

## 2.2 Research Personnel

Statistics on research personnel, along with those on R&D expenditures, are another effective indicator of the extent of research activities. Personnel engaged in R&D<sup>18</sup> can be classified as researchers and support personnel (assistant research workers, technicians, and clerical and other supporting personnel).

### 2.2.1 Researchers

#### 2.2.1.1 Number of Researchers

Countries use different methods for determining the number of researchers. The Frascati Manual defines researchers as "professionals engaged in the conception or creation of new knowledge, product processes, methods, and systems, and in the management of the projects concerned." But this definition is quite vague, and countries that follow the Frascati Manual also specify their own definitions of the term "researcher" for counting researchers.

For this reason, there are differences between countries in methods for measuring the number of researchers, and international comparisons are difficult. In comparison between Japan and the United States, the number of researchers counted in the Report on the Survey of Research & Development conducted by the Statistics Bureau of Japan's Ministry of Internal Affairs and Communications is not exactly equivalent to the researchers counted in the U.S. National Science Foundation's National Patterns of R&D Resources. Differences of methods for determining the numbers of researchers are shown in Table 2-2-1, and would appear to be obstructing a fair statistical comparison.

The category of researcher at universities and colleges, in Japan, consisting of teachers, doctoral students, medical staff, etc., differs between Japan and the United States in the following ways.

#### (1) Teaching Staff

In 1999, a year in which it is possible to compare

teachers in Japan and the United States, 169,070 teachers at universities and colleges in Japan, including those in the humanities and social sciences, were classified as researchers. On the other hand, according to Table 8 in the "National Patterns of R&D Resources: 2002 Data Update," in the United States, only 118,000 college and university teaching personnel who responded that they had obtained a doctoral degree and were primarily engaged in research were classified as researchers—a smaller result than in Japan.

It would appear, then, that the number of teaching personnel in the United States who are involved in research is much larger than in Japan when the same kind of statistics are used. On the other hand, if the same statistical method used in the United States were applied to Japan, the number of Japanese researchers would be smaller.

#### (2) Number of Graduate School Students

A comparison for 1999 reveals that 59,057 people who were studying in doctoral courses, including the humanities and social sciences, in Japan were classified as researchers. This figure is virtually identical to the 1999 figure of 59,007 graduate school students in doctoral courses counted in the Ministry of Education, Culture, Sports, Science and Technology's "Handbook of Education, Culture, Sports, Science and Technology Statistics (2003 edition)."

In the United States, however, the number of graduate school students receiving remuneration for research assistance work is 91,300 people (NSF, "Science and Engineering Indicators 2004", Appendix Table 5-28), which is reduced by the FTE (Full-Time Equivalent) rate coefficient of 50% to arrive at a total of about 45,700 researchers. In the United States, therefore, while the count extends beyond doctoral courses to include people in Master's course programs as well, it is limited to students who are engaged in research assistance work, and is further reduced by a predetermined coefficient. Thus, it is highly probable that the estimate for number of researchers would yield a lower result than Japan's

<sup>18</sup> Research personnel: "Report on the Survey of Research and Development" compiled by the Statistics Bureau classifies personnel engaged in R&D as follows. (2002 revision)

Researcher: Persons who hold a university degree (or persons who have equivalent or greater knowledge in their specialty), who are engaged in research activities in their own chosen subject. "Researchers" as used herein, refers only to full-time researchers, and excludes those who also perform other duties in addition to research.

Assistant research workers: Persons who assist researchers and who are engaged in research activities under their direction and who have the possibility of becoming researchers in the future.

Technicians: Persons, other than researchers and assistant research workers, who are engaged in technical services related to research activities under the guidance and supervision of researchers and assistant research workers. Clerical and other supporting personnel: Excepting those mentioned above, persons who are engaged in miscellaneous activities, clerical work, accounting, etc., relating to research activities. Japanese statistics on persons engaged in R&D are as of April 1 of the appropriate year up to 2001, and as of March 31 for 2002.

