1148
Switzerland	CH	51	81	36	16	14	2	1	201
Germany	DE	50	89	30	20	10	1	0	200
Israel	IL	51	99	31	16	2	1	0	200
Sweden	SE	42	80	40	24	12	2	0	200
UK	UK	38	94	31	26	11	0	0	200

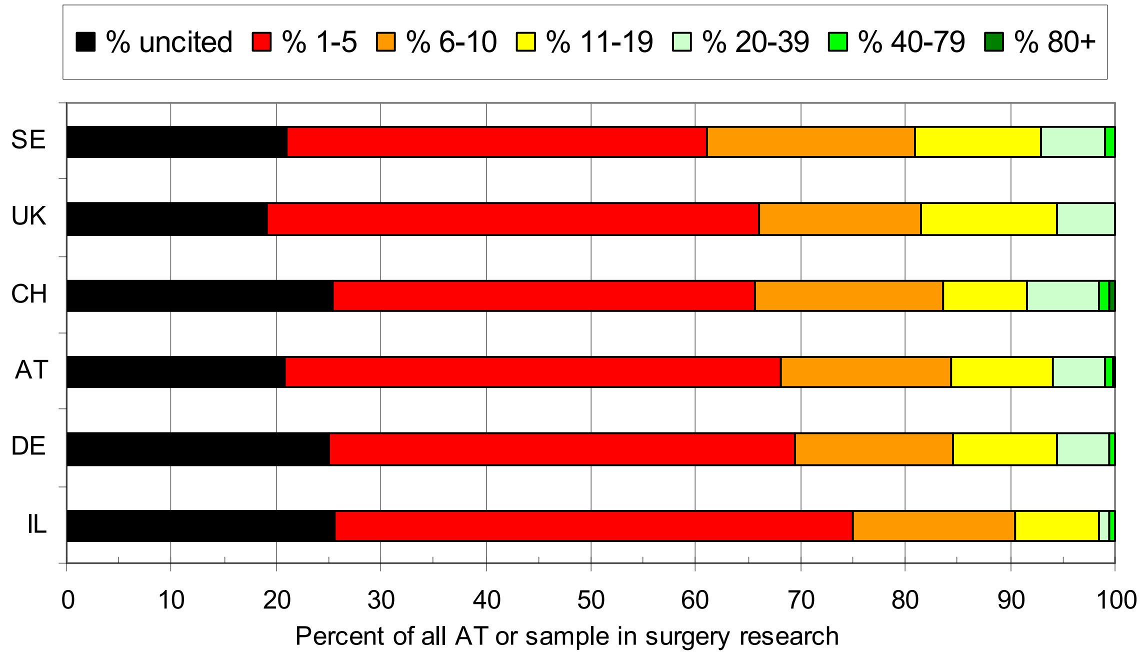
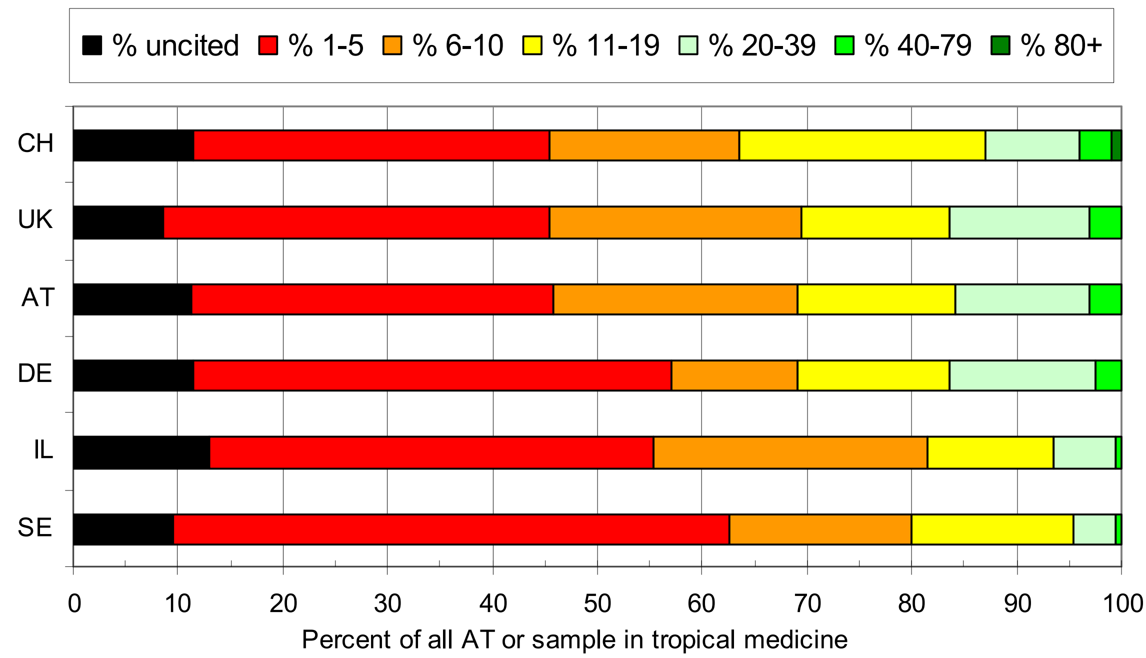


