SUPPLY OF, AND DEMAND FOR, SCIENCE GRADUATES IN SCOTLAND:

a review of available data

Report by the Scottish Executive,
the Scottish Funding Council and Futureskills Scotland

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SCOTTISH EXECUTIVE

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Introduction by the Chief Scientific Adviser for Scotland

Science and innovation are increasingly important for our economic competitveness and growth. This principle is firmly established in our policy documents, *"A Science Strategy for Scotland", "A Smart, Successful Scotland"* and the *"Framework for Economic Development for Scotland"*.

Science graduates feed into the labour market in a number of important ways. For example, they may be professsionals in the health service, they may work in R&D intensive businesses, or as researchers and teachers in our institutions.

In more general terms, it is essential that we encourage young people to participate in Science, Technology, Engineering and Mathematics (STEM) subjects in order to build a society which is receptive and responsive to science. In regarding the future, individuals must be able to engage confidently and competently with technological development in order to keep pace with the social and cultural implications of changes and to fully exploit them.

I hope this report provides a useful source of baseline data on science students and their prospects in the economy.

Professor Anne Glover FRSE, FAAM
Chief Scientific Adviser for Scotland

Part 1 – EXECUTIVE SUMMARY

Purpose of the Report

This report has been compiled by the Scottish Executive in order to help meet a commitment in its science strategy to examine the supply of scientists into the Scottish economy. A Steering Group chaired by the Scottish Executive (SE), and with representatives from Futureskills Scotland (FSS) and the Scottish Funding Council (SFC), agreed on the coverage of the report. Project steering group representatives contributed data and analysis in their relevant areas of expertise.

The report provides for the first time a synthesis of relevant and readily available information in this area. It provides data on the supply of science entrants to first degree and postgraduate courses in Scotland, the level of current demand for science graduates, and projections on the potential demand for scientists in the future. The project steering group is considering the publication of a fuller version of the report later this year when further data will be available on students and the labour market. This will be undertaken in discussion with the science Sector Skills Councils on the level of extra data that may be able to be collected in the future.

The current report does not examine the supply of science skills into the economy at technician level. It is acknowledged that this is a important area which should be examined in any future report.

Main Points

- The number of Scottish domiciled entrants to first degree courses choosing science degrees is increasing much faster than those choosing non-science degrees. A similar trend is also found for non-Scottish domiciled entrants.
- The increases are particularly marked for entrants to first degree courses in Subjects Allied to Medicine, Biological Sciences, and Mathematical Sciences.
- There have been some small decreases in headcount for some degree subjects, for example the "pure" science of Chemistry. These appear to be offset by significant increases in the more "applied" science subjects for example Other Physical Sciences (which includes Forensic and Archaeological Science, and Earth Sciences), Microbiology and Psychology. Whatever the underlying reasons for these trends, it appears that the university system is responding to

student demand to provide courses which are relevant to their ambitions.

- In 2004-05 around a quarter of first degree, and just over half of postgraduate Science entrants were of non-Scottish domicile.
- Scottish and non-Scottish domiciled students show similar propensities to study science degrees at Scottish HEIs.
- Those studying Science, Maths and Engineering degrees are more likely to agree that their job prospects improve as a result compared to their counterparts in other areas. They are also more likely to be working full time with permanent contracts.
- Employers in the science industry are generally happy with the labour market. They are also more likely, compared to employers in other sectors to:
    - recruit people from Scottish HEIs;
    - consider the subject studied and qualification gained to be important in terms of employees ability to acquire jobs; and
    - to fund/arrange training for their employees.
- The demand for scientists in the future looks positive. Total employment for science occupations is projected to grow at a faster rate between 2004 and 2014 than that expected for non-science occupations. Both growth in the economy and replacement demand will provide a considerable number of job opportunities in science occupations.

Actions

- SFC to regularly publish the pattern of provision for Science subjects as part of their overall pattern of provision work and to discuss any concerns with the Scottish Executive should they arise.

- Scottish Executive to liaise with DfES and DTI to ensure that any UK reporting data on the supply and demand of scientists includes the most up to date data on Scotland.

- Scottish Executive to publish annual destinations data on graduates which includes information on science subjects

- FSS to provide, subject to available resources, information on a biennial basis for the projected demand for science occupations in Scotland and the views of employers in the science sector on skills and recruitment issues.

- In any future report of this kind, consideration will be given to examining the supply of and demand for science technicians and others with a science qualification working in the science sector in discussion with the Sector Skills Councils (SSCs) who play a key role in this area.

PART 2 – GENERAL POLICY CONTEXT, SCIENCE DEFINITION AND REPORT METHODOLOGY

Introduction

The UK Government and the Scottish Executive recognise the importance of ensuring a steady flow of science, engineering and technology graduates to meet demand in the economy. Interest has been growing in this area since the publication by the UK Government in 2002 of *"SET for Success: Report of Sir Gareth Roberts' Review"*. A number of reports have been commissioned in recent years to provide a more detailed picture of developments in terms of UK science graduates in the labour market. In 2006, the main finding was that the UK has improved its position on OECD countries in terms of supply of graduates. Overall supply is increasing at a steady rate with some variation in individual subject lines, and the UK stock of science graduates is projected to rise. UK reports suggest that at a broad level, supply will meet demand although there may be problems in specific subject areas. Science graduates enjoy a high rate of employment. These findings are broadly in line with the information presented in this study on the current Scottish position.

Science Strategy

The Scottish Executive's science and innovation strategy, *"A Science Strategy for Scotland"*, published in 2001 recognises that science and innovation are the cornerstones of Scotland's future. It identifies the need to "ensure that enough people study science to a standard which will enable the future needs of the country to be met" as one of five major interlinked themes in the promotion and development of the science base.

Since the publication of the science strategy, the Executive has implemented a range of measures to boost science teaching and support across primary, secondary and tertiary education, and complementary informal provision in its science centres. Careers Scotland is also helping young people to consider the wide range of career opportunities that science courses can lead to. This progress is reflected in *"A Science Strategy for Scotland 2001 – Progress report"* published in February 2006.

The Scottish Executive is consulting on the measures we will need to develop in the future to modernise science education, promote science careers and increase public engagement with science as part of the current round of work on its science and innovation strategy.

Recent UK Reports

The UK *"Science and Innovation Investment Framework 2004-2014"* commits the UK Government to review annually the relative balance between the supply of and demand for science[1] skills. The annual report on the Framework in 2006, *"Science and innovation investment framework 2004-2014: next steps"* shows that in terms of OECD Countries, the UK compares favourably on supply of these skills, and its relative position has improved. The report suggests that an increasing number of entrants to Higher Education are attracted to Subjects Allied to Medicine with a decrease in the numbers of entrants to Engineering and Physical Sciences. Projections suggest an increasing demand for these skills over the next ten years and that supply is likely to increase to meet this, except in Engineering and Physical Sciences.

Part of the annual monitoring work for the 10 Year Framework was compiled through a DfES report, *"The Supply and Demand for Science, Technology, Engineering and Mathematics Skills in the UK Economy"* (Research Report RR775). It highlights a number of interesting trends and concludes that the UK's stock of science and engineering graduates compares well internationally and is increasing at a steady rate. Some specific findings of interest in the report in terms of UK science graduates are:

- In 2003, the UK had the largest increase in both the absolute number of STEM graduates, and as a proportion of growth per 100,000 persons in employment (25 to 34 years of age). By this measure the stock of 20-29 year old STEM graduates in the UK increased by 16% since 2000.[2]
- There are higher graduate earnings premia for Medicine, Physics, Chemistry and Engineering compared to all degrees in terms of the additional lifetime earnings of graduates.[3]
- The stock of STEM graduates is projected to rise by 62% from 2004 to 2014, with the highest growth in Subjects Allied to Medicine

[1] Science is defined in reference to the June 2006 DfES report, "The Supply and Demand for Science, Technology, Engineering and Mathematics Skills in the UK Economy" (Research Report RR775) which references the DTI's definition in its March 2006 paper "Science, Engineering and Technology Skills in the UK" (DTI Economics paper number 16). The DTI definition of science degree holders includes the fields of medicine, dentistry, subjects allied to medicine (eg. nursing and pharmacy), biological sciences, veterinary sciences, agricultural sciences, physical sciences (eg. physics and chemistry), environmental sciences, mathematical and statistical sciences, computer sciences and ICT, engineering, technology, architecture, building and planning.

[2] Countries sampled included Korea, Ireland, France, Australia, UK, Finland, New Zealand, Norway, Spain, Sweden, Japan, Switzerland, Denmark, United States, Slovak Republic, Belgium, Iceland, Germany, Poland, Turkey, Portugal, Mexico, Italy, Austria, Czech Republic, Netherlands, Hungary.

[3] The difference in the present value of the after tax employment lifetime earnings, of degrees in certain subjects compared to holding 2 or more A-levels (the analysis holds other factors constant that might influence lifetime earnings, such as personal, regional and job related characteristics.)

(113%); then Biological Science (77%); then Mathematical and Computer Science (70% each). Engineering is predicted to rise by 36% and Physical Science by 32%.

- At a broad level in the UK, supply is likely to increase to meet the increase in demand for STEM skills over the next 10 years. However, there may be problems with specific subjects. On current trends, the increases in supply to Engineering and Physical Sciences are relatively low and with over half the graduates in these subjects not going on to STEM occupations straight away, there is a possibility that demand for these skills will not be met by supply. Still, the increasing returns to Engineering suggest that the market for these skills is adjusting to the reduced flow.

The recent DTI Economics Paper No.16: "*Science, Engineering and Technology Skills in the UK"* examined a range of data sources on the supply and demand of Science, Engineering and Technology (SET) skills in the UK. In general, they found that the supply of SET skills is strong. There has been substantial growth in the numbers of graduates with SET qualifications, with some variation by subject. The report also found the labour market for those with SET qualifications to be strong. SET graduates have high employment rates and continue to receive a wage premium for their skills. This suggests that the demand for such workers has kept up with expanding supply.

The DTI report also included forecasts of the employment pattern for Science, Engineering and Technology workers over the next decade to 2014. The projections are taken from the Sector Skills Development Agency's (SSDA) forecasts and are produced using the same model as Futureskills Scotland's labour market projections. The results from the DTI paper are similar with employment in each of the science occupations expected to grow at a faster rate between 2004 and 2014 than that expected for all occupations.

The Labour Market Trends feature: "*Scientist, engineers and technologists in Great Britain"* (Labour Market Trends, April 2006)[4] found that there is unlikely to be a shortage for SET skills in the near future. Analysis of employment and wages suggests that demand for science skills has matched the growth in supply. Unemployment and inactivity among SET graduates is relatively low with labour market outcomes being slightly better than those for other graduates. Furthermore, the inflows of new SET graduates are generally

[4] SET subjects are defined here as medicine, medical-related subjects, biological sciences, agricultural sciences, physical/environmental sciences, engineering, technology and architecture/related studies.

rising fast and this means that, unlike the working age population as a whole, SET graduates are not an ageing population.

Methodology and Data Sources in this Report

Science definition

As there is no commonly accepted definition of "science", a number of definitions have been used throughout this report reflecting the different data sources used. Every attempt has been made to gather meaningful data. Data has been sourced as follows:

- For the sections about science graduates the Principal Subject or "JACS" codes to define the Medical, Life and Physical Sciences for graduates and undergraduates are used;
- For the section on employers' views, the science industry is defined using Standard Industry Classification (SIC) codes; and
- For the sections on the demand for scientists in the future define science occupations are defined using Standard Occupational Classification (SOC) 2000 codes.

A full description of the definitions of science used in this report can be found in the Annexes.

Data sources

Data has been compiled from a number of sources including:

- long term HESA data on the numbers of science entrants at both first degree and postgraduate level over the period 1996-97 to 2004-05 (This includes comparative data on students studying in Scotland from other domiciles);
- short term HESA data exploring changes at the principal subject level within each of the science subject areas over the period 2002-03 to 2004-05;
- *On Track: Class of 2004* (Sweep Two) and *Scotland's Class of '99* data;
- *Higher Education Graduates and Graduate Destinations 2004-05* published by the Scottish Executive;
- *Annual Survey of Hours and Earnings*, which is the official source of pay estimates; and
- Futureskills Scotland's 2004 Employers Skills Surveys and Labour Market Forecasts to 2014.

What the report does not include

The supply side information on graduate entrants excludes information on qualifications likely to be gained by those qualifiying to technician level.

However information on science occupations and industries in this report is likely to include information concerning those with broader science skills.

(Please refer to annexes 1 and 2 and Chapter 2 for more information on report definitions and methodology.)

Clearly more detailed information on the supply and demand of science technicians would be a useful area for futher investigation. The college sector plays a key role in this area.

Part 3 – TRENDS IN ENTRANTS TO SCIENCE COURSES AT SCOTTISH HEIs

Data sources

Information in this Chapter has been provided by the Scottish Executive and the Scottish Funding Council and includes long term and short term HESA data on the numbers of entrants to science degree courses. Please refer to the Annexes and to Part 2 for more information on methodology.

Introduction

This section examines the trends in the number of entrants to first degree and postgraduate science courses at Scottish HEIs. A combination of broad long-term data, and detailed short-term data is used to highlight the trends in provision, and to provide some context as to the drivers behind these trends. In certain sections of the long-term analysis the trends for Scottish domiciled entrants, and non-Scottish domiciled entrants are explored.

Main Points

- In general, there has, over the period 1996-97 to 2004-05, been considerable growth in entrants to courses at both the first degree and postgraduate levels across all areas of Science (Medical, Life, and Physical) – although in the detail there are variations between subject groups.

Key findings

Numbers of students and growth rate

- Between 1996-97 and 2004-05 the number of entrants to science courses and postgraduate study at Scottish HEIs increased by 27% (all domiciles); over the same time period the number choosing non science subjects increased by 4%.
- Between 1996-97 and 2004-05 the number of Scottish entrants to science courses and postgraduate study at Scottish HEIs increased by 22%; over the same time period the number choosing non science subjects decreased by 5%. [5]

[5] To note context - fewer than 8% of Scots studying science do so in the UK outside of Scotland.

- In 2004-05, numbers of Scottish entrants to first degree science courses at Scottish or UK HEIs were a quarter higher than 8 years earlier, while Scottish non – science entrants rose by just 1%.
- There has been a 7% increase in the number of Scottish postgraduate entrants to science subjects at Scottish HEIs since 1996-97 compared to a 16% decrease in the number of Scottish non – Science postgraduate entrants.
- There has been a 6% increase in the number of Scottish postgraduate entrants to science subjects at Scottish or UK HEIs since 1996-97 compared to a 12% decrease in the number of Scottish non – Science postgraduate entrants.