**Table 2-2-1 Comparison of Japanese and U.S. definitions of researchers**

Country	Japan	United States
Companies, etc.	<ul style="list-style-type: none"> <li>• Have university graduate (or higher) qualifications</li> <li>• Have a research theme in which conducting research</li> </ul>	<ul style="list-style-type: none"> <li>• University graduate level, or have equivalent or higher level of expert knowledge</li> <li>• Engaged in research themes</li> </ul>
	• Researchers calculated by FTE	• Researchers calculated by FTE
NPO	<ul style="list-style-type: none"> <li>• Have university graduate (or higher) qualifications</li> <li>• Have a research theme in which conducting research</li> </ul>	<ul style="list-style-type: none"> <li>• People who have Ph.D.s, and who state that they are mainly engaged in research and development</li> </ul>
	• Researchers calculated by FTE	• Actual number of researchers (head count)
Public institutions	<ul style="list-style-type: none"> <li>• Have university graduate (or higher) qualifications</li> <li>• Have a research theme in which conducting research</li> </ul>	<ul style="list-style-type: none"> <li>• People who have Ph.D.s, and who state that they are mainly engaged in research and development (excluding military-related personnel)</li> </ul>
	• Researchers calculated by FTE	• Actual number of researchers (head count)
Universities and colleges	<ul style="list-style-type: none"> <li>• Teachers, enrolled doctoral students, medical staff, or</li> <li>• Those who have university graduate (or higher) qualifications</li> <li>• Engaged in research themes (including teaching staff)</li> </ul>	<ul style="list-style-type: none"> <li>• People who have Ph.D.s, and who state that they are mainly engaged in research and development, and university graduates engaged in research assistance</li> </ul>
	<ul style="list-style-type: none"> <li>• Actual number of researchers (head count)</li> <li>(FTE values are also reported to the OECD)</li> </ul>	<ul style="list-style-type: none"> <li>• Actual number of researchers (head count), excluding graduate students</li> <li>• Graduate students are FTE converted with a 50% coefficient</li> </ul>

Source: Japan-Ministry of Internal Affairs and Communications, Statistics Bureau (Statistics Bureau). "Report on the Survey of Research and Development"  
 United States-National Science Foundation. "National Patterns of R&D Resources: 2002 Data Update"

method of including all students engaged in doctoral course programs. According to Table 8 in the "National Patterns of R&D Resources: 2002 Data Update," 68,026 graduate school students are regarded as students who are engaged in research assistance work.

Therefore, when making comparisons between Japan and the United States, it is important to remember that the measurement of researcher numbers in Japan is overestimated, primarily at the universities. In 2002, the Ministry of Education, Culture, Sports, Science and Technology conducted a "Survey of Full-time Equivalency Data at Universities and Colleges," the results of which will be used in the future to estimate the number of researchers.

As a result, while there may be differences in the methods of measuring researcher numbers, it is useful, however, to look at general trends for each country from its own methods. The United States had the largest

number of researchers (2002: 1,335,000), followed by Japan, at 820,000 (2006), at 705,000 using FTE (2004), and Germany (2004: 268,000) (Figure 2-2-2).

The total number of researchers in Japan increased by 3.95% in 2004 over the previous year (increase of 4.45% using FTE), followed by a year-on-year increase of 0.47% in 2005 (increase of 0.28% using FTE) and of 3.67% in 2006 (increase of 4.10% using FTE). The 1997 survey included expansion of surveyed industries, and in 2002 included expansion of surveyed industries, a changed survey date, and an altered definition of researchers, etc. The annual average rates of increase since 1986 were 4.29% from 1986 to 1991, 2.94% from 1991 to 1996, 1.47% from 1996 to 2001 and 1.78% from 2001 to 2006.