Table A5.32 Citations in five years to 1991-97 papers in tropical medicine (TROPM)

		No cites	*1-5*	*6-10*	*11-19*	*20-39*	*40-79*	*80+*	*Total*
Austria	AT	15	46	31	20	17	4	0	133
Switzerland	CH	23	68	36	47	18	6	2	200
Germany	DE	23	91	24	29	28	5	0	200
Israel	IL	26	84	52	24	12	1	0	199
Sweden	SE	19	106	35	31	8	1	0	200
UK	UK	17	74	48	28	27	6	0	200



ANNEX 6   CITECAT PIC PLOTS FOR THE 3 MEDICAL FACULTIES

The following graphs show scatter plots of the mean Citecat against the mean PIC for the individual institutes (with more than 20 papers) at each of the 3 medical faculties

Institute name	*Papers*	*Sum PIC*	*Sum CC*	*Mean PIC*	*Mean CC*	*N 200*	*N 100*	*N = 50-99*	*N = 20-49*
UNIVERSITY OF VIENNA									
Institut für Medizinische Biochemie	101	306	272	3.03	2.69		2.69		
Institut für Hirnforschung	63	168	166	2.67	2.63			2.63	
Institut für Gefäßbiologie und Thromboseforschung	55	143	108	2.60	1.96			1.96	
Institut für Immunologie	205	518	469	2.53	2.29	2.29	2.29		
Klinisches Institut für Neurologie	33	83	86	2.52	2.61				2.61
Institut für Medizinische Biologie	23	57	49	2.48	2.13				2.13
Klinische Abteilung für Hämatologie und Hämostasiologie	264	636	616	2.41	2.33	2.33	2.33		
Institut für Pathophysiologie	430	1028	1075	2.39	2.50		2.50		
Institut für Pharmakologie	109	259	228	2.38	2.09		2.09		
Institut für Krebsforschung	204	483	472	2.37	2.31	2.31	2.31		
Institut für Labortierkunde und -genetik	18	42	36	2.33	2.00				
Klinisches Institut für Medizinische und Chemische Labordiagnostik	197	459	414	2.33	2.10		2.10		
Universitätsklinik für Klinische Pharmakologie	132	303	280	2.30	2.12		2.12		
Klinisches Institut für Virologie	68	152	156	2.24	2.29			2.29	
Universitätsklinik für Dermatologie	354	777	761	2.19	2.15	2.15	2.15		
Klinische Abteilung für Gastroenterologie und Hepatologie	155	331	294	2.14	1.90		1.90		
Universitätsklinik für Innere Medizin I	655	1396	1263	2.13	1.93	1.93	1.93		
Universitätsklinik für Neurologie	316	663	657	2.10	2.08	2.08	2.08		
Klinische Abteilung für Endokrinologie und Stoffwechsel	192	398	343	2.07	1.79		1.79		
Universitätsklinik für Innere Medizin IV	277	568	492	2.05	1.78	1.78	1.78		
Institut für Medizinische Chemie	128	257	190	2.01	1.48		1.48		
Klinische Abteilung für Angiologie	58	116	113	2.00	1.95			1.95	
Universitätsklinik für Blutgruppenserologie und Transfusionsmedizin	120	240	223	2.00	1.86		1.86		
Institut für Histologie und Embryologie	118	235	229	1.99	1.94		1.94		
Institut für Physiologie	88	175	149	1.99	1.69			1.69	
Universitätsklinik für Innere Medizin III	436	862	773	1.98	1.77	1.77	1.77		
Institut für Medizinische Statistik	138	272	273	1.97	1.98		1.98		
Klinische Abteilung für Onkologie	189	371	308	1.96	1.63		1.63		
Klinische Abteilung für Pulmologie	37	72	55	1.95	1.49				1.49
Klinisches Institut für Klinische Pathologie	290	559	501	1.93	1.73	1.73	1.73		
Klinische Abteilung für Nephrologie und Dialyse	172	329	302	1.91	1.76		1.76		