Trends in subject areas for the Scottish domicile

- The largest percentage increases over the period 1996-97 to 2004-5 in terms of first degrees occur in the subjects Other Physical Sciences[6] (119%), Maths (79%) and Biological Sciences (69%)
- The largest percentage decreases over the period 1996-97 to 2004-5 in terms of first degrees occurred in Chemistry (-45%), Engineering and Technology (-12%) and Physics (-9%).
- The largest percentage increases over the period 1996-97 to 2004-5 in terms of postgraduates occured in Maths (113%), Subjects Allied to Health (97%) and Biological Sciences (80%).
- The largest percentage decreases over the period 1996-97 to 2004-5 in terms of Postgraduates occurred in Engineering and Technology (-45%), Computing Science (-42%) and jointly Chemistry (-32%) and Physical Sciences (-32%)

(Please refer to the charts and graphs in this chapter for more information on absolute numbers of students.)

Foreign domicile trends

- The higher increase in the numbers studying science as opposed to non science subjects is reflected in similar trends for the rest of the UK and the rest of the EU first year undergraduates but not non EU first year undergraduates.
- International students make up almost one third of our science undergraduate and slightly over half of our science postgraduate popultation.

[6] Other Physical Science subjects in the HESA definition includes: Materials Science; Forensic and Archaeological Science; Astronomy; Geology; Ocean Sciences; Physical and Terrestrial Geographical and Environmental Sciences and Others.

- Overall 47% of those entering Scotland to study a first degree studied a science subject. They are widely distributed across Medical (31%), Life (25%) and Physical (44%) sciences.
- Overall, 38% of those entering Scotland to study a postgraduate degree studied a science subject. They are widely distributed across Medical (20%), Life (17%) and Physical (63%) Sciences.

Data - Total Entrants to Science

This section presents the total number of entrants to science courses at Scottish HEIs, and the long-term trend in entrants to science and non-science courses.

First Degree

Figure 1 shows the total number of entrants to first degree courses at Scottish HEIs in 2004-05 by Science subject group, and by domicile.

Figure 1: Entrants to first degree science courses, by subject group, and area of domicile, 2004-05

	Domicile of Entrants to First Degree Course in 2004-05					
Subject	**Scottish**	***Rest UK***	***Rest EU***	***Non EU***	**Non-Scottish Total**	**Total Entrants**
Medicine & Dentistry	715	*410*	*30*	*115*	555	1270
Veterinary medicine	95	*80*	*10*	*50*	140	235
Subjects Allied to Medicine	3620	*390*	*200*	*190*	780	4400
Total Medical Science	**4430**	***880***	***240***	***355***	**1475**	**5905**
Biological Sciences	3045	*775*	*230*	*130*	1130	4180
Agriculture & related subjects	170	*30*	*5*	*5*	40	210
Total Life Science	**3215**	***805***	***235***	***135***	**1170**	**4390**
Engineering & Technology	2250	*185*	*495*	*265*	945	3195
Computer science	1735	*155*	*165*	*130*	450	2185
Other Physical Sciences	790	*200*	*25*	*15*	245	1030
Mathematical sciences	475	*155*	*40*	*55*	250	725
Chemistry	270	*65*	*35*	*5*	105	375
Physics	255	*60*	*40*	*5*	105	360
Total Physical Science	**5770**	***825***	***800***	***470***	**2095**	**7865**
All science subjects	**13415**	***2505***	***1275***	***960***	**4740**	**18155**
Total subjects (including non-science subjects)	**28225**	***5335***	***2460***	***2410***	**10205**	**38430**

Figure 1 shows that:

- 74% of all those studying science subjects at first degree level in Scotland are of Scottish domicile;
- Scottish science entrants in 2004-05 were most likely to be undertaking a course in: Subjects Allied to Medicine (27%), Biological Sciences (23%), Engineering and Technology (17%) and Computer Science (13%);
- Veterinary Medicine is the only science subject area where the number of non-Scottish students is greater than the number of Scottish students;
- As proportions of the overall total number of entrants in the subject group, rest of the UK students account for: 12% in Medical Science; 10% in Life Science and 22% in Physical Science;
- As proportions of the overall total number of entrants in the subject group, rest of the EU students studying in Scotland account for: 10% in Medical Science; 8% in Life Science and 28% in Physical Science; and
- As proportions of the overall total number of students in the subject group, non-EU students studying in Scotland account for: 6% in Medical Science; 5% in Life Science and 25% in Physical Science.

Figure 2 shows the long-term trend (1996-97 to 2004-05) for entrants to science and non-science first degree courses, by domicile.

Figure 2: Entrants to science and non-science first degree courses, by domicile, 1996-97 to 2004-05

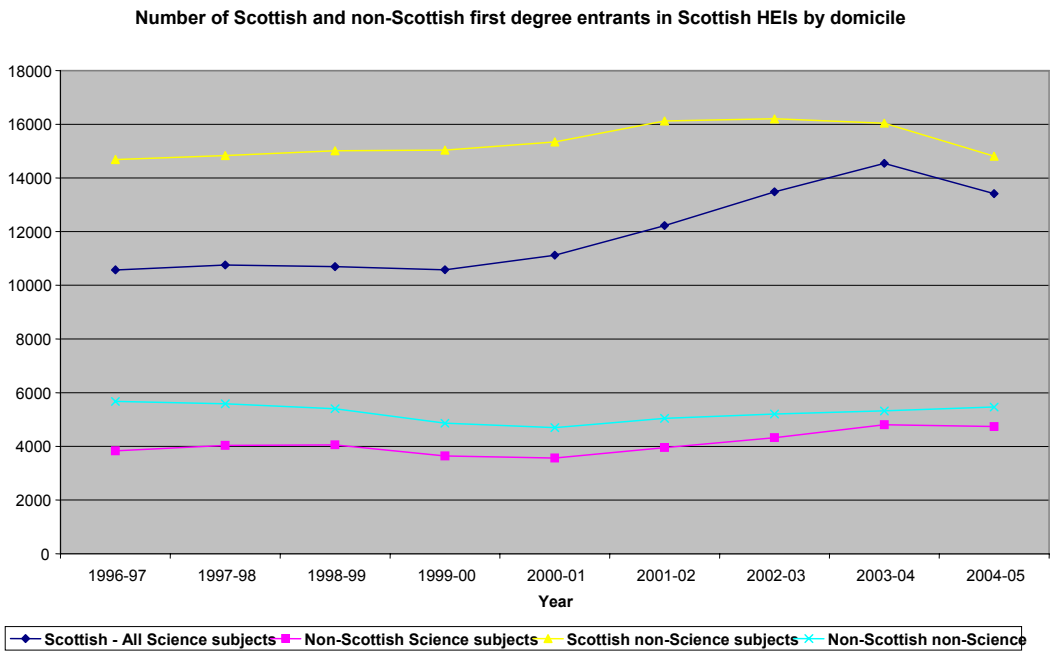


Figure 2 shows that:

- There was a 27% increase in the number of Scottish entrants to science degrees between 1996-97 and 2004-05, compared to a 1% increase in the number of Scottish non – science entrants;
- The increase (27%) in entrants to Science began in 1999-00, as numbers remained stable over the period 1996-97 to 1999-00. Over the period 1999-00 to 2004-05, there was a 2% decrease in the number of Scottish non – science entrants;
- There was a 24% increase in the number of non-Scottish entrants to science degrees between 1996-97 and 2004-05, compared to a 4% decrease in the number of non-Scottish entrants to non-science subjects; and
- The majority of this increase was witnessed over the period 2001-02 to 2004-05, where non-Scottish entrants to science subjects increased by 20%.

Postgraduate

Figure 3 shows the total number of entrants to postgraduate courses at Scottish HEIs in 2004-05 by science subject group, and by domicile.

Figure 3: Entrants to postgraduate science courses, by subject group, and area of domicile, 2004-05

	Domicile of Entrants to Postgraduate Courses in 2004-05					
Subject	**Scottish**	***Rest UK***	***Rest EU***	***Non EU***	**Non-Scottish Total**	**Total Entrants**
Medicine & Dentistry	285	*45*	*30*	*65*	145	425
Veterinary medicine	20	*15*	*10*	*10*	40	55
Subjects Allied to Medicine	1,245	*165*	*150*	*280*	595	1,840
Total Medical Science	**1,550**	***230***	***195***	***355***	**780**	**2,330**
Biological Sciences	490	*155*	*120*	*230*	505	995
Agriculture & related subjects	75	*30*	*35*	*70*	140	210
Total Life Science	**565**	***185***	***155***	***300***	**645**	**1,205**
Engineering & Technology	405	*130*	*205*	*740*	1,070	1,480
Computer science	505	*115*	*200*	*420*	730	1,240
Other Physical Sciences	175	*100*	*45*	*90*	235	410
Mathematical sciences	155	*35*	*50*	*135*	220	375
Chemistry	80	*30*	*40*	*35*	105	185
Physics	55	*20*	*15*	*10*	45	100
Total Physical Science	**1,380**	***430***	***555***	***1,425***	**2,410**	**3,790**
All science subjects	**3,490**	***845***	***905***	***2,080***	**3,830**	**7,320**
Total subjects (including non-science subjects)	**9,640**	***1,915***	***1,950***	***5,815***	**9,685**	**19,320**

Figure 3 shows that:

- 48% of all those studying science subjects at postgraduate level in Scotland were of Scottish domicile;
- Scottish postgraduate science entrants in 2004-05 were most likely to be undertaking a course in: Subjects Allied to Medicine (36% of Scottish domiciled entrants); Computing Sciences (15%); Biological Sciences (14%); and Engineering and Technology (12%);
- In each of the single science subject groups identified in this study, the number of non-Scottish entrants is higher than the number of Scottish entrants in Veterinary Medicine, Agriculture, Mathematical

Science, Computer Science and particularly in Engineering and Technology;

- As proportions of the overall total number of entrants in the subject group, rest of the UK entrants account for: 12% in Medical Science; 10% in Life Science and 22% in Physical Science;
- As proportions of the overall total number of entrants in the subject group, rest of the EU entrants studying in Scotland account for: 10% in Medical Science; 8% in Life Science and 28% in Physical Science; and
- As proportions of the overall total number of entrants in the subject group, non-EU students studying in Scotland account for: 6% in Medical Science; 5% in Life Science and 25% in Physical Science.

Figure 4 shows the long-term trend (1996-97 to 2004-05) for entrants to science and non-science postgraduate courses, by domicile.

Figure 4: Entrants to science and non-science postgraduate courses, by domicile, 1996-97 to 2004-05

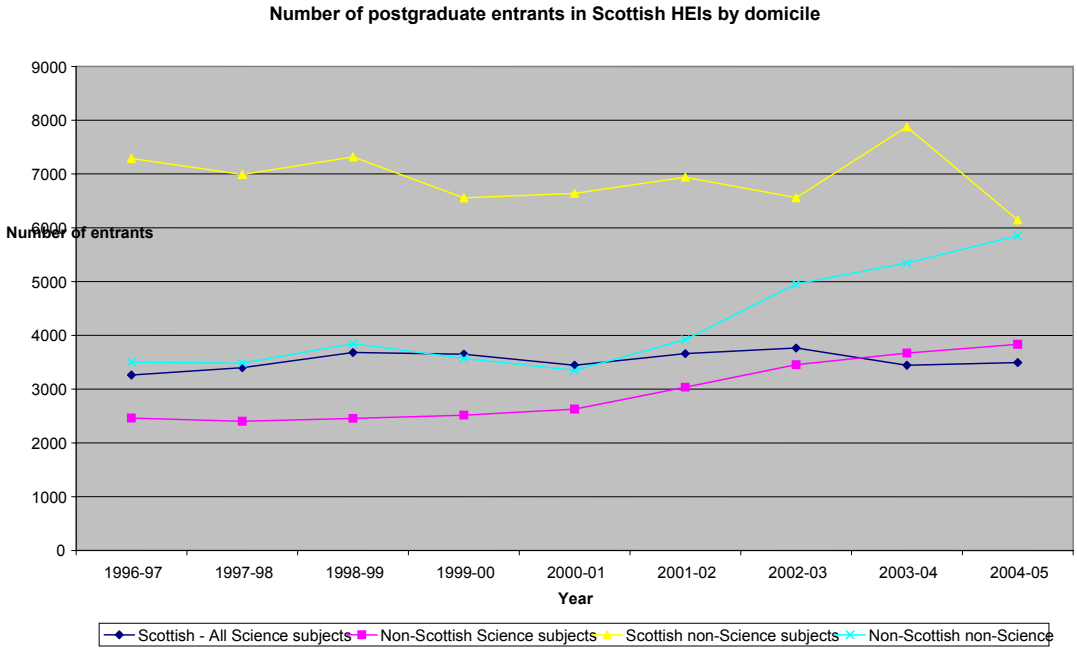


Figure 4 shows that:

- There has been a 7% increase in the number of Scottish postgraduate entrants in science subjects since 1996-97 compared to a 16% decrease in the number of Scottish non – science postgraduate entrants;
- Between 1996-97 and 2004-05 there has been a 56% increase in the number of non-Scottish postgraduate entrants in science subjects,

compared to a 67% increase in non-Scottish entrants to non-science subjects; and

- As witnessed in the analysis of non-Scottish first degree entrants, the main increases in non-Scottish entrants occurred from 2000-01 onwards.

The analysis now looks at developments within the three broad Science Themes (Medical, Life, and Physical Science) in more detail.

Data – Long Term trends in Medical Science

It is important to note that places for some courses in the area of Medical Science are controlled by the Scottish Executive. More information can be found in Annex 2.

First Degree

Figure 5 presents the long-term trend (1996-97 to 2004-05) in entrants to first degree courses in the area of Medical Science. The chart shows the overall trend for Medical Science and the trends for the subjects groups within this area.