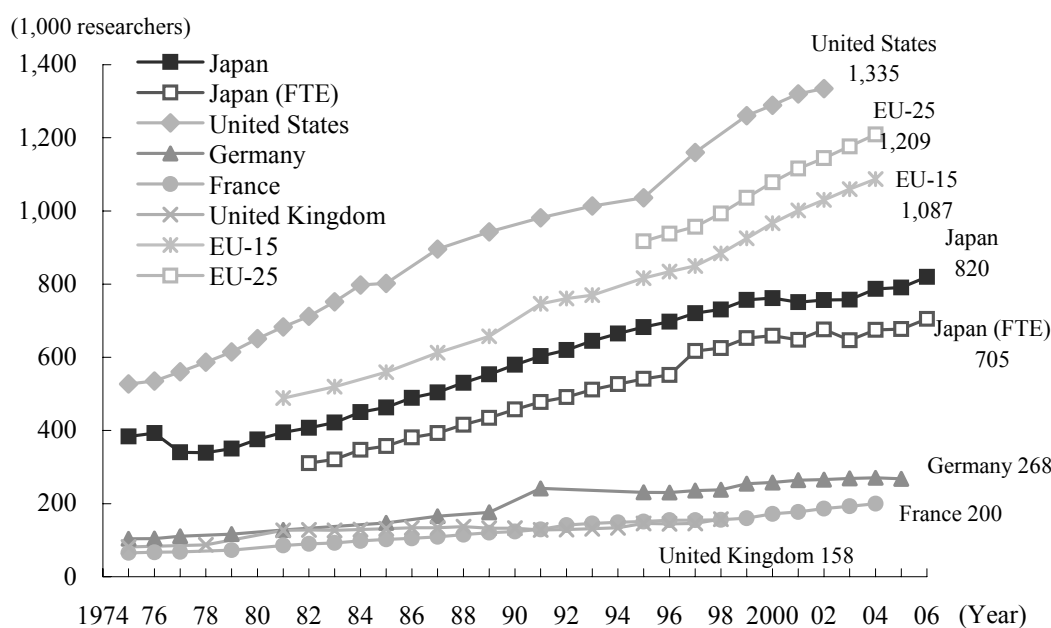


Figure 2-2-2 Trends in the number of researchers in selected countries

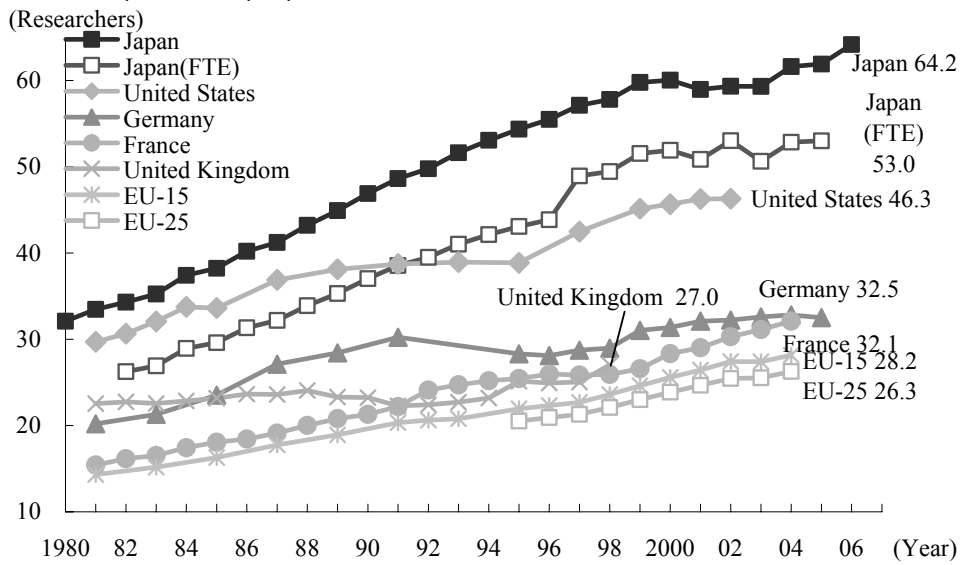
- Notes:
1. The figures for all countries include social sciences and humanities.
  2. Figures for Japan's number of researchers up to 2001 are as of April 1, after 2002 are as of March 31
  3. Japan's FTE values up to 1996 are OECD estimates.
  4. In Japan, the software industry has been covered in the survey since FY1997 and the wholesale industry since FY2002.
  5. U.K. figures through 1983 show total number of researchers in industrial (scientists and researchers) and national institutions (degree-holding researchers and above), and do not include universities and private research institutions.
  6. EU-15 (15 countries: Belgium, Germany, France, Italy, Luxembourg, Netherlands, Denmark, Ireland, United Kingdom, Greece, Portugal, Spain, Austria, Finland, and Sweden) figures are OECD estimates.
  7. EU-25 (10 countries with EU-15: Cyprus, Czech, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak, and Slovenia) figures are OECD estimates.