Institute name	*Papers*	*Sum PIC*	*Sum CC*	*Mean PIC*	*Mean CC*	*N 200*	*N 100*	*N = 50-99*	*N = 20-49*
Institut für Medizinische Physik	62	117	127	1.89	2.05			2.05	
Klinische Abteilung für Rheumatologie	61	115	126	1.89	2.07			2.07	
Klinische Abteilung für Infektionen und Chemotherapie	174	324	296	1.86	1.70		1.70		
Universitätsklinik für Innere Medizin II	332	610	538	1.84	1.62	1.62	1.62		
Universitätsklinik für Nuklearmedizin	133	241	195	1.81	1.47		1.47		
Institut für Medizinische Computerwissenschaften	106	192	200	1.81	1.89		1.89		
Klinische Abteilung für Kardiologie	237	423	363	1.78	1.53	1.53	1.53		
Institut für Umwelthygiene	32	57	45	1.78	1.41				1.41
Universitätsklinik für Notfallmedizin	72	128	86	1.78	1.19			1.19	
Universitätsklinik für Psychiatrie	366	650	659	1.78	1.80	1.80	1.80		
Klinische Abteilung für Arbeitsmedizin	48	81	78	1.69	1.63				1.63
Universitätsklinik für Kinder- und Jugendheilkunde	375	631	545	1.68	1.45	1.45	1.45		
Universitätsklinik für Urologie	109	183	178	1.68	1.63		1.63		
Universitätsklinik für Chirurgie	645	1081	939	1.68	1.46	1.46	1.46		
Universitätsklinik für Anästhesie und Allgemeine Intensivmedizin	261	431	371	1.65	1.42	1.42	1.42		
Klinisches Institut für Hygiene und Medizinische Mikrobiologie	110	179	162	1.63	1.47		1.47		
Institut für Biomedizinische Technik und Physik	38	60	46	1.58	1.21				1.21
Institut für Medizinische Kybernetik und Artificial Intelligence	7	11	10	1.57	1.43				
Universitätsklinik für Strahlentherapie und Strahlenbiologie	45	68	45	1.51	1.00				1.00
Universitätsklinik für Frauenheilkunde	543	814	646	1.50	1.19	1.19	1.19		
Universitätsklinik für Physikalische Medizin und Rehabilitation	65	97	80	1.49	1.23			1.23	
Institut für Anatomie	142	211	164	1.49	1.15		1.15		
Universitätsklinik für Neurochirurgie	81	119	127	1.47	1.57			1.57	
Universitätsklinik für Augenheilkunde und Optometrie	148	217	174	1.47	1.18		1.18		
Universitätsklinik für Neuropsychiatrie des Kindes- und Jugendalters	26	38	27	1.46	1.04				1.04
Universitätsklinik für Radiodiagnostik (hier MR dabei)	409	589	499	1.44	1.22	1.22	1.22		
Universitätsklinik für Orthopädie	105	150	126	1.43	1.20		1.20		
Institut für Sozialmedizin	20	28	12	1.40	0.60				0.60
Universitätsklinik für Unfallchirurgie	47	65	52	1.38	1.11				1.11
Institut für Biomedizinische Forschung	40	55	57	1.38	1.43				1.43
Institut für Gerichtliche Medizin	32	44	35	1.38	1.09				1.09
Universitätsklinik für Hals-, Nasen-, Ohrenkrankheiten	127	172	144	1.35	1.13		1.13		