Figure 5: Entrants to first degree Medical Science courses at Scottish HEIs, 1996-97 to 2004-05

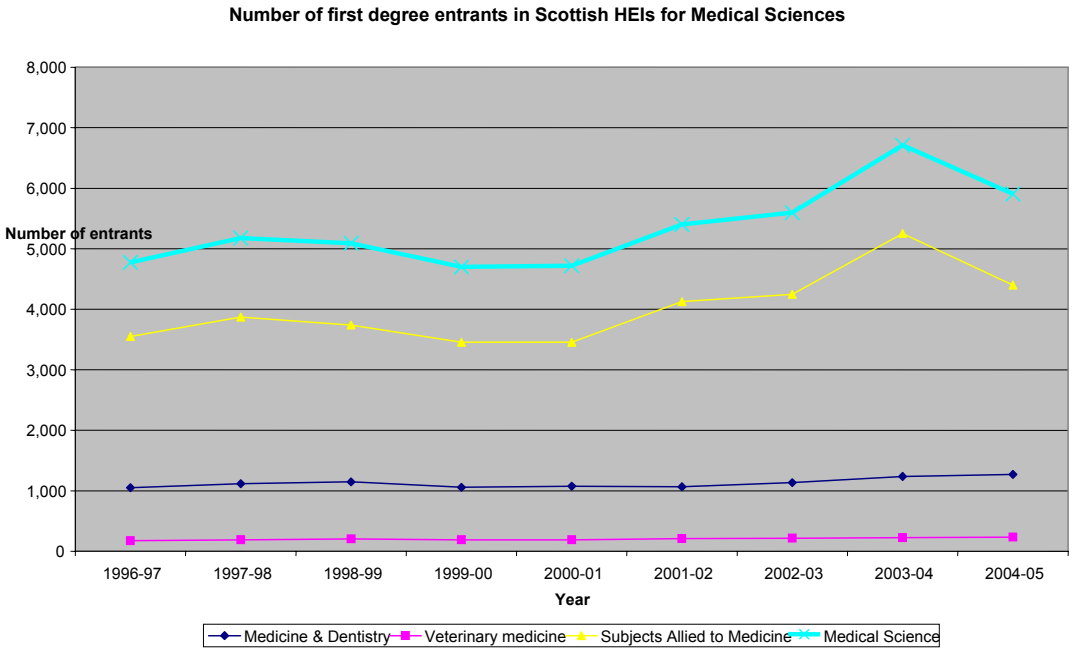


Figure 5 shows that:

- The majority of entrants (75%) to Medical Science at Scottish HEIs were undertaking a course in Subjects Allied to Medicine; and
- Over the period 1996-97 to 2004-05 there has been an increase in entrants to all subject groups within the area of Medical Science.

Figure 6 presents the percentage change, over the period 1996-97 to 2004-05, in the number of entrants to first degree courses in the subject groups within Medical Science.

Figure 6: Percentage change in number of first degree entrants to Medical Science, by domicile, 1996-97 to 2004-05

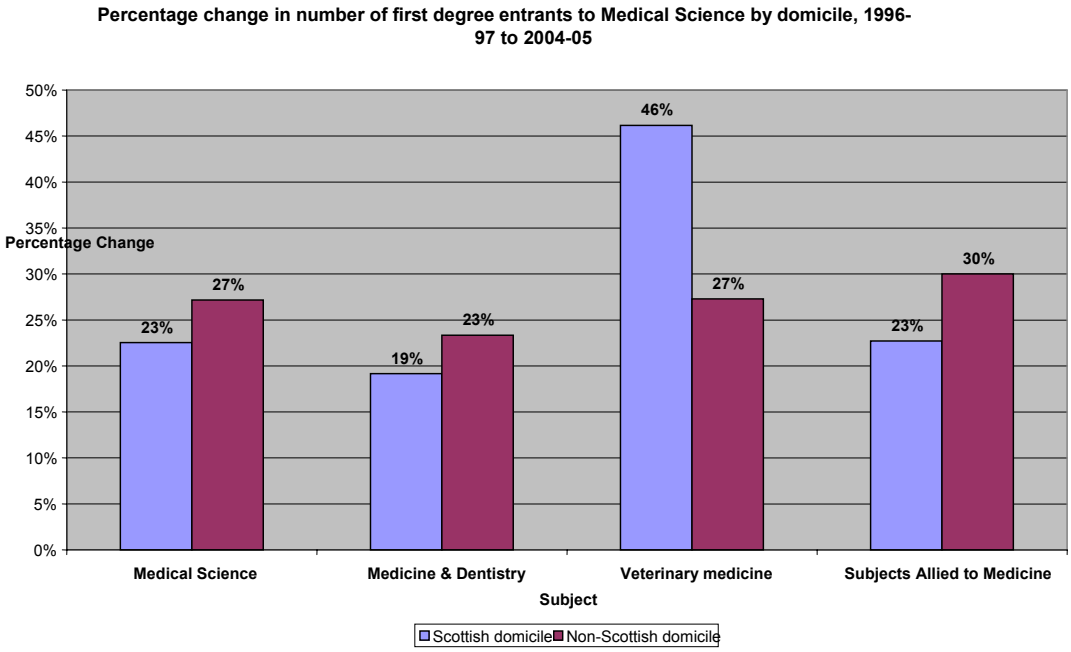


Figure 6 shows that:

- All subject groups within the area of Medical Science witnessed considerable growth in the number of entrants; and
- With the exception of Veterinary Medicine, subjects in this area witnessed relatively higher levels of growth in the number of non-Scottish domiciled entrants.

Postgraduate provision

Figure 7 presents the long-term trend (1996-97 to 2004-05) in entrants to postgraduate courses in the area of Medical Science. The chart shows the overall trend for Medical Science and the trends for the subjects groups within this area.

Figure 7: Entrants to postgraduate Medical Science at Scottish HEIs, 1996-97 to 2004-05

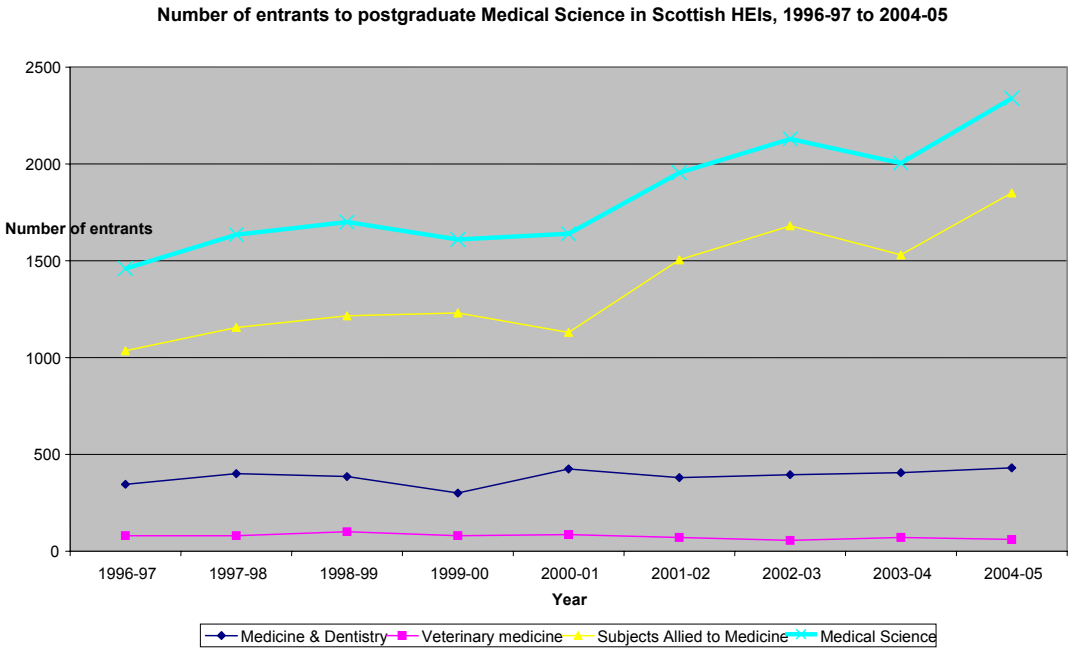


Figure 7 shows that:

- As with first degree provision in this area, postgraduate provision is dominated by courses in Subjects Allied to Medicine (79% of entrants in this area in 2004-05); and
- Whilst there have been increases in entrant numbers to courses in Medicine and Dentistry, and Subjects Allied to Medicine, there has been a decrease in entrants to courses in Veterinary Medicine.

Figure 8 presents the percentage change, over the period 1996-97 to 2004-05, in the number of entrants to postgraduate courses in the subject groups within Medical Science.

Figure 8: Percentage change in number of postgraduate entrants to Medical Science, by domicile, 1996-97 to 2004-05

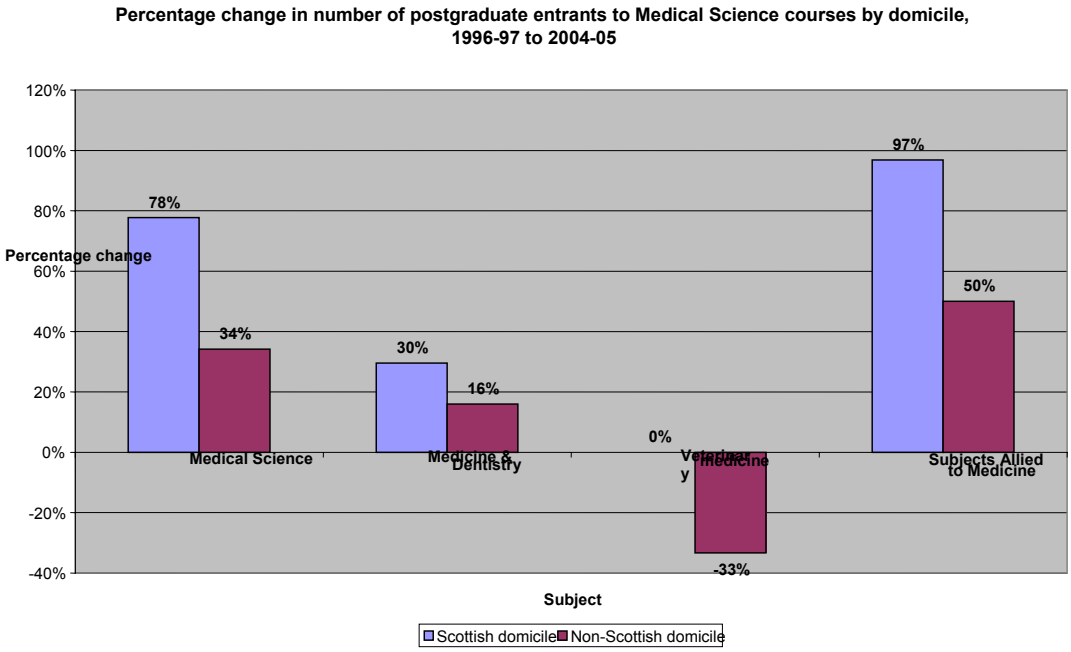


Figure 8 shows that:

- In contrast to the changes in entrants at the first degree level, there have been relatively higher percentage changes in the number of Scottish domiciled entrants to Medical Science courses; and
- The number of non-Scottish domiciled entrants to courses in Veterinary Medicine has declined between 1996-97 to 2004-05

Data - Short-term trends in Medical Science

In order to provide more context to the changes witnessed in the long-term trend, this section presents the short-term changes (2002-03 to 2004-05) at the principal subject level for courses in the subject groups within Medical Science. In figures 9 to 11 entrants to principal subjects in these subject groups are disaggregated by their level of study.

Medicine & Dentistry

Figure 9 shows, by principal subject and level of study, entrants to courses in Medicine & Dentistry over the period 2002-03 to 2004-05.

Figure 9: Entrants to Medicine & Dentistry principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	**2002-03**	**2003-04**	**2004-05**	**2002-03**	**2003-04**	**2004-05**	**2002-03**	**2003-04**	**2004-05**
Pre-clinical Medicine	837	894	937	0	3	2	837	897	939
Pre-clinical Dentistry	119	155	143	0	0	0	119	155	143
Clinical Medicine	157	179	162	363	398	415	519	576	577
Clinical Dentistry	2	6	19	22	11	9	24	17	28
Others in Medicine and Dentistry	21	5	9	7	0	1	28	5	10
Total	**1,135**	**1,238**	**1,270**	**392**	**412**	**427**	**1,527**	**1,650**	**1,697**

Figure 9 shows that:

- First degree courses are dominated by the Pre-clinical Medicine and Clinical Medicine, whilst the majority of postgraduate entrants are undertaking Clinical Medicine courses; and
- There have been increases in the number of entrants at both the postgraduate (9%) and first degree levels (12%) However, as described in Annex 2, this is partly due to changes in the number of places for these subjects.

Figure 10 shows, by principal subject and level of study, entrants to courses in Veterinary Medicine over the period 2002-03 to 2004-05.

Figure 10: Entrants to Veterinary Medicine principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Pre-clinical Veterinary Medicine	213	226	234	23	22	37	236	248	271
Clinical Veterinary Medicine and Dentistry	0	2	0	33	44	22	33	46	22
Total	**213**	**228**	**234**	**56**	**66**	**59**	**269**	**294**	**293**

Figure 10 shows that:

- The number of entrants to courses at both the postgraduate and first degree levels have increased over the period, although places in this area are also controlled.

Figure 11 shows, by principal subject and level of study, entrants to courses in Subjects Allied to Medicine over the period 2002-03 to 2004-05.

Figure 11: Entrants to Subjects Allied to Medicine principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Anatomy, Physiology and Pathology	489	467	367	222	152	193	711	619	560
Pharmacology, Toxicology and Pharmacy	340	328	360	204	163	319	543	491	679
Complementary Medicine	43	122	125	4	0	0	47	122	125
Nutrition	116	110	116	97	60	72	213	170	188
Ophthalmics	78	86	86	3	3	5	81	89	91
Aural and Oral Sciences	39	45	0	0	0	0	39	45	0
Nursing	2,596	3,509	2,698	400	465	470	2,996	3,974	3,168
Medical Technology	190	164	178	80	68	96	270	232	274
Others in Subjects allied to Medicine	360	418	470	664	619	689	1,024	1,037	1,159
Total	**4,250**	**5,249**	**4,401**	**1,674**	**1,530**	**1,843**	**5,924**	**6,779**	**6,244**

Figure 11 shows that:

- In general, the number of entrants to postgraduate and first degree courses in Subjects Allied to Medicine increased (by 10% and 4% respectively);
- Entrants to Anatomy, Physiology and Pathology fell at both postgraduate (by 13%) and first degree (by 25%) levels;
- The largest increase in entrants at the postgraduate level was in Pharmacology, Toxicology and Pharmacy, where entrants increased by 57% between 2002-03 and 2004-05; and
- The number of entrants to first degree Complementary Medicine nearly tripled between 2002-03 and 2004-05, albeit from a low base.

Data – Long term trends in Life Science

First Degree Provision

Figure 12 presents the long-term trend (1996-97 to 2004-05) in entrants to first degree courses in the area of Life Science. The chart shows the overall trend for Life Science and the trends for the subjects groups within this area.