Source: Japan-Statistics Bureau. "Report on the Survey of Research and Development"  
Others with Japan (FTE values)-OECD, "Main Science and Technology Indicators"

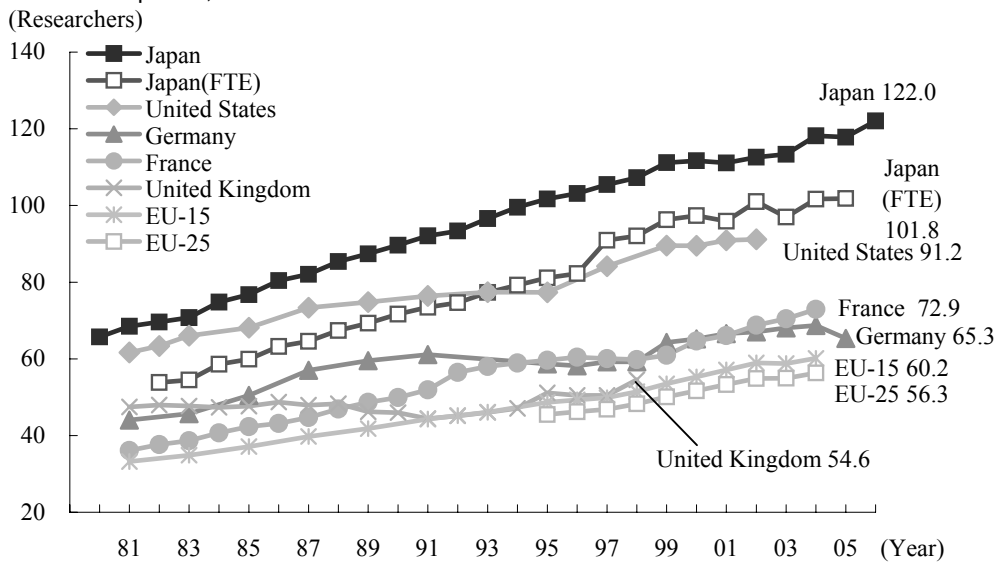
### 2.2.1.2 Number of Researchers per 10,000 Population and per 10,000 Laborers

In Japan, the number of researchers per 10,000 people was 64.2 in 2006, while the number of researchers per 10,000 people was 122.0, the highest figures among the advanced nations (Figure 2-2-3). But the trends in recent years show that the numbers of researchers per 10,000 people and per 10,000 laborers have been flat in Japan since around 2000, but increased again at 2004.

(1) Number of researchers per 10,000 people



(2) Number of researchers per 10,000 labors



**Figure 2-2-3 Trends in the number of researchers per 10,000 people and 10,000 labore**

- Notes: 1. The figures for all countries include social sciences and humanities.  
 2. Figures for Japan's labor force and number of researchers are as of March 31 of each year, except up to 2001 are as of April 1.  
 3. EU-15 and EU-25 figures are OECD estimates.

Source: Number of researchers data: Same as in Figure 2-2-2.

Population and labor force data: Japan-Statistics Bureau. "Population Estimates Series", "Monthly Report on the Labor Force Survey." Other countries include Japan's FTE value-OECD. "Main Science and Technology Indicators"

### 2.2.1.3 Number of Researchers by Sector

As for the number of researchers by type of organization, industry (companies) had the most in Japan at 58.7% of the total, followed by universities and colleges at 36.0% and government research institutions (public institutions) at 4.2%.

The United States has a greater percentage of researchers working in industry, and the percentage of researchers in its government research institutions is low, similar to Japan. In Europe, meanwhile, research personnel are concentrated to a higher degree in government research than in the United States and in Japan (Figure 2-2-4).

#### (Business Enterprises)

In the last five years from 2001 to 2006 (with 2002 using the revised survey), the number of researchers in business enterprises increased by 14.3% (an average

annual rate of increase of 2.70%, from 421,000 researchers to 481,000), which, while slowing, is still increasing compared to other organizations. This hints that industry, as well, has come to place great importance on research and development (Figure 2-2-5).

As for the number of researchers by type of industry, the information and communication electronics and equipment industry registered the highest number, followed in order by the transportation industry, the general machinery industry, the electrical machinery, the electronic parts and devices industry, the chemical industry, and precision machinery industry (Figure 2-2-6).