Institute name	*Papers*	*Sum PIC*	*Sum CC*	*Mean PIC*	*Mean CC*	*N 200*	*N 100*	*N = 50-99*	*N = 20-49*
Universitätsklinik für Mund-, Kiefer- und Gesichtschirurgie	52	66	70	1.27	1.35			1.35	
Institut für Medizinische Psychologie	45	53	31	1.18	0.69				0.69
Institut für Geschichte der Medizin	23	27	7	1.17	0.30				0.30
Universitätsklinik für Zahn-, Mund- und Kieferheilkunde	51	59	44	1.16	0.86			0.86	
Universitätsklinik für Tiefenpsychologie und Psychotherapie	21	22	12	1.05	0.57				0.57
UNIVERSITY OF GRAZ									
Institut für Medizinische Biochemie und Medizinische Molekularbiologie	166	413	393	2.49	2.37		2.37		
Institut für Experimentelle und Klinische Pharmakologie	140	318	303	2.27	2.16		2.16		
Institut für Medizinische Biologie und Humangenetik	30	66	59	2.20	1.97				1.97
Abteilung für Pädiatrische Kardiologie	21	46	27	2.19	1.29				1.29
Gemeinsame Einrichtung Magnet Resonanz (MR) Graz	33	69	72	2.09	2.18				2.18
Institut für Histologie und Embryologie	42	87	69	2.07	1.64				1.64
Gemeinsame Einrichtung Klinische Immunologie	1	2	3	2.00	3.00				
Institut für Medizinische Physik und Biophysik	59	118	108	2.00	1.83			1.83	
Institut für Pathologie	222	418	332	1.88	1.50	1.50	1.50		
Klinisches Institut für Medizinische und Chemische Labordiagnostik	8	15	16	1.88	2.00				
Klinische Abteilung für Nephrologie und Hämodialyse	28	51	43	1.82	1.54				1.54
Klinische Abteilung für Angiologie	44	80	66	1.82	1.50				1.50
Universitätsklinik für Blutgruppenserologie und Transfusionsmedizin	5	9	8	1.80	1.60				
Klinische Abteilung für Endokrinologie und Nuklearmedizin	30	54	47	1.80	1.57				1.57
Klinische Abteilung für Onkologie	24	43	35	1.79	1.46				1.46
Institut für Pathophysiologie	66	118	104	1.79	1.58			1.58	
Klinische Abteilung für Hämatologie	67	119	112	1.78	1.67			1.67	
Klinische Abteilung für Gastroenterologie und Hepatologie	76	133	116	1.75	1.53			1.53	
Institut für Medizinische Chemie und Pregl-Laboratorium	35	61	50	1.74	1.43				1.43
Universitätsklinik für Neurologie	81	140	147	1.73	1.81			1.81	
Institut für Physiologie	70	119	91	1.70	1.30			1.30	
Medizinische Universitätsklinik	410	695	590	1.70	1.44	1.44	1.44		
Universitätsklinik für Strahlentherapie-Radioonkologie	15	25	14	1.67	0.93				
Institut für Sozialmedizin und Epidemiologie	20	33	29	1.65	1.45				1.45
Abteilung für Infektiologie	11	18	11	1.64	1.00				

Institute name	*Papers*	*Sum PIC*	*Sum CC*	*Mean PIC*	*Mean CC*	*N 200*	*N 100*	*N = 50-99*	*N = 20-49*
Herzchirurgie	29	47	32	1.62	1.10				1.10
Universitätsklinik für Dermatologie und Venerologie	210	329	348	1.57	1.66	1.66	1.66		
§ 48 Abteilung für Medizinische Technik und Datenverarbeitung	2	3	2	1.50	1.00				
Universitätsklinik für Neurochirurgie	33	49	35	1.48	1.06				1.06
Geburtshilflich-Gynäkologische Universitätsklinik	198	293	207	1.48	1.05		1.05		
Universitätsklinik für Kinder- und Jugendheilkunde	249	368	315	1.48	1.27	1.27	1.27		
Institut für Hygiene	44	65	57	1.48	1.30				1.30
Allgemeine Chirurgie	85	125	114	1.47	1.34			1.34	
Klinische Abteilung für Allgemeine Pädiatrie	130	190	175	1.46	1.35		1.35		
Universitätsklinik für Radiologie	185	267	207	1.44	1.12		1.12		
Institut für Gerichtliche Medizin	12	17	14	1.42	1.17				
Klinische Abteilung für Kardiologie	120	170	124	1.42	1.03		1.03		
Universitätsklinik für Medizinische Psychologie und Psychotherapie	12	17	12	1.42	1.00				
Klinische Abteilung für Pädiatrische Pulmonologie und Allergologie	25	35	26	1.40	1.04				1.04
Universitätsklinik für Chirurgie	198	277	227	1.40	1.15		1.15		
Universitäts-Augenklinik	42	58	39	1.38	0.93				0.93
Universitätsklinik für Urologie	37	51	46	1.38	1.24				1.24
Klinische Abteilung für Neonatologie	22	30	28	1.36	1.27				1.27
Thorax- und Hyperbare Chirurgie	20	27	23	1.35	1.15				1.15
Klinische Abteilung für Pädiatrische Hämato-Onkologie	29	39	37	1.34	1.28				1.28
Orthopädie	3	4	3	1.33	1.00				
Universitätsklinik für Psychiatrie	38	50	30	1.32	0.79				0.79
Institut für Medizinische Informatik, Statistik und Dokumentation	23	30	25	1.30	1.09				1.09
Universitätsklinik für Kinderchirurgie	41	52	31	1.27	0.76				0.76
Gefäßchirurgie	23	29	30	1.26	1.30				1.30
Hals-, Nasen-, Ohren-Universitätsklinik	27	34	23	1.26	0.85				0.85
Universitätsklinik für Anästhesiologie und Intensivmedizin	68	83	67	1.22	0.99			0.99	
Klinische Abteilung für Pädiatrische Kardiologie	26	31	27	1.19	1.04				1.04
Transplantationschirurgie	20	23	16	1.15	0.80				0.80
Universitätsklinik für Unfallchirurgie	27	31	21	1.15	0.78				0.78
Plastische Chirurgie	8	9	9	1.13	1.13				
Institut für Anatomie	28	31	18	1.11	0.64				0.64