Figure 12: Entrants to first degree Life Science courses at Scottish HEIs, 1996-97 to 2004-05

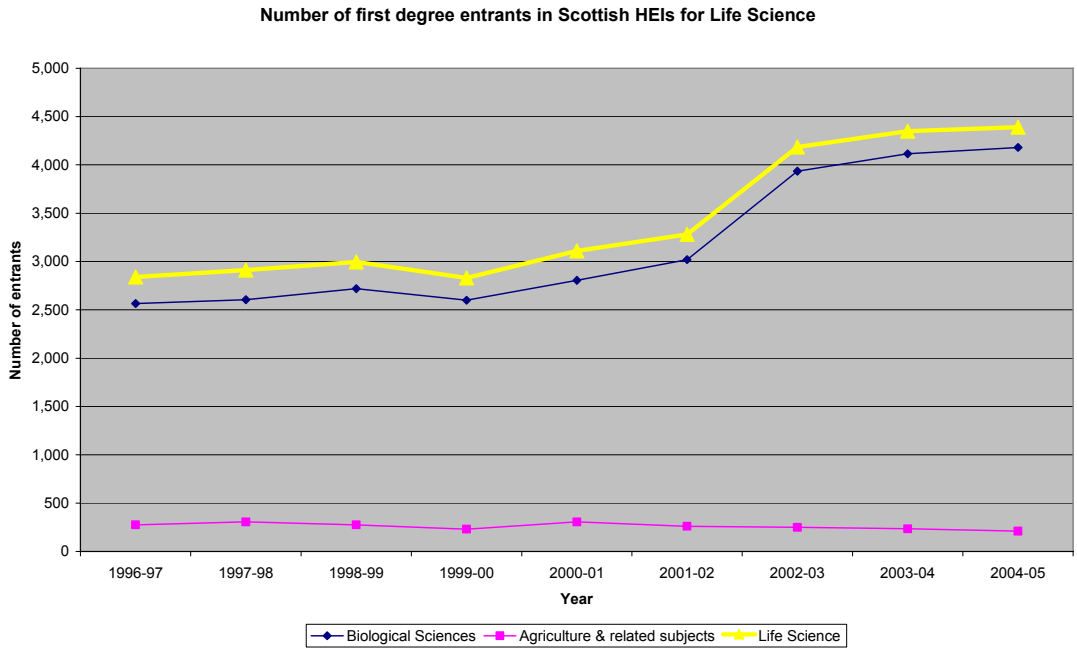


Figure 12 shows that:

- At the first degree level entrants to courses in Life Sciences are predominately undertaking courses in Biological Sciences (95% of first degree Life Science entrants in 2004-05); and
- There has been strong growth in the number of entrants to Biological Science, particularly over the period 2001-02 to 2004-05 (where entrants increased by 38%).

Figure 13 presents the percentage change, over the period 1996-97 to 2004-05, in the number of entrants to first degree courses in the subject groups within Life Science.

Figure 13: Percentage change in number of first degree entrants to Life Science, by domicile, 1996-97 to 2004-05

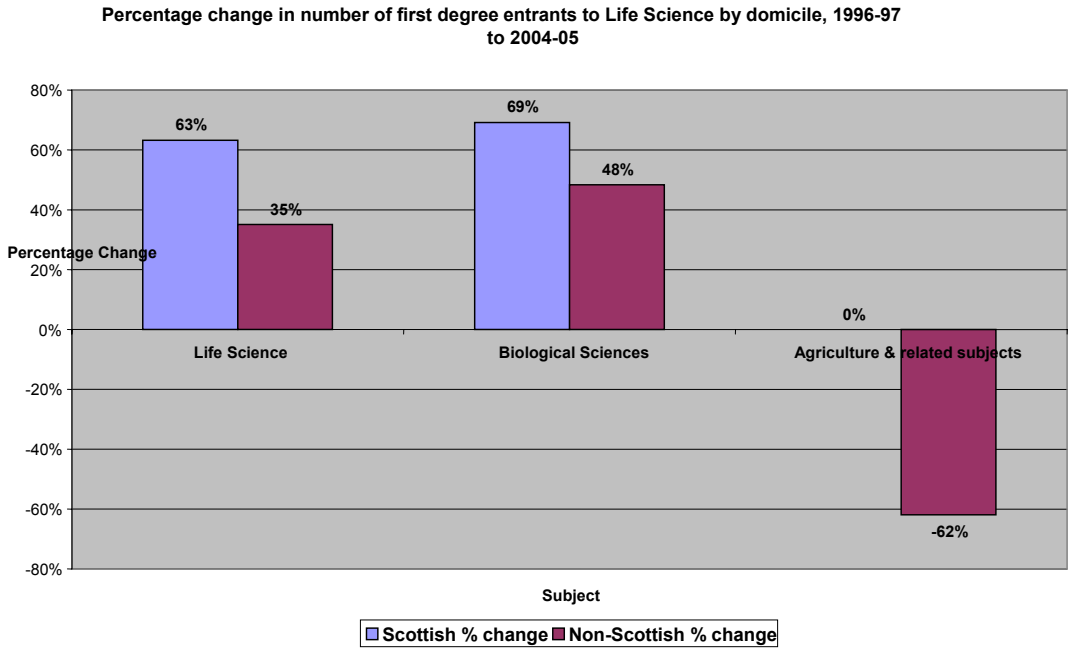


Figure 13 shows that:

- There were higher increases in the number of Scottish domiciled entrants to Biological Sciences, compared to non-Scottish domiciled entrants; and
- The decline in entrants to Agriculture & Related Subjects was due to falling numbers of non-Scottish domiciled entrants.

Postgraduate

Figure 14 presents the long-term trend (1996-97 to 2004-05) in entrants to postgraduate Life Science. The chart shows the overall trend for Life Science and the trends for the subject groups within this area.

Figure 14: Entrants to postgraduate Life Science at Scottish HEIs, 1996-97 to 2004-05

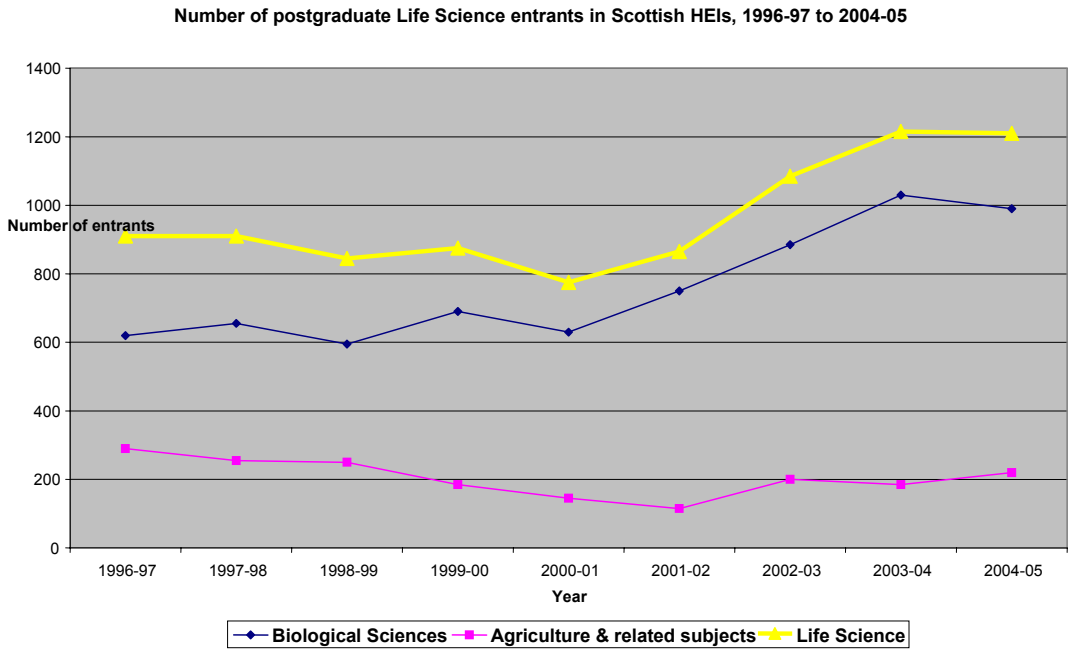


Figure 14 shows that:

- As was witnessed at the first degree level of study, there has been an increase in the number of entrants to Biological Sciences, and a fall in entrants to Agriculture & Related Subjects; and
- As with courses at the first degree level, entrants to postgraduate Life Science are predominately undertaking Biological Sciences (82% of entrants).

Figure 15 presents the percentage change, over the period 1996-97 to 2004-05, in the number of entrants to postgraduate courses in the subject groups within Life Science.

Figure 15: Percentage change in number of postgraduate entrants to Life Science, by domicile, 1996-97 to 2004-05

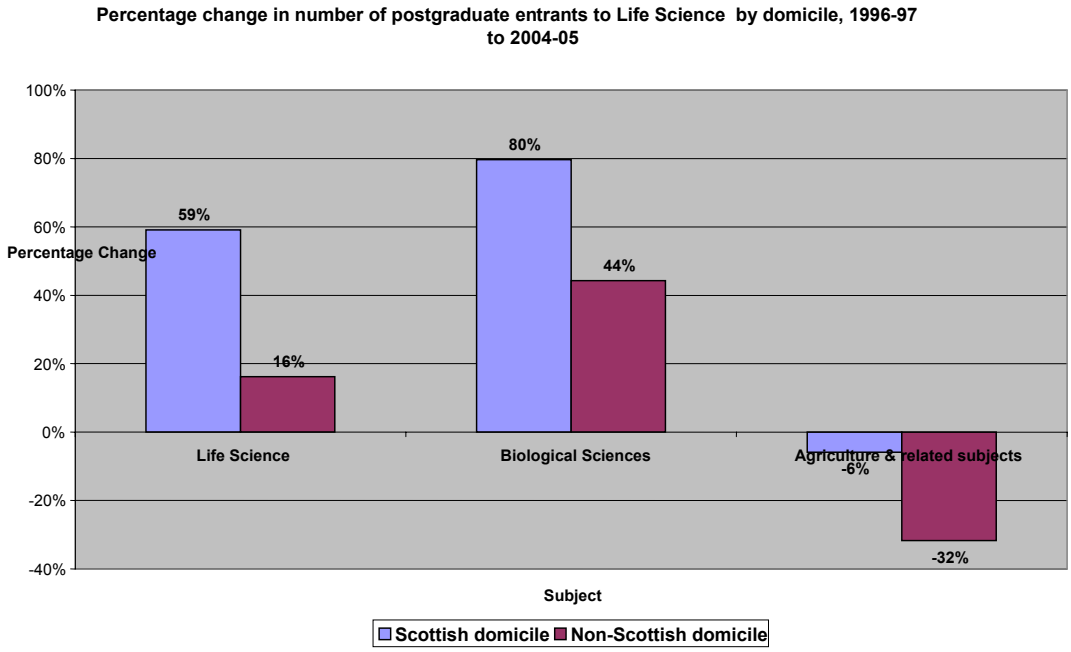


Figure 15 shows that:

- The majority of the growth in entrants to postgraduate Life Science has been due to the considerable increases in Scottish domiciled entrants (who are undertaking courses in Biological Science); and
- As witnessed with first degree level entrants, the decreases in entrants to postgraduate courses in Agriculture & Related Subjects has been driven by the falling number of non-Scottish domiciled entrants.

Data - Short-term trends in Life Science

In order to provide more context to the changes witnessed in the long-term trend, this section presents the short-term changes (2002-03 to 2004-05) at the principal subject level for courses in the subject groups within Life Science. In figures 16 and 17 entrants to principal subjects in these subject groups are disaggregated by their level of study.

Biological Sciences

Figure 16 shows, by principal subject and level of study, entrants to Biological Sciences over the period 2002-03 to 2004-05.

Figure 16: Entrants to Biological Sciences principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	**2002-03**	**2003-04**	**2004-05**	**2002-03**	**2003-04**	**2004-05**	**2002-03**	**2003-04**	**2004-05**
Biological Sciences	0	0	0	10	7	6	10	8	6
Biology	1,042	1,125	1,009	297	391	282	1,338	1,516	1,291
Botany	2	14	14	26	22	57	28	36	71
Zoology	197	196	185	30	40	37	227	236	222
Genetics	61	67	58	39	47	35	100	114	93
Microbiology	139	173	184	49	75	86	188	248	270
Sports Science	359	468	574	32	5	0	391	473	574
Molecular Biology, Biophysics and Biochemistry	170	148	163	98	68	61	268	216	224
Psychology	1,608	1,706	1,751	221	239	289	1,829	1,945	2,040
Others in Biological Sciences	356	224	239	83	138	140	439	362	379
Total	**3,935**	**4,121**	**4,175**	**884**	**1,031**	**993**	**4,819**	**5,152**	**5,168**

Figure 16 shows that:

- In general the number of entrants to postgraduate and first degree Biological Sciences has increased (by 12% and 6% respectively);
- The number of entrants to Biology has fallen at both the postgraduate (by 5%) and first degree levels (by 3%);
- The general increase in entrants to first degree Biological Sciences has been driven by increasing numbers of entrants to Psychology (9% increase); Sports Science (60% increase); and Microbiology (32% increase); and
- The general increase in entrants to postgraduate Biological Sciences has been driven mainly by increasing numbers of entrants to Psychology (31% increase); Microbiology (76% increase); and Botany (where numbers have more than doubled).

Agriculture & Related Subjects

Figure 17 shows, by principal subject and level of study, entrants to Agriculture and Related Subjects over the period 2002-03 to 2004-05.

Figure 17: Entrants to Agriculture and Related principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Animal Science	53	45	49	49	43	37	102	88	86
Agriculture	162	145	141	129	125	155	290	269	296
Forestry	13	21	8	10	13	9	23	34	17
Food and Beverage studies	19	21	6	6	5	10	25	26	16
Agricultural Sciences	0	1	5	1	1	3	1	2	8
Others in Agriculture and related subjects	1	0	0	0	0	0	1	0	0
Total	**247**	**233**	**209**	**194**	**186**	**213**	**441**	**419**	**422**

Figure 17 shows that:

- Generally there has been a fall in the number of entrants to first degree courses (a decrease of 15%), but an increase in entrants to postgradaute courses (an increase of 10%); and
- The general increase in entrants to postgraduate courses is due mainly to the 20% increase in the number of entrants to postgraduate courses in Agriculture.

Data – Long term trends in Physical Science

First Degree Provision

Figure 18 presents the long-term trend (1996-97 to 2004-05) in entrants to first degree courses in the area of Physical Science. The chart shows the overall trend for Physical Science and the trends for the subjects groups within this area.