As for the number of researchers out of 10,000 employees, except for academic research institutions, the information and communication electronics equipment industry had the largest number, at more than 3.1 times higher than the average for all industries, followed in order by the electronic and electrical measuring instruments industry, the oils and paints industry, the precision machinery industry, and the electronic parts and devices industry (Figure 2-2-7).

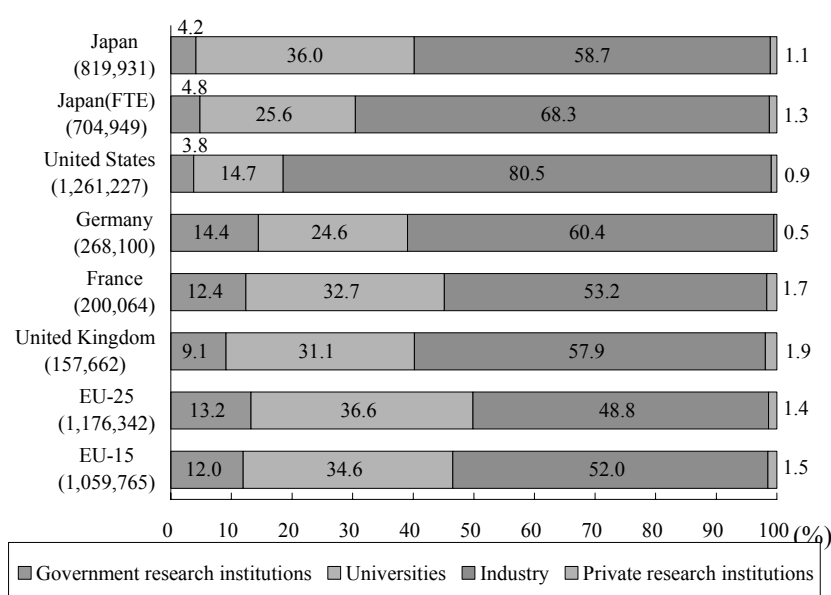


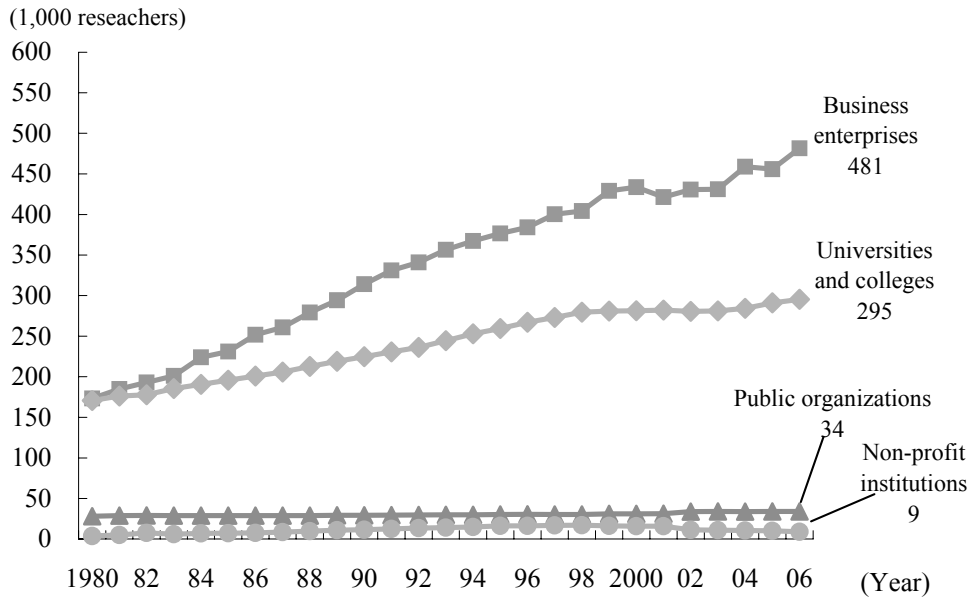
Figure 2-2-4 Share of researchers by sector in selected countries

- Notes: 1. For the comparison, statistics for all countries include research in social sciences and humanities. Statistics for Japan, as of March 31, 2006, include the FTE value for public institutions, universities and colleges, companies, and nonprofit organizations.  
 2. Japan's FTE values are Statistics Bureau data.  
 3. The data are estimates for Japan in 2006, the United Kingdom in 1998, the United States in 1999, and Germany in 2005, France in 2004, EU-15 in 2003 and EU-25 are in 2003.  
 4. Data for private research institutions in Germany is included in data for government research institutions.