Institute name	*Papers*	*Sum PIC*	*Sum CC*	*Mean PIC*	*Mean CC*	*N 200*	*N 100*	*N = 50-99*	*N = 20-49*
Universitätsklinik für Zahn-, Mund- und Kieferheilkunde	23	25	17	1.09	0.74				0.74
Gemeinsame Einrichtung Kinder- und Jugendneuropsychiatrie	1	1	1	1.00	1.00				
§ 48 Abteilung für Chirurgische Forschung	3	3	1	1.00	0.33				
Universitätsklinik für Orthopädie	3	3	1	1.00	0.33				
Institut für Biomedizinische Forschung	1	1	0	1.00	0.00				
UNIVERSITY OF INNSBRUCK									
Institut für Biochemische Pharmakologie	69	237	210	3.43	3.04			3.04	
Institut für Medizinische Biologie und Humangenetik	107	298	320	2.79	2.99		2.99		
Institut für Pharmakologie	126	337	341	2.67	2.71		2.71		
Institut für Pathophysiologie	170	428	393	2.52	2.31		2.31		
Klinische Abteilung für Gastroenterologie und Hepatologie	96	241	259	2.51	2.70			2.70	
Institut für Mikrobiologie	63	157	128	2.49	2.03			2.03	
Institut für Physiologie und Balneologie	124	308	284	2.48	2.29		2.29		
Universitätsklinik für Innere Medizin	34	82	83	2.41	2.44				2.44
Klinische Abteilung für Kardiologie	18	42	46	2.33	2.56				
Institut für Medizinische Chemie und Biochemie	337	786	839	2.33	2.49	2.49	2.49		
Klinische Abteilung für Allgemeine Innere Medizin	518	1140	1108	2.20	2.14	2.14	2.14		
Sozialmed	149	323	272	2.17	1.83		1.83		
Klinische Abteilung für Nephrologie	342	727	676	2.13	1.98	1.98	1.98		
Universitätsklinik für Dermatologie und Venerologie	163	346	372	2.12	2.28		2.28		
Hygiene	178	368	320	2.07	1.80		1.80		
Institut für Pathologische Anatomie	248	502	465	2.02	1.88	1.88	1.88		
Universitätsklinik für Psychiatrie	172	344	290	2.00	1.69		1.69		
Klinische Abteilung für Hämatologie und Onkologie	26	50	56	1.92	2.15				2.15
Universitätsklinik für Neurologie	210	402	370	1.91	1.76	1.76	1.76		
Universitätsklinik für Urologie	133	250	297	1.88	2.23		2.23		
Besondere Universitätseinrichtung Lernzentrum	7	13	11	1.86	1.57				
Universitätsklinik für Strahlentherapie-Radioonkologie	18	33	21	1.83	1.17				
Institut für Anatomie und Histologie	78	139	129	1.78	1.65			1.65	
Universitätsklinik für Frauenheilkunde	133	232	171	1.74	1.29		1.29		
Institut für Biostatistik und Dokumentation	56	96	90	1.71	1.61			1.61	