Figure 18: Entrants to first degree Physical Science at Scottish HEIs, 1996-97 to 2004-05

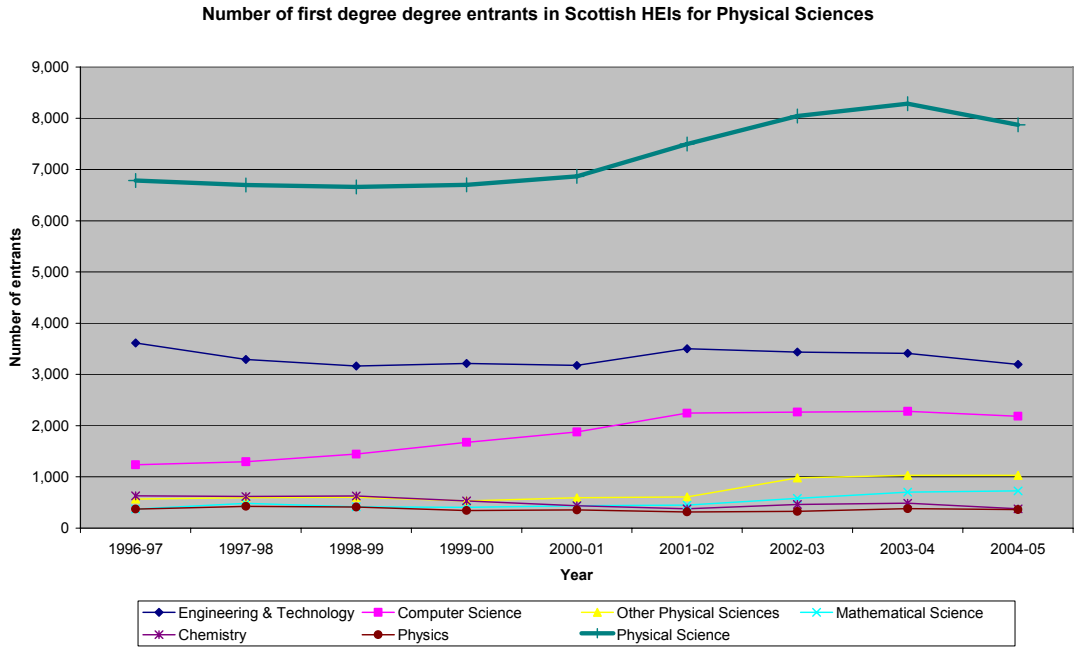


Figure 18 shows that:

- Generally there has been an increase in the number of entrants to Physical Science, particularly over the period 2000-01 to 2004-05 where entrants increased by 15%;
- The general increase over the period 2000-01 to 2004-05 has been driven by increasing entrants to: Computer Science (a 17% increase); Mathematical Sciences (a 67% increase); and Other Physical Sciences (a 75% increase); and
- Over the period 1996-97 to 2004-05 there have been some noticeable decreases in entrants to certain subject groups, particularly to courses in: Engineering & Technology (a 12% decrease); Chemistry (a 41% decrease); and Physics (a 3% decrease).

Figure 19: Percentage change in number of first degree entrants to Physical Science, by domicile, 1996-97 to 2004-05

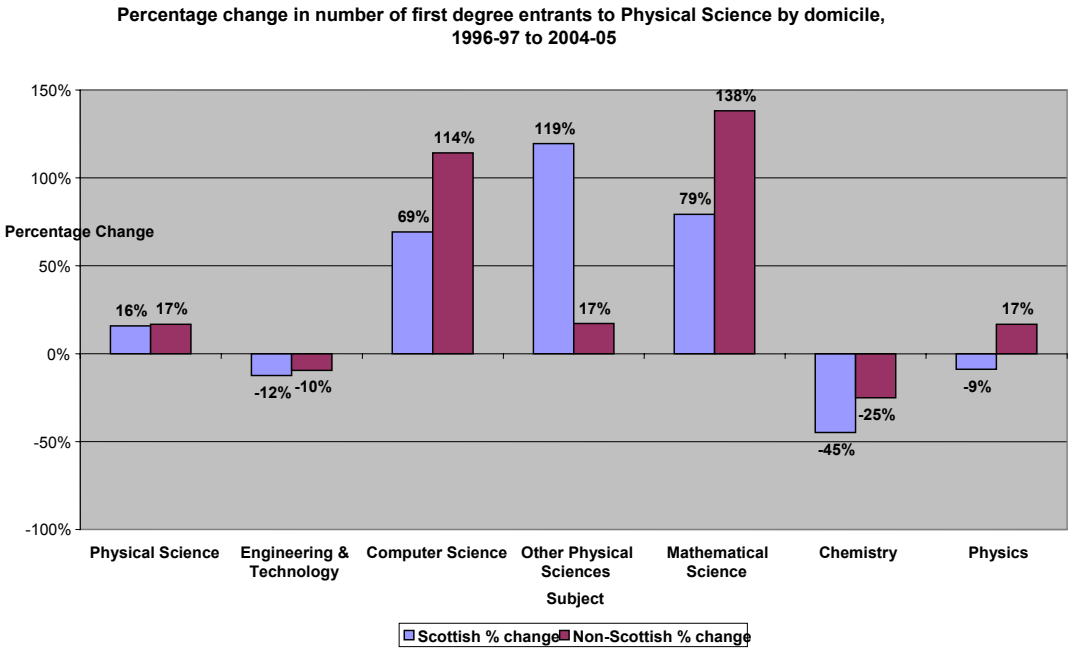


Figure 19 shows that:

- Generally across the area of Physical Science there has been a similar increase in Scottish domiciled and non-Scottish domiciled entrants;
- Between subject groups there are noticeable differences in the changes in entrant numbers by domicile, with larger decreases in Scottish domiciled entrants (relative to non-Scottish domiciled entrants) for Engineering & Technology, and Chemistry; and
- The slight fall in entrants to courses in Physics is due to decreases in the number of Scottish domiciled entrants to courses in this area (as there has been an increase in the number of non-Scottish domiciled entrants to first degree Physics).

Postgraduate

Figure 20 presents the long-term trend (1996-97 to 2004-05) in entrants to postgraduate Physical Science. The chart shows the overall trend for Physical Science and the trends for the subjects groups within this area.

Figure 20: Entrants to postgraduate Physical Science at Scottish HEIs, 1996-97 to 2004-05

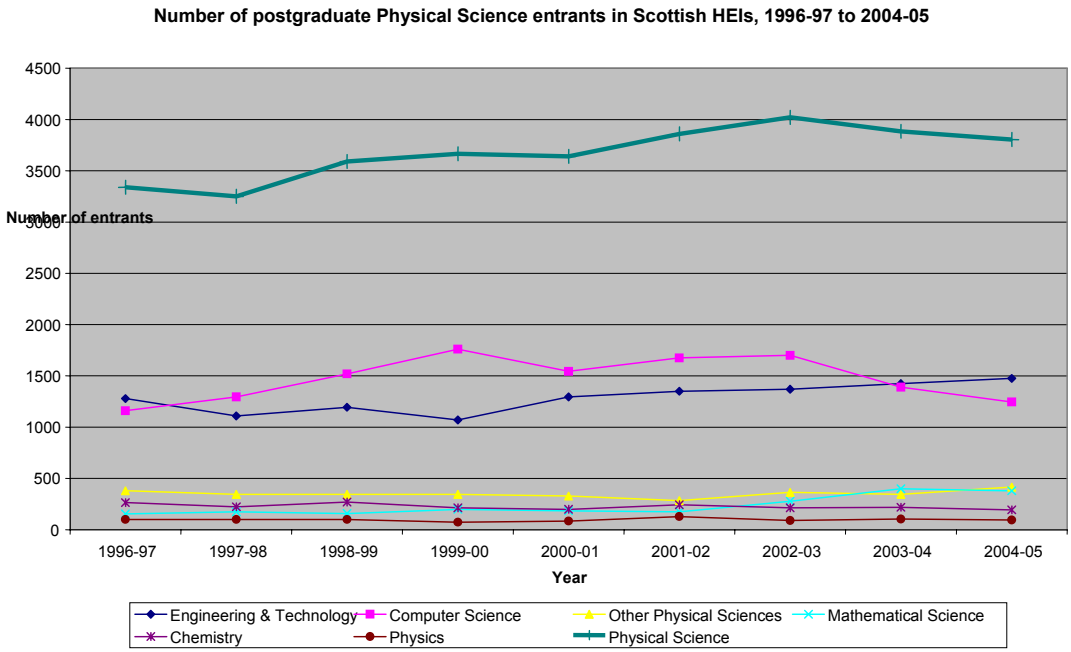


Figure 20 shows that:

- There has been, in general, an increase (of 14%) in entrants to postgraduate Physical Science over the period 1996-97 to 2004-05; and
- As with entrants to first degree Physical Science, there is a mixed picture in the trends by subject group, with increases in entrants to Engineering & Technology (a 15% increase), and Mathematical Sciences (a 145% increase, albeit from a low base), but decreases in Chemistry (a 26% fall) and Physics (a 5% fall).

Figure 21 presents the percentage change, over the period 1996-97 to 2004-05, in the number of entrants to postgraduate courses in the subject groups within Physical Science.

Figure 21: Percentage change in number of postgraduate entrants to Physical Science, by domicile, 1996-97 to 2004-05

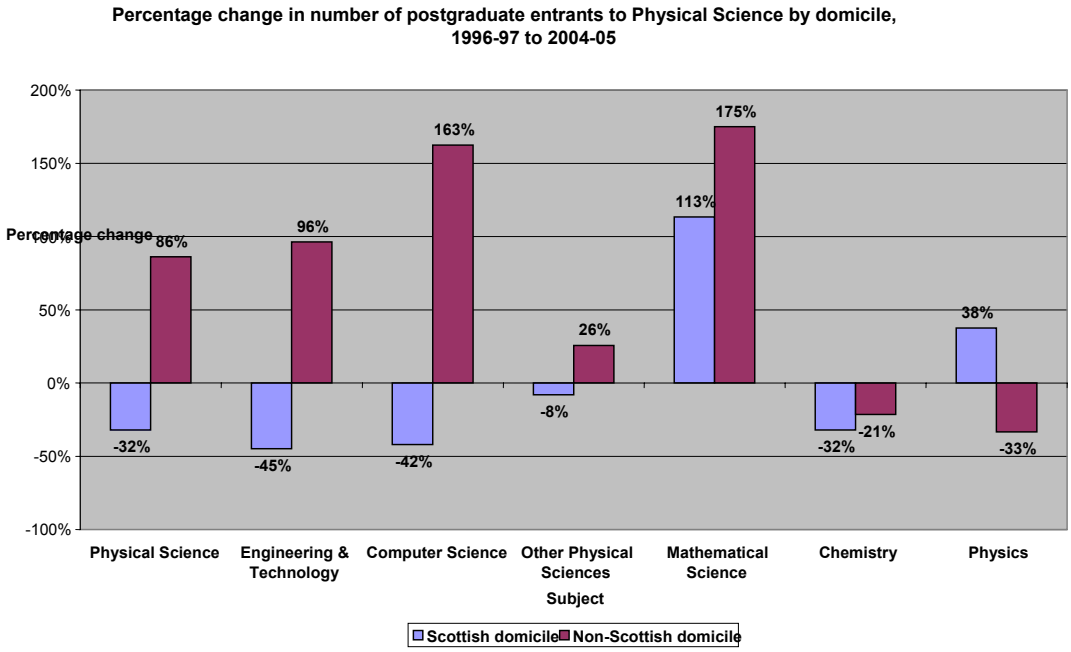


Figure 21 shows that:

- In general, the increase to postgraduate Physical Science has been driven by non-Scottish domiciled entrants; and
- Most of the Physical Science subject groups witnessed a fall in the number of Scottish domiciled entrants, with the exception of Mathematical Science, and Physics.

Data - Short-term trends in Physical Science

In order to provide more context to the changes witnessed in the long-term trend, this section presents the short-term changes (2002-03 to 2004-05) at the principal subject level for courses in the subject groups within Physical Science. In figures 22 to 24 entrants to principal subjects in these subject groups are disaggregated by their level of study.

Engineering & Technology

Figure 22 shows, by principal subject and level of study, entrants to courses in Engineering & Technology over the period 2002-03 to 2004-05.

Figure 22: Entrants to Engineering & Technology principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	**2002-03**	**2003-04**	**2004-05**	**2002-03**	**2003-04**	**2004-05**	**2002-03**	**2003-04**	**2004-05**
Engineering	0	36	21	0	8	6	0	44	26
General Engineering	230	373	368	282	293	501	512	665	869
Civil Engineering	560	670	767	142	180	201	702	850	968
Mechanical Engineering	593	623	656	148	131	60	741	754	716
Aerospace Engineering	131	129	123	9	3	15	140	132	138
Naval Architecture	45	76	66	29	33	26	74	109	92
Electronic and Electrical Engineering	1,274	1,005	755	407	351	417	1,680	1,355	1,172
Production and Manufacturing Engineering	289	254	200	163	123	44	452	377	244
Chemical, Process and Energy Engineering	167	152	142	138	179	187	305	331	329
Others in Engineering	2	10	6	0	0	0	2	10	6
Technologies	1	0	0	0	0	0	1	0	0
Minerals Technology	0	0	0	35	79	11	35	79	11
Polymers and Textiles	63	0	0	8	0	0	71	0	0
Materials Technology not otherwise specified	1	1	0	0	0	6	1	1	6
Maritime Technology	1	0	0	0	0	0	1	0	0
Industrial Biotechnology	3	0	0	0	0	0	3	0	0
Others in Technology	75	87	89	17	41	3	92	128	92
Total	**3,433**	**3,413**	**3,193**	**1,377**	**1,420**	**1,476**	**4,810**	**4,833**	**4,669**

Figure 22 shows that:

- Generally there has been a decrease in the number of entrants to first degree Engineering & Technology (a fall of 7%), but entrants to postgraduate courses have increased (by 7%);
- The decreases at the first degree level have been due to falling numbers of entrants to: Electronic and Electrical Engineering (a decrease of 41%); Production and Manufacturing Engineering (a decrease of 31%); and Chemical, Process and Energy Engineering (a decrease of 15%);
- Entrants to first degrees have increased in the following subjects: General Engineering (an increase of 60%); Civil Engineering (an increase of 37%); and Mechanical Engineering (an increase of 11%);
- Entrants to postgraduate level courses have increased in the following subjects: General Engineering (an increase of 78%); Civil Engineering (an increase of 42%); and Chemical, Process and Energy Engineering (an increase of 36%); and
- Entrants to postgraduate courses have decreased in the following subjects: Mechanical Engineering (a decrease of 60%); and Production and Manufacturing Engineering (a decrease of 73%).

Mathematical & Computer Science

Figure 23 shows, by principal subject and level of study, entrants to courses in Mathematical and Computer Science over the period 2002-03 to 2004-05.