Source: Japan -Statistics Bureau. "Report on the Survey of Research and Development"  
 Others-OECD. "Main Science and Technology Indicators"

By field of research, engineering ranks the highest. Next is physical science, followed by health, and finally agricultural sciences. Within the engineering field, researchers are concentrated in "electrical engineering and telecommunications engineering," and "mechanical engineering, shipbuilding and aeronautical engineering."

Within the physical sciences, chemistry has the majority. These three fields employ more than 70% of all Business enterprises researchers (Figure 2-2-8).



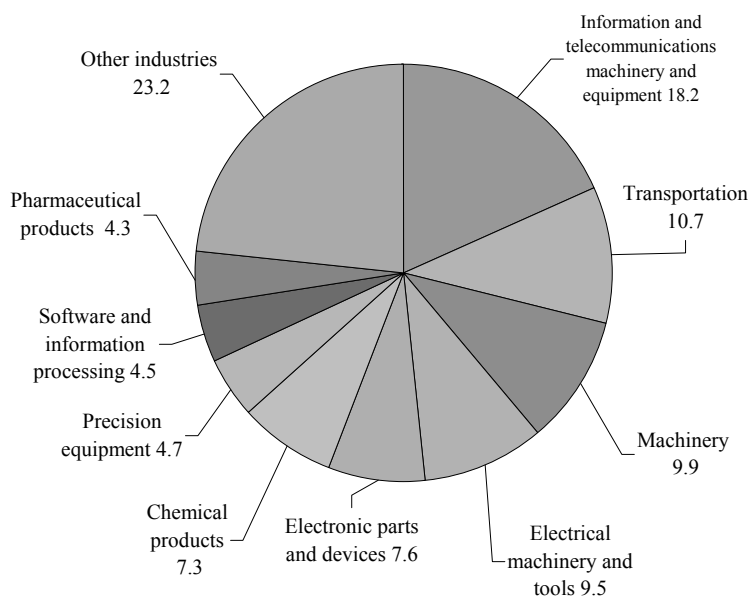
**Figure 2-2-5 Trends in the number of researchers by sector in Japan**

- Notes: 1. Numbers include researchers in the humanities and social sciences and are as of March 31 of each year, except for FY2001, which is as of April 1.  
 2. Survey categories were changed in FY2002; numbers up to FY2001 are for researchers whose primary duty is research at the following organizations (except at universities and colleges, where the number includes those who conduct research as an additional post).

After 2002	Up to 2001
Enterprises	Companies
Non-profit institutions	Private research institutions
Public organizations	Research institution excluding private research institutions
Universities and colleges	Universities and colleges

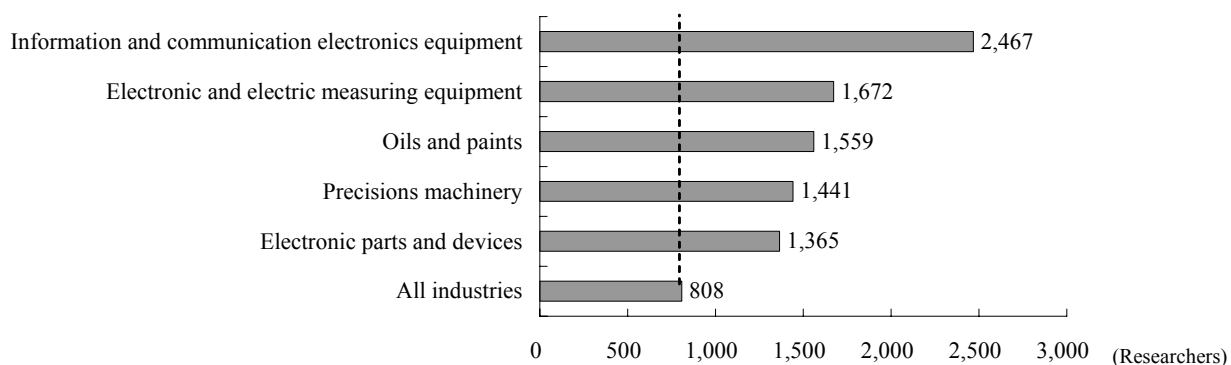
3. In Japan, the software industry has been covered in the survey since FY1997 and the wholesale industry since FY2002.

Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (11))



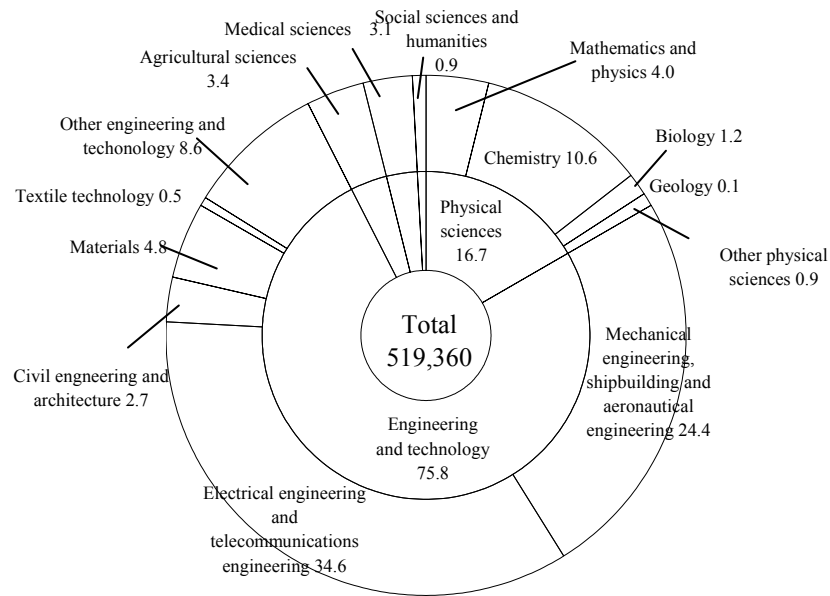
**Figure 2-2-6 Researchers at business enterprises by type of industry (2006)**

Note: Figures are their shares in percentages to total company researchers.  
 Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (12))



**Figure 2-2-7 Number of researchers per 10,000 employees at business enterprises (top five industrial categories except academic research institutions) (2006)**

Notes: 1. Regarding researchers per 10,000 employees, the data for number of employees and number of researchers are as of March 31, 2006.  
 2. Academic research institutions (5,306 researchers per 10,000 employees) are not shown on graph.  
 Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (12))



**Figure 2-2-8 Composition of number of business enterprises researchers by field of research (2006)**

Note: Figures are their shares in percentages to total company researchers.  
 Source: Statistics Bureau. "Report on the Survey of Research and Development"

### (Non-Profit Institutions and Public Organizations)

A chronological comparison of the number of researchers is made difficult by the transformation of national experimental research institutions into incorporated administrative agencies, in addition to the revision of the Statistics Bureau's "Survey of Research and Development." However, the number of researchers in 2006 stands at 8,900 in non-profit institutions and within public organizations, at 3,400 in national institutions, 13,700 in local government-owned institutions, and 17,000 in public corporations and incorporated administrative agencies (Figure 2-2-9).

When looking at sector composition, a disproportionately large share of researchers was seen in engineering at non-profit institutions and among public organizations, in medical sciences and engineering at national institutions, in agricultural sciences at local government-owned institutions, and in engineering and the physical sciences at public corporations and incorporated administrative agencies (Figure 2-2-10).