Institute name	*Papers*	*Sum PIC*	*Sum CC*	*Mean PIC*	*Mean CC*	*N 200*	*N 100*	*N = 50-99*	*N = 20-49*
Universitätsklinik für Kinder- und Jugendheilkunde	160	274	235	1.71	1.47		1.47		
Universitätsklinik für Chirurgie	251	426	400	1.70	1.59	1.59	1.59		
Universitätsklinik für Nuklearmedizin	31	52	52	1.68	1.68				1.68
Universitätsklinik für Anästhesie und Allgemeine Intensivmedizin	142	238	199	1.68	1.40		1.40		
Institut für Medizinische Physik	24	36	37	1.50	1.54				1.54
Universitätsklinik für Radiodiagnostik	67	96	75	1.43	1.12			1.12	
Universitätsklinik für Neurochirurgie	39	55	36	1.41	0.92				0.92
Universitätsklinik für Hals-, Nasen- und Ohrenheilkunde	41	57	56	1.39	1.37				1.37
Institut für Gerichtliche Medizin	29	40	49	1.38	1.69				1.69
Magnetic-Resonanz-Tomographie und Spektroskopie (MRI) Innsbruck	47	64	56	1.36	1.19				1.19
Universitätsklinik für Augenheilkunde und Optometrie	53	72	54	1.36	1.02			1.02	
Universitätsklinik für Medizinische Psychologie und Psychotherapie	20	27	24	1.35	1.20				1.20
Universitätsklinik für Orthopädie	27	36	33	1.33	1.22				1.22
Universitätsklinik für Unfallchirurgie	15	19	11	1.27	0.73				
Institut für Hygiene und Sozialmedizin	4	5	4	1.25	1.00				
Universitätsklinik für Plastische und Wiederherstellungschirurgie	25	31	47	1.24	1.88				1.88
Universitätsklinik für Zahn-, Mund- und Kieferheilkunde	18	21	20	1.17	1.11				

Tab 6.1 Mean PIC and mean Citecat of selected institutes of the three medical faculties