Figure 23: Entrants to Mathematical & Computer Science principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Mathematical and Computing Sciences	0	32	9	0	8	6	0	40	14
Mathematics	453	534	653	100	145	229	552	679	882
Operational Research	2	1	0	52	60	47	54	61	47
Statistics	123	129	64	131	192	96	253	321	159
Computer Science	1,915	1,645	1,681	812	597	736	2,727	2,242	2,417
Information Systems	230	429	343	780	703	429	1,010	1,132	773
Software Engineering	84	172	137	64	59	24	147	230	161
Artificial Intelligence	38	38	24	42	39	50	80	77	74
Total	**2,843**	**2,980**	**2,910**	**1,979**	**1,801**	**1,616**	**4,822**	**4,781**	**4,526**

Figure 23 shows that:

- Generally, there has been an increase in the number of entrants to Mathematical and Computer Science (increase of 2%), but entrants to postgraduate courses have decreased (a fall of 18%);
- Entrants to first degree courses have increased in the following subjects: Mathematics (increase of 44%); Information Systems (increase of 49%); and Software Engineering (increase of 64%);
- Entrants to first degree courses have decreased in the following subjects: Computer Science (decrease of 12%); and Statistics (decrease of 48%);
- At the postgraduate level the only subject to witness a considerable increase in entrants was Mathematics where there was an increase of 130%; and
- Entrants to postgraduate level courses decreased in the following subjects: Computer Science (decrease of 9 per cent); Statistics (decrease of 27%); and Information Systems (decrease of 45%).

Chemistry, Physics and Other Physical Sciences

Figure 24 shows, by principal subject and level of study, entrants to Chemistry, Physics and Other Physical Sciences over the period 2002-03 to 2004-05.

Figure 24: Entrants to Chemistry, Physics and Other Physical Sciences principal subjects, 2002-03 to 2004-05

	First Degree			Postgraduate			Total		
Principal Subject	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Chemistry	456	479	375	217	223	189	673	702	564
Physics	320	379	358	88	105	101	408	484	459
Physical Sciences	0	32	29	0	0	0	0	32	29
Materials Science	1	1	0	1	1	0	2	2	0
Forensic and Archaeological Science	112	146	245	4	2	43	116	148	289
Astronomy	90	97	75	16	19	16	106	116	91
Geology	198	191	166	53	56	54	251	247	220
Ocean Sciences	10	10	2	3	5	14	13	15	16
Physical and Terrestrial Geographical and Environmental Sciences	394	435	403	273	249	265	667	684	668
Others in Physical Sciences	178	120	112	4	0	16	182	120	128
Total	**1,759**	**1,891**	**1,765**	**658**	**659**	**697**	**2,417**	**2,550**	**2,462**

Figure 24 shows that:

- Generally there has been an increase in the number of entrants to postgraduate courses (increase of 6%), but entrants to first degree courses have remained relatively unchanged;
- Entrants to Physics have increased at both the first degree level (by 12%), and the postgraduate level (by 15%);
- There has been a decrease in entrants to Chemistry at both the first degree (a decrease of 18%), and postgraduate (a decrease of 13%) levels;
- The number of entrants to Forensic and Archaeological Science have increased considerably at both first degree level (where they have more than doubled), and postgraduate level (where the number of entrants in 2004-05 was more than ten times higher than in 2002-03, albeit from a low initial base); and
- The number of entrants to first degree courses in Geology have decreased by 16%, although entrants to postgraduate courses have remained stable.

Part 4 – GRADUATE DESTINATIONS DATA

Data sources

Information in this section has been provided by the Scottish Funding Council and the Scottish Executive and includes data from *"On Track: Class of 2004", "Scotland's Class of '99"*, and *"Higher Education Graduates and Graduate Destinations 2004-05"*. Wage premia was considered using the Annual Survey of Hours and Earnings

Science graduate destinations

We have examined, in the earlier parts of this report, the changing pattern of provision and demand for 'Science' courses in Scotland over the past 10 years.

This section examines how science graduates fare after they leave a Higher Education Institution and enter the labour market.

Early labour market outcomes

All graduates from higher education courses are asked to fill in a First Destinations survey six months after graduation. This survey captures information on whether or not graduates are in employment, and if so in what type of occupation, and in what sector. In figures 1 and 2, the science graduates' outcomes from 2004-05 (for occupation and for sector) are compared to those for all graduates.

Figure 1: Occupations of graduates from Scottish HEIs six months after graduation

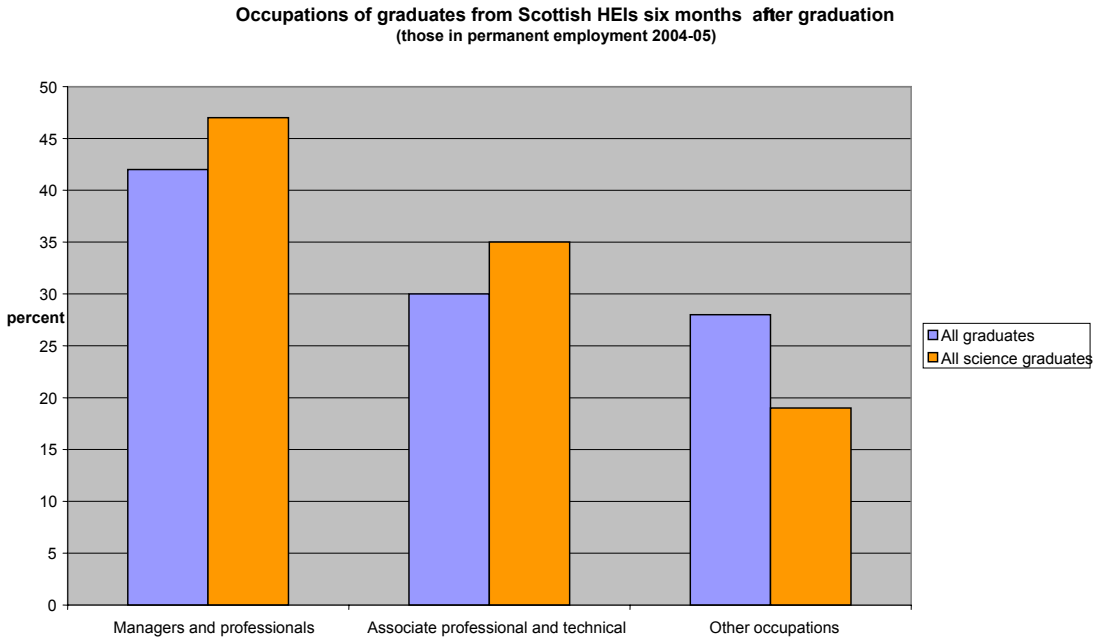
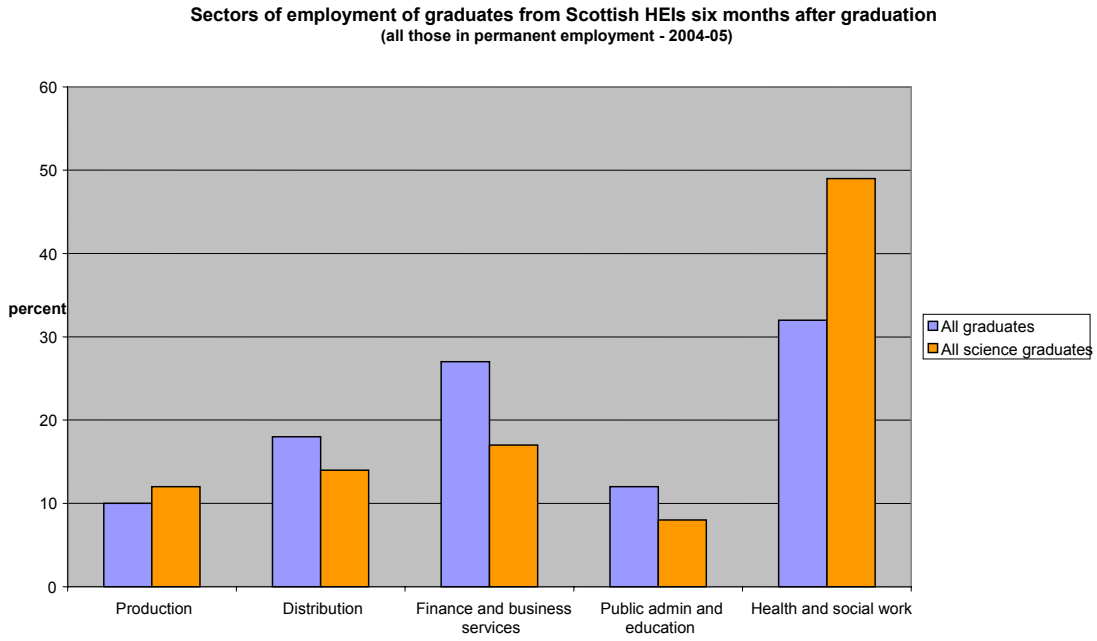


Figure 2: Sectors of employment for graduates from Scottish HEIs six months after graduation



Figures 1 and 2 show that:

- Science graduates are more likely, compared to graduates from other subjects, to enter into managerial and professional roles (47% of science graduates, compared to 42% of other graduates), or associate professional and technical roles (35% of science graduates, compared to 30% of other graduates), occupations; and
- Science graduates are considerably more likely, compared to all graduates, to be in permanent employment in Health and Social Work six months after graduation (49% of science graduates in permanent employment, compared to 32% of all graduates).

The First Destinations Survey also provides information on the location of where graduates are employed. The 2004-05 data shows that:

- Science graduates from Scottish HEIs were just as likely, when compared to all graduates, to be employed in Scotland six months after graduation (77 per cent of both Science, and all graduates, in permanent employment were working in Scotland).

Satisfaction and outcomes

On Track: Class of 2004 is a five year longitudinal study, funded by the SFC, of graduating further and higher education students. The second sweep of the survey was completed a year after students gained their qualification. This survey allows us to not only explore the outcomes of graduates, but also their satisfaction with their experience of further and higher education.

Sweep 2 of *On Track* shows that:

- Looking at subject area, satisfaction levels were high across all areas but those studying Humanities or Science, Maths and Engineering were slightly more satisfied than those studying Business or Arts subjects;

- Those who studied Science, Maths and Engineering are more likely to agree that their job prospects had improved (76%), compared to Business (66%), Humanities (70%), Sport, Leisure and Care Services (65%) and Arts (58%) students;

- In terms of subject choice, fewer of those who studied Arts (26%) are working full-time than those who studied Business (50%), Humanities (48%), Sport, Leisure and Care Services (38%) or Science,

Maths and Engineering (58%). The highest proportion of Arts students are in part-time employment (37%). Business students (71%) and Science, Maths and Engineering students (69%) are more likely to have the added security of a permanent contract compared with the other subjects;

- High numbers of those who studied Humanities (37%) work in the education sector compared with only 5% of those who studied Science, Maths and Engineering – these learners are more likely to work in Health and social work (as supported by the results of the First Destinations Survey); and

- As found in Sweep 1 of *On Track* the group most likely to feel that their jobs are appropriate to their degree subject are the Science, Maths and Engineering graduates (72%).

Medium-term Graduate Outcomes

The First Destinations Survey provides a useful picture of the very early labour market experiences of graduates. However, it often takes longer than six months for graduates to find their place in the labour market (whilst some may choose to undertake further study, or travel). Therefore it is useful to explore outcomes over a longer period of time. *Scotland's Class of '99* was commissioned by the SFC following the publication of the UK-wide study *Class of '99* by the Department for Education and Skills in October 2005.

The UK report explored the early labour market experiences of UK graduates, which includes analysis by subject studied. Due to a smaller sample, the Scottish report analyses the data on graduates from Scottish HEIs in more depth and includes comparisons with the data for graduates from HEIs in the rest of the UK. Therefore there is limited analysis in *Scotland's Class of '99* that examines outcomes by subject studied for graduates from Scottish HEIs. However, using the results from the UK report the following is found:

- Science graduates, particularly those who undertook a course in Medicine & Related, Mathematics & Computing, and Engineering were very likely to indicate that their job, 4 years after graduation is 'appropriate for someone with their qualifications'; and

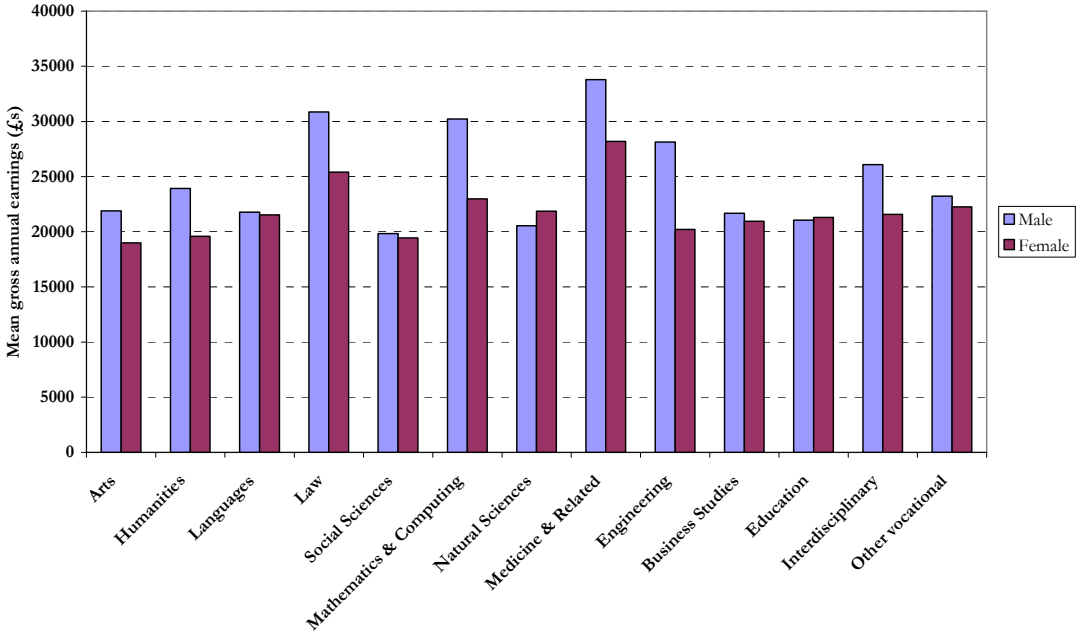
- Graduates from these disciplines were more likely, compared to other graduates to be working in graduate level job[7].

Earnings

Earnings of Scientists

The *Class of '99* report provides a comparison of earnings of graduates from broad subject groups. The average earnings, four years after graduation, for males in the Class of '99 sample was £25,800, and for females it was £22,700. Figure 3 presents an overview of earnings by subject of study, and by gender.