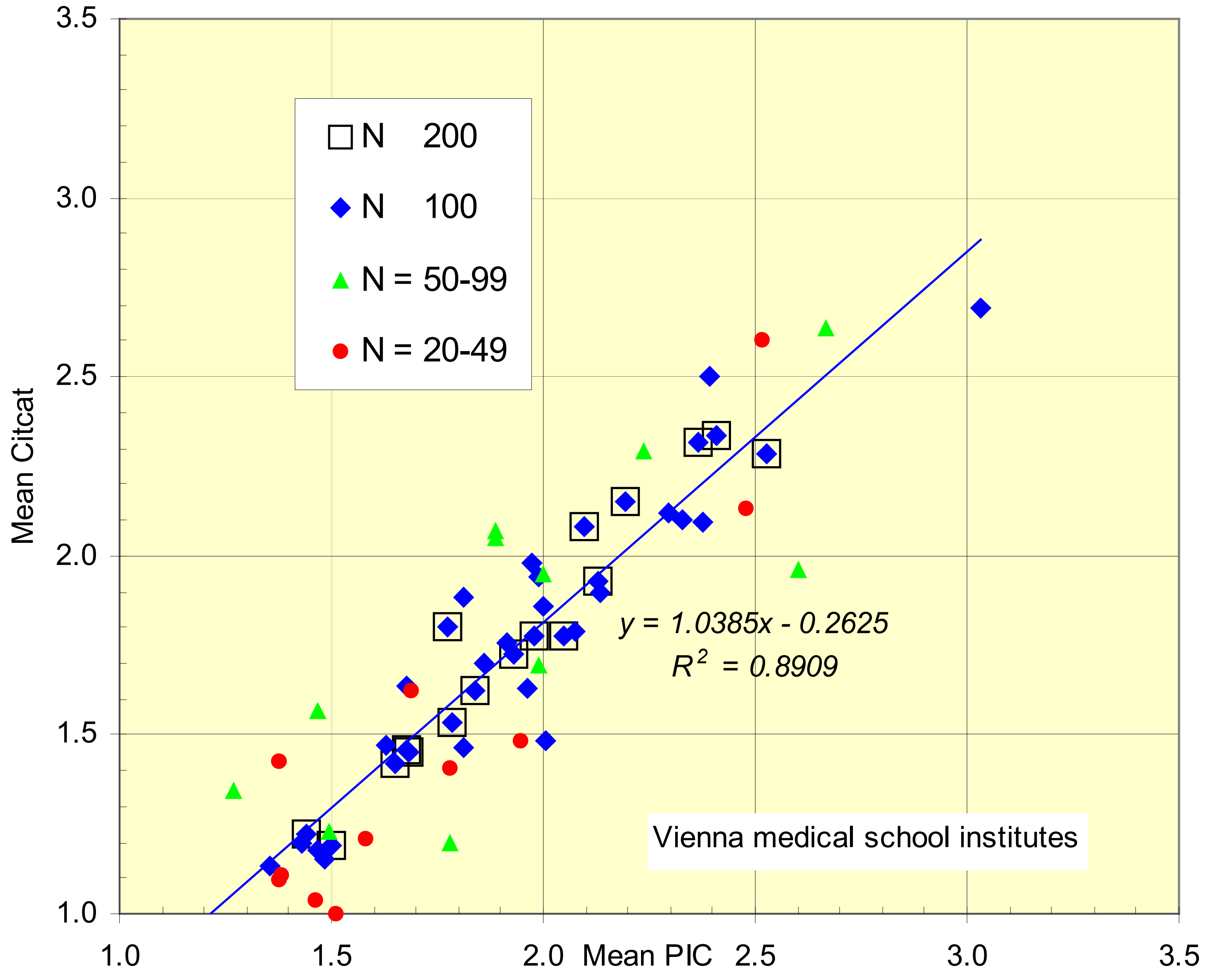


Figure 6.1 Vienna Medical School Institutes

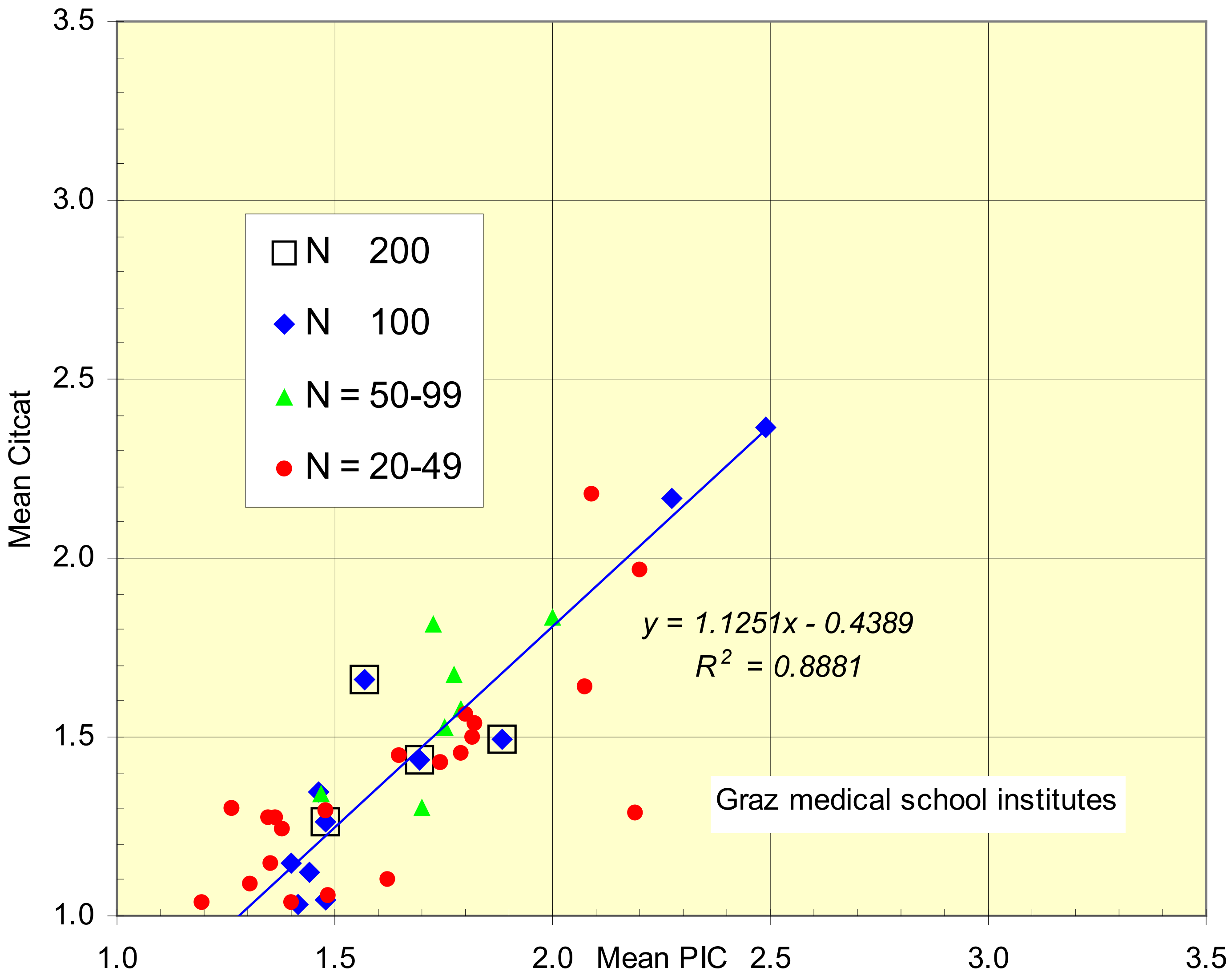


Figure 6.2 Graz medical school institutes