Figure 3: Mean gross earnings of Scottish HEI graduates, by subject of study and gender



Source: The Class of '99 survey

Figure 3 shows that:

- Graduates from the Class of '99 sample who undertook courses in Mathematical & Computing science, Medicine & related, and Engineering were more likely (compared to other graduates) to be on above average earnings four years after graduation.

[7] As defined using *SOC (HE): A Classification of occupations for studying the graduate labour market*, Peter Elias and Kate Purcell (2004) (http://www2.warwick.ac.uk/fac/soc/ier/research/current/7yrs2/rp6.pdf)

Relative changes to the earnings of scientists

Using the *Annual Survey of Hours and Earnings (ASHE)* we also looked at the extent to which the earnings of those working in the Science sector of the economy were changing relative to those in the wider economy. The logic behind this was that any shortage in the supply of qualified individuals to fill these posts should be reflected in an increase in the wages of this group beyond that which was experienced by other workers in the economy between 1998 and 2005.

This approach is complicated by the fact that official income data is based on a sample survey rather than census, and wage figures are therefore estimates subject to a confidence interval rather than distinct points of income. The data suggests that there has not been a statistically significant change in the relationship between earnings in the science sector and the wider economy either up or down. This provides support to the evidence collated elsewhere in this report that there has been no general worsening of the position with regard to the availability of labour in the science sector

In general terms, supply of graduates could reasonably be expected to respond to any market signals which might develop, such as emerging wage premia, as students become aware of these.

Relative earnings premia for scientists

Figure 4 below draws on the government's *Annual Survey of Hours and Earnings (ASHE)* to compare the earnings of those in Science based occupations with those in other occupational groups.

Figure 4 - Median Annual Pay - Gross (£) - For full-time employee jobs by Occupational Group, 2005 - SCOTLAND

Occupation	2006
Science Professionals	£ 33,507
Engineering and IT Professionals	£ 34,844
Health Professionals	£ 49,907
All of the Above	£ 36,441
Managers and Senior Officials	£ 32,935
Professional Occupations	£ 32,040
Associate Professional and Technical Occupations	£ 26,140
Administrative and Secretarial Occupations	£ 17,032
Skilled Trades Occupations	£ 21,322
Personal Service Occupations	£ 15,324
Sales and Customer Service Occupations	£ 13,392
Process, Plant and Machine Operatives	£ 19,911
Elementary Occupations	£ 15,356
All	£ 22,603

Source: Annual Survey of Hours and Earnings, Office for National Statistics

1. Employees on adult rates whose pay for the survey pay-period was not affected by absence.
2. The Occupation Groups are based on Standard Occupation Classification (SOC) Codes. The SOC codes were updated in 2002; a best fit approached has been used here to create a series from 1998 to 2005.
3. Science Professionals include:Chemists; Biological Scientists and Biochemists; Physicists, Geologists and Meterologists;

The table above gives information on the median wages of all those who work within an occupational classification not just the graduates. From the table we can see that "Science Professionals" in the classifications on average earn more than the average for all the standard occupational groups. However they do not on average earn as much as Engineering and IT professionals and Health professionals. It should be noted that there is likely to be more variance amongst the standard occupational groups than within the more tightly defined science professional group.

Part 5 – SCIENCE EMPLOYERS VIEWS

Data sources

Information in this section has been provided by Futureskills Scotland from its 2004 Employers Skills Surveys.

More information about this survey and a series of reports containing results from the 2004 and previous years' surveys can be found on the Futureskills Scotland website (www.futureskillsscotland.org.uk).

Main points

Views of employers in the science sector are similar to those in other sectors. The labour market generally works well for employers and provides them with what they require. Skill shortages and skills gaps are relatively uncommon. Where skills issues do arise, softer core skills are of most concern to employers.

Where views of employers in the science sector do differ from those in other sectors, these are linked to positive developments in the industry.

- Recruitment needs differ in the science sector. Employers in the science sector are more likely to recruit from university. Both type of qualification and subject studied are important in recruiting employees from further and higher education. This suggests employers in the science sector will continue to demand workers with science qualifications.
- Employers in the science sector are more likely to arrange or fund training for their staff. They are also more likely to offer a mixture of both on-the-job and off-the-job training.

Introduction

The views of employers in the science sector are taken from the Scottish Employers Skill Survey 2004. This survey is the largest of its kind in Scotland and its main aim is to provide evidence on the main-skills related issues affecting employers in Scotland. The 2004 survey was based on interviews with more than 7,500 workplaces.

The definition of science industry used in this section is based on the definition used in the *DTI Economics Paper No. 16: Science, Engineering and Technology Skills in the UK*. More information on the industrial sectors included in the definition can be found in Annex 1 of this report.

Challenges facing employers

It is important to set employers' responses to skills questions in a wider context. Employers were asked to identify the main challenges they anticipated facing over the next twelve months. Skills related challenges were not those most cited by employers in the science sector or other sectors (Figure 1). However, employers in the science sector were slightly more likely than employers in other sectors to cite attracting appropriately skilled staff as a challenge over the following twelve months.

The challenges which were mentioned most often by science sector employers were:

- business regulations (18%); and
- increasing competition from within Scotland (11%).

Figure 1: Main challenges faced by employers

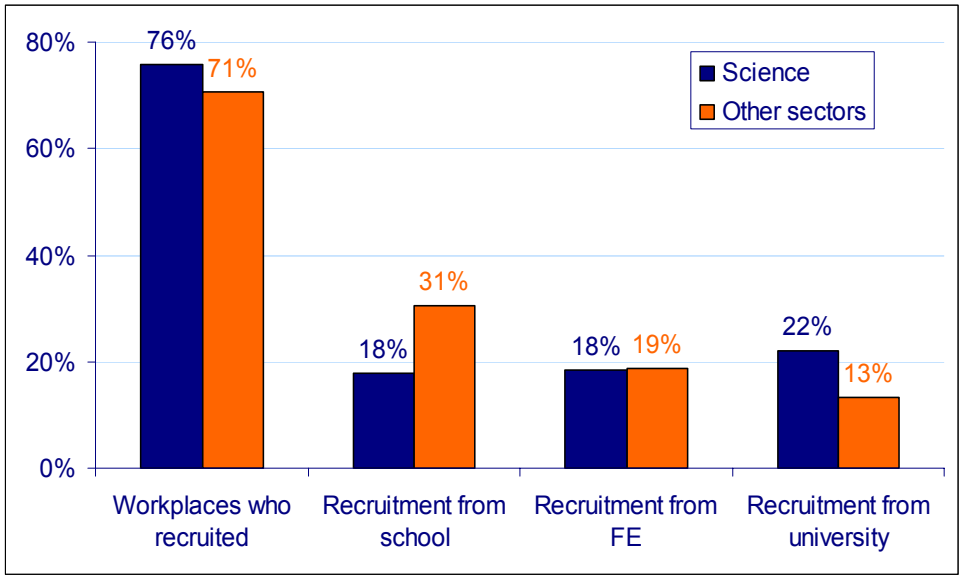
	Science	*Other sectors*
Increasing competition from within Scotland	11%	23.1%
Business regulations	18%	12.3%
Cash flow	11%	9.9%
Attracting appropriately skilled staff	10%	7.7%
Changes in the structure of the market	11%	6.7%

Source: SESS 2004

Recruitment

Around three quarters of employers in the science industry have recruited in the previous two to three years. Of those employers who had recruited, those in the science sector were generally more likely to have recruited a person from a Scottish university (Figure 2).

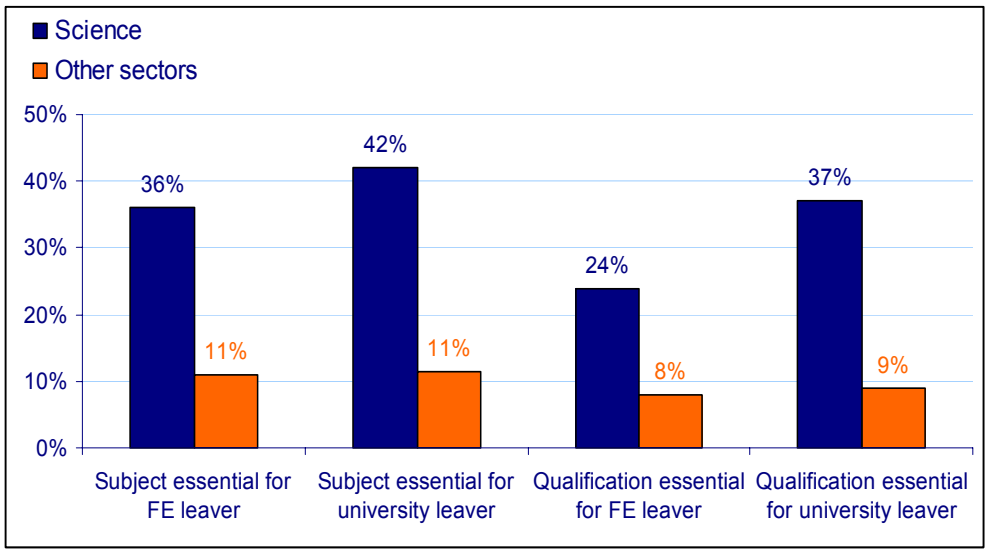
Figure 2: Recruitment activity



Source: SESS 2004

Employers in the science sector were more likely to report that both subject studied and qualification gained were essential for the employee acquiring the job (Figure 3). This was the case for both college and university.

Figure 3: Importance of subject studied and qualification gained in employee acquiring job



Source: SESS 2004

Vacancies, hard-to-fill vacancies and skill shortages

A skill shortage arises when an employer has a vacancy that is hard-to-fill because applicants lack the necessary skills, qualifications or experience. Skill shortages in Scotland are relatively uncommon, affecting around one in twenty workplaces and less than one percent of employees.

Compared with the rest of the economy, the science sector is characterised by (Figure 4):

- skill shortages affecting a similar proportion of workplaces; and
- the same proportion of hard-to-fill vacancies occurring as the result of skill shortages.

Figure 4: Vacancies, hard-to-fill vacancies and skill shortages

	Science	*Other sectors*
% of workplaces with vacancies	23%	18%
% of workplaces with hard-to-fill vacancies	12%	9%
% of workplaces with skill shortages	5.5%	4.8%
Vacancies as % of employees	3.3%	4.0%
Hard-to-fill vacancies as % of employees	1.5%	1.8%
Skill shortages as % of employees	0.8%	1.0%

Source: SESS 2004

When skills issues did arise, employers in the science sector most frequently cited weaknesses in "softer" core skills such as oral communication and customer handling skills (Figure 5). This was the same for employers in other sectors.

Figure 5: Skills lacking in applicants for skill shortage vacancies

	Science	*Other sectors*
Oral communication	48%	64%
Customer handling skills	40%	60%
Problem solving skills	40%	57%
Other technical and practical skills	39%	45%
Planning and organising	38%	41%

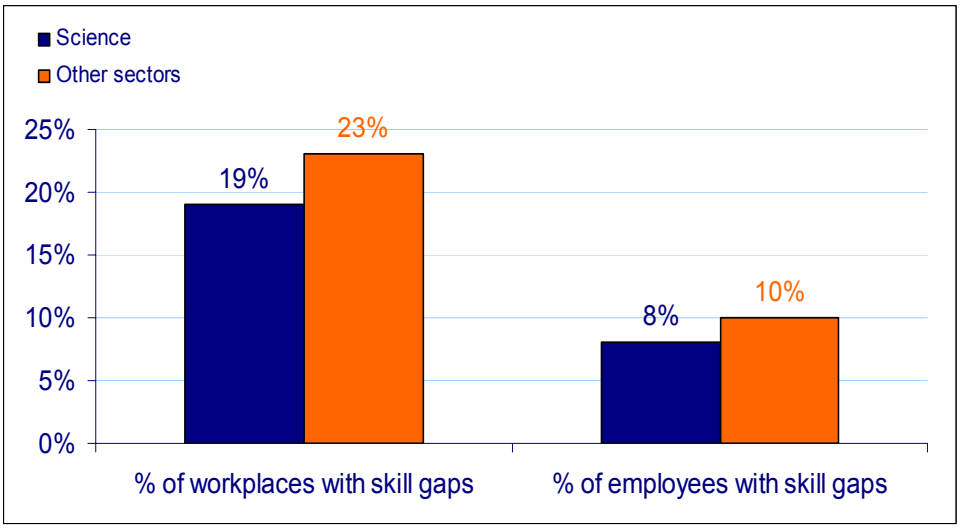
Skill gaps

A skill gap arises when an employer judges that an employee is not fully proficient in their job. Skill gaps are more common that skill shortages, affecting around one in five workplaces.

Compared with the rest of the economy, skills gaps in the science sector affect similar proportions of workplaces and employees (Figure 6).

- 19% of workplaces in the science sector reported having staff that were not fully proficient compared to 23% of workplaces in other sectors.
- Eight per cent of employees in the science sector and ten per cent of employees in other sectors were judged to be not fully proficient.

Figure 6: Skill gaps



Source: SESS 2004

Where skill gaps arose, science sector employers most frequently cited weaknesses in "soft" skills such as planning and organising and problem solving skills (Figure 7). This is similar to the skills cited by other sectors.

Figure 7: Skills lacking in skill gap employees

	Science	*Other sectors*
Planning and organising	57%	53%
Problem solving skills	51%	50%
Team working skills	50%	48%
Customer handling skills	49%	54%
Oral communication	43%	47%

Source: SESS 2004

Skill gaps can lead to severe implications for businesses. The implications experienced by science sector workplaces are similar to those for other sectors, though the magnitude of the implications vary (Figure 8).

Figure 8: Impact of skill gaps

	Science	*Other sectors*
Difficulties meeting customer service objectives	50%	58%
Difficulties meeting required quality standards	49%	51%
Difficulties introducing new working practices	43%	39%
Delays developing new products	40%	29%
Increased operating/running costs	35%	44%

Source: SESS 2004

The most common response to skill gaps was to provide more investment in staff by either:

- providing further training for staff; or
- expanding trainee programmes.

Employers in the science sector were more likely to expand trainee programmes than those in other sectors (Figure 9).