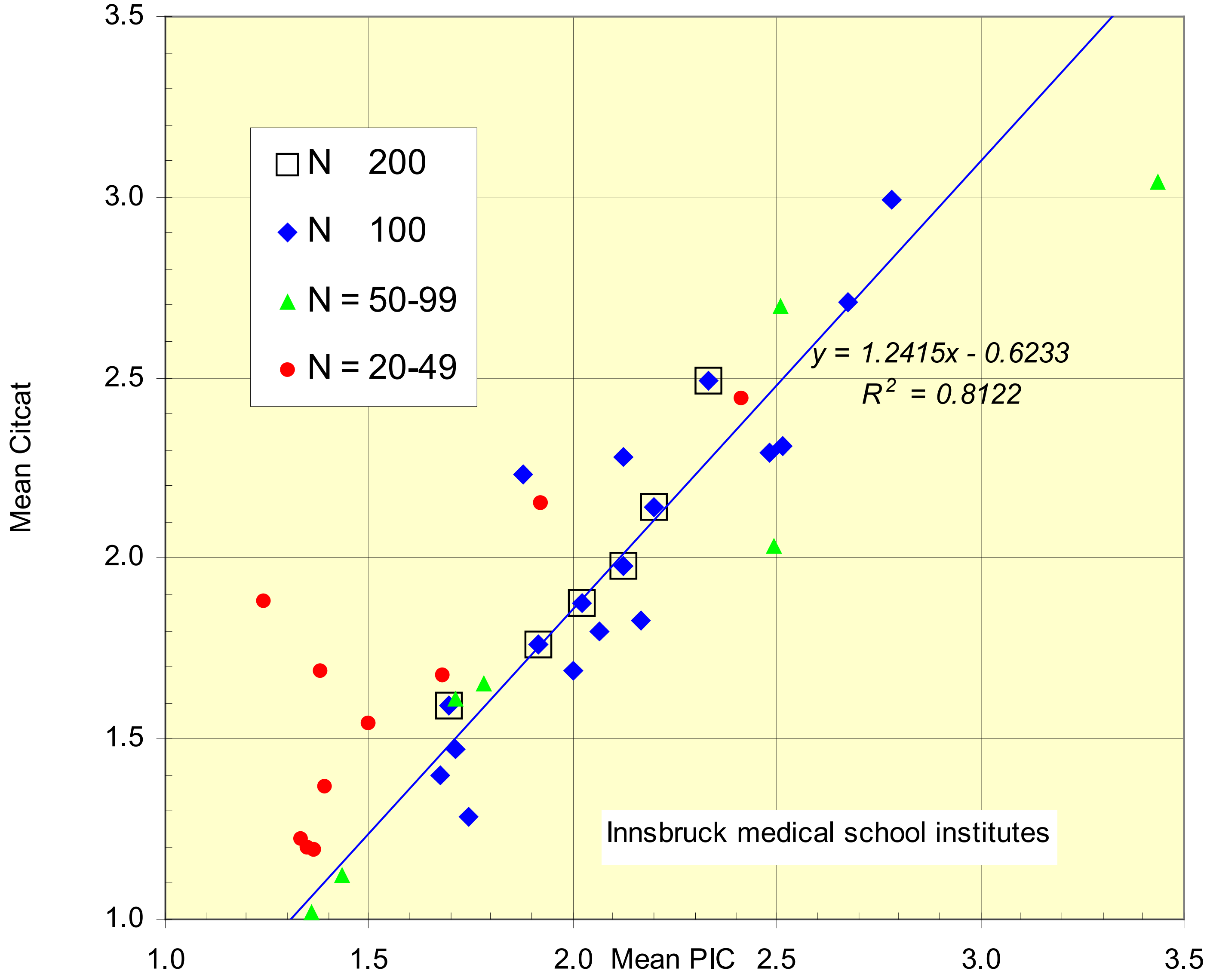


Figure 6.3 Innsbruck medical school institutes

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