Figure 9: Employer responses to skill gaps

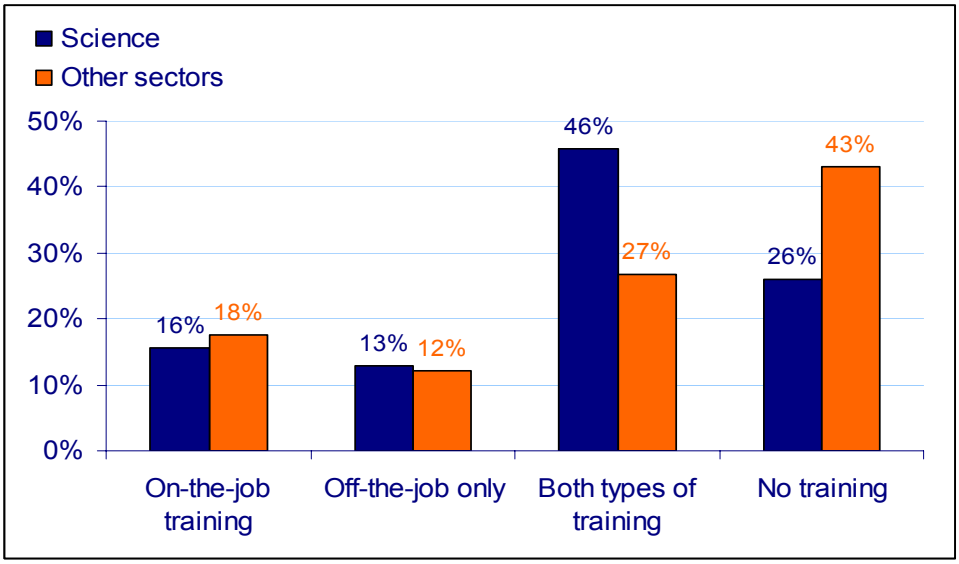
	Science	*Other sectors*
Provided further training	88%	87%
Expanded trainee programmes	61%	48%
Changed working practices	48%	42%
Relocated work from within the company	35%	17%
Increased recruitment	18%	15%

Source: SESS 2004

Training

Science sector employers are more likely to fund or arrange training for their staff than employers in other sectors (Figure 10).

Figure 10: Types of training funded or arranged by employers



Source: SESS 2004

For those science sector employers who had not funded or arranged any training over the past twelve months, the main reason for not doing so was that staff were considered already to be fully proficient. This was similar to employers in other sectors.

Part 6 – THE DEMAND FOR SCIENTISTS IN THE FUTURE

Data sources

Information in this section has been provided by Futureskills Scotland from its Labour Market Forecasts to 2014.

Main points

The future outlook for science occupations looks positive.

- Total employment for science occupations is expected to grow at a faster rate between 2004 and 2014 than that expected for non-science occupations.
- Growth in the economy, and the need to replace workers who either temporarily or permanently leave the workforce, will both provide a considerable number of job opportunities in science occupations.

Methods used to produce Futureskills Scotland's labour market forecasts

Futureskills Scotland's labour demand projections are prepared by the University of Warwick's Institute for Employment Research (IER) in collaboration with Cambridge Econometrics (CE). IER and CE produce an economic model called the Local Economy Forecasting Model (LEFM). The model is based on detailed information about how important aspects of the economy – such as output and employment – relate to each other and have changed over time. This information is then broken down separately for different industries, areas and occupations. Using this information, the model makes projections of how the number of jobs will change in the future.

It is important to distinguish between the two types of demand which can result in new job openings occurring. Job openings requiring new employees can arise because of growth in the economy and the need to replace workers who temporarily or permanently leave the workforce.

We call job opportunities arising from growth in the economy expansion demand. Expansion demand is the number of jobs that will arise (or be lost) because of growth (or decline) in any particular industry or occupation.

At the same time, a large number of job opportunities will arise through the need to replace those who leave the labour market either permanently or temporarily. This is referred to as replacement demand. Examples of replacement demand include people who retire and people who temporarily leave their jobs to look after children.

For a fuller description of how the labour market forecasts are produced, a technical report, entitled Labour Market Projections to 2014: Technical Report, is available from the Futureskills Scotland website (www.futureskillsscotland.org.uk).

The future labour market – the outlook for all of Scotland

There will be considerable demand for employees between 2004 and 2014. During this period, it is anticipated that there will be 969,000 new job openings in Scotland.

- Of these, growth in the economy is projected to provide 50,000 new job opportunities.
- The need to replace workers who leave the workforce is expected to provide 920,000 job openings.

Most of the job opportunities will arise in public and private sector service industries. Similarly, occupations which generally require higher levels of skills and qualifications are expected to dominate total employment in 2014

The demand for scientists in the future

Introduction

This section on the demand for scientists in the future uses the same definition of science occupations as used in the *DTI Economics Paper No. 16: Science, Engineering and Technology Skills in the UK*. Annex 1 of this report provides a full description of the occupations included in this definition.

Although many employees in science occupations will hold science qualifications, it is not necessarily the case that all workers in these occupations will hold science qualifications. Due to the limitations of labour market forecasts, it is not possible to establish whether the future job opportunities within science occupations will be for individuals with science qualifications. However, the analysis should still prove useful as science occupations are a natural employment opportunity for those with science and related skills.

Total employment to 2014 in science occupations

The overall outlook for science occupations looks positive in the future with employment in science occupations anticipated to grow at a faster rate between 2004 and 2014 than is expected for other occupations (Figure 1).

- Total employment in science occupations is anticipated to rise from 261,000 jobs in 2004 to 292,000 jobs in 2014. This is an increase in total employment of 12%.
- Total employment in other occupations is expected to increase by 1%.

The number of job opportunities in science occupations is consistent with the job opportunities occurring in the economy as a whole – that is, in general there is continued move from lower skilled jobs to higher skilled and professional ones. The projections for the economy as a whole show that professional and associate professional occupations are expected to dominate employment growth. The results for science occupations, however, should be set in the context that the definition of science occupations consists of a high proportion of the total number professional and associate professional jobs.

Figure 1: Historical and projected employment for science and non-science occupations, 1984 to 2014

	1984	*1994*	*2004*	*2009*	*2014*
Science professionals	46,000	59,000	79,000	85,000	91,000
Health professionals	15,000	20,000	25,000	27,000	31,000
Science and technology associate professionals	34,000	42,000	53,000	56,000	60,000
Health associate professionals	76,000	91,000	104,000	107,000	110,000
All science occupations	**171,000**	**212,000**	**261,000**	**276,000**	**292,000**
Non-science occupations	**2,064,000**	**2,157,000**	**2,261,000**	**2,267,000**	**2,280,000**

Source: CE/IER

Total new job openings to 2014 for science occupations

Between 2004 and 2014, it is projected that there will be 119,000 job opportunities requiring new employees in science occupations (Figure 2).

Of these, 31,000 new job openings are expected to arise in science occupations during this period as a result of growth in the economy or expansion demand.

- This is higher than the anticipated 19,000 new job opportunities expected to arise in other occupations.
- The scale of expansion demand is considerable given that science occupations account for just 12% of the total number of jobs in Scotland in 2014. However, it is important to bear in mind the large numbers of professional and associate professional occupations which are included within the definition of science occupations.

The need to replace workers who leave the workforce or retire – replacement demand – will result in 88,000 new job openings in science occupations.

- This is small compared to 831,000 jobs openings expected to occur in non-science occupations as a result of replacement demand.

Figure 2: Total new job openings requiring new employees by occupation, 2004 to 2014

	Base year (2004)	*Expansion demand*	*Replacement demand*	*Job openings (2014)*
Science professionals	79,000	12,000	22,000	35,000
Health professionals	25,000	6,000	9,000	15,000
Science and technology associate professionals	53,000	7,000	16,000	23,000
Health associate professionals	104,000	5,000	41,000	46,000
All science occupations	261,000	31,000	88,000	119,000
Non-science occupations	2,261,000	19,000	831,000	850,000

Source: CE/IER

Limitations of labour market forecasting

Labour marketing forecasting uses past trends and data to model what might happen in the future. Projections cannot accurately tell you exactly how many jobs in certain areas, industries or occupations there will be. However, they can provide a broad indication of likely future trends based on what has happened in the past.

Two important facts should be remembered about the projections of the demand for scientists presented here.

- The further into the future we project, the greater the likelihood of inaccuracy.
- Breaking down the projections by industrial, occupational and geographical levels further increases the inaccuracy.

The labour market projections presented here will be unable to say exactly how many scientists will be demanded between 2004 and 2014. The results of the forecasts should be seen as indication of the likely demand for workers in science occupations. Looking at the broad results, the overall future outlook for science occupations is positive with many job opportunities predicted.

REPORT DEFINITION OF SCIENCE Annex 1

Definition of science courses at Scottish Higher Education Institutions

In this report we have aggregated subjects with in the Higher Education Statistics Agency "JACS Subject Coding System - Principal Subjects' to identify 'Science' provision in the HEI sector. Using the principal subjects we have aggregated subjects into three broad science themes: Medical; Life; and Physical Sciences. Within each theme are the relevant science subject groups. The subjects groups for Medical Sciences are: Medicine & Dentistry; Veterinary medicine; and Subjects Allied to Medicine. The subject groups for Life Sciences are: Biological Sciences; and Agriculture & Related Subjects. And the Physical Sciences theme is composed of the following subject groups: Engineering & Technology; Computer Sciences; Other Physical Sciences; Mathematical Sciences; Chemistry; and Physics.

Level of Study
The analysis distinguishes between first degree and postgraduate entrants.

Domicile of student
Certain parts of the analysis in section three distinguish between entrants who were domiciled in Scotland prior to commencing their studies, and entrants who were domiciled outside of Scotland prior to commencing their studies.

Entrants
We have defined entrants as those students on their first year of the course or programme. We have chosen to also look at the numbers of entrants, as we believe this provides a better indicator of changes in the pattern of provision.

Science Principal Subjects

The list below provides an overview of the principal subjects that have been classed as science subjects for this report.

Pre-clinical Medicine	Materials Science
Pre-clinical Dentistry	Physics
Clinical Medicine	Forensic and Archaeological Science
Clinical Dentistry	Astronomy
Others in Medicine and Dentistry	Geology

Anatomy, Physiology and Pathology

Pharmacology, Toxicology and Pharmacy

Complementary Medicine

Nutrition

Ophthalmics

Aural and Oral Sciences

Nursing

Medical Technology

Others in Subjects allied to Medicine

Biology

Botany

Zoology

Genetics

Microbiology

Sports Science

Molecular Biology, Biophysics and Biochemistry

Psychology

Others in Biological Sciences

Pre-clinical Veterinary Medicine

Clinical Veterinary Medicine and Dentistry

Animal Science

Agriculture

Forestry

Food and Beverage studies

Agricultural Sciences

Others in Veterinary Sciences, Agriculture and related subjects

Chemistry

Ocean Sciences

Physical and Terrestrial Geographical and Environmental Sciences

Others in Physical Sciences

Mathematics

Operational Research

Statistics

Computer Science

Information Systems

Software Engineering

Artificial Intelligence

Others in Mathematical and Computing Sciences

General Engineering

Civil Engineering

Mechanical Engineering

Aerospace Engineering

Naval Architecture

Electronic and Electrical Engineering

Production and Manufacturing Engineering

Chemical, Process and Energy Engineering

Others in Engineering

Minerals Technology

Ceramics and Glasses

Polymers and Textiles

Materials Technology not otherwise specified

Maritime Technology

Industrial Biotechnology

Others in Technology

Definition of science industry

The chapter on views of employers in the science industry defined the science industry using the following Standard Industrial Classification (SIC) codes.

SIC Code	Description
11	Oil and gas extraction
24	Manufacture of chemicals and chemical products
28	Manufacture of fabricated metal products
29	Manufacture of machinery and equipment n.e.c
30	Manufacture of office machinery, computers
32	Manufacture of radio, television and communication equipment
33	Manufacture of medical precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles etc
35	Manufacture of other transport equipment
41	Water collection, purification
65	Financial intermediation, except insurance and pensions
67	Activities auxiliary to financial intermediation
70	Real estate activities
72	Computer and related activities
73	Research and development
74	Other business activities
75	Public administration, defence, compulsory, social security
80	Education
85	Health and social work
91	Activities of membership organisations n.e.c

This definition of science industry is taken from the *DTI Economics Paper No. 16: Science, Engineering and Technology Skills in the UK.* Science, engineering and technology (SET) graduates work in a wide range of industrial sectors. This definition includes sectors where SET graduates make up at least five per cent of the workforce in the sector.

Definition of science occupations

The chapter on the demand for scientists in the future defines science occupations using the following Standard Occupational Classification (SOC) 2000 codes.

SOC Code	Description
21	Science and technology professionals
22	Health professionals
31	Science and technology associate professionals
32	Health associate professionals

This definition of science industry is taken from the *DTI Economics Paper: Science, Engineering and Technology Skills in the UK.*

It should be noted that not all those classified as being employed in a science occupation will hold a formal qualification in a science subject or have developed particular skills in science based work. In addition, many holders of science, engineering and technology qualifications will find employment in those non-science occupations.

For a full definition of the types of jobs included in the definition of science occupations, please visit the Office for National Statistics at http://www.statistics.gov.uk/methods_quality/soc/structure.asp.

FUNDING AND CONTROLLED SUBJECTS Annex 2

How SFC funds

Funding for HEIs consist of teaching funding from SFC and tuition fees. HEIs are funded by SFC to deliver a target of full-time equivalent (FTE) funded student places each academic year. Funded places are split between funding subject groups and separate units of resource (subject prices) applied to the funded places in each group.

Controlled Subjects

SFC controls the number of students in the HE system in the following subjects: Undergraduate Medicine pre clinical; Undergraduate Medicine clinical; Undergraduate Dentistry pre clinical; Undergraduate Dentistry clinical; Nursing and Midwifery pre-registration education; Initial Teacher Education; and Undergraduate Veterinary Medicine.

The Scottish Executive Health Department and NHS Education for Scotland determine the numbers of students all of these areas except Initial Teacher Training which is determined by the Scottish Executive Education Department and Undergraduate Veterinary Medicine determined by Scottish Executive Environment and Rural Affairs Department.

Figure 1 Controlled funded student places allocated 2006-07 by FTE[8]

Subject	Student Places
Undergraduate Medicine pre clinical	**1758**
Undergraduate Medicine clinical	**2146**
Undergraduate Dentistry pre clinical	**220.3**
Undergraduate Dentistry clinical	**415.7**
Nursing and Midwifery pre-registration education	**3325**
Undergraduate Veterinary Medicine	**695.1**
Total	**8560.1**

As some of these controlled subjects are used to increase numbers and deliver specific Government targets, for example Nursing and Teacher Training, the changes in these subjects' popularity should also be treated with caution.

[8] SFC funds these by FTE only not by Headcount but this givens an indication as to the volume of students that SFC funds for these areas.

SCOTTISH EXECUTIVE

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