### (Universities and Colleges)

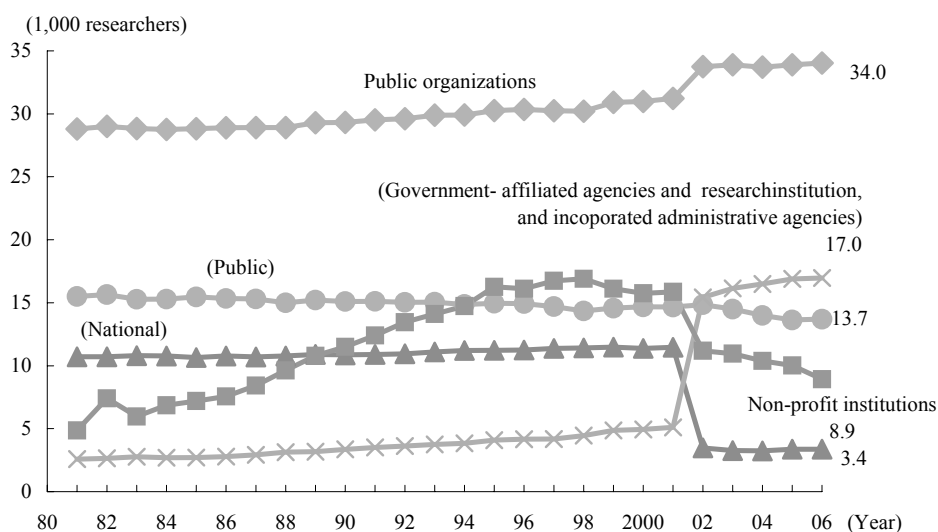
The number of researchers at universities and colleges, including those in the humanities and social sciences, has increased by 4.7% in the last five years (2001-2006), (an

average annual rate of increase of 0.92%) up to 295,000 researchers from 282,000. Looking at the number of researchers by type of institution in 2006, private universities and colleges have 137,500 researchers, followed by national universities and colleges (135,400), after which comes local public universities and colleges (22,500) (Figure 2-2-11). However, in terms of researchers whose primary role is research, the order becomes national universities (129,000), followed by private universities (123,000), and then local public universities (19,000).

Researchers in universities and colleges consist of faculty members, doctoral students, medical staff and others. Looking at the composition of researchers by type of institution, in national universities and colleges, doctoral students make up a large ratio of the researchers, and private universities and colleges have a greater ratio of teachers and medical staffs and a smaller ratio of students for doctoral degrees. The figures for public universities and colleges fall in between those for the national universities and the private universities and colleges (Figure 2-2-12).

By sector composition, a large share of university researchers were medical specialists, whether faculty members, doctoral students, or medical staff. Other sectors with relatively high shares of the total were engineering, for teachers, and science, for students in doctoral course (Figure 2-2-13).

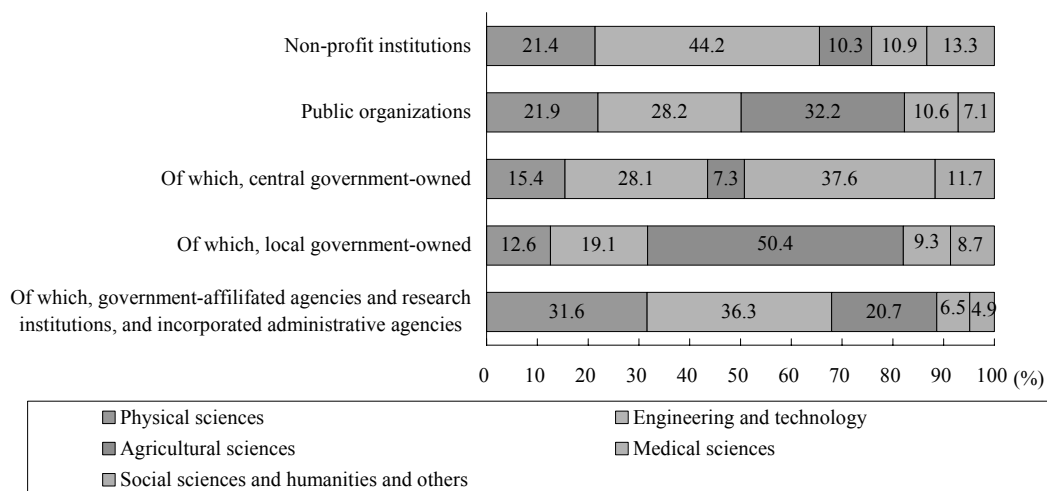




**Figure 2-2-9 Trends in the number of researchers in non-profit organizations and public institutions**

- Notes: 1. Numbers include researchers in the humanities and social sciences and are as of March 31 of each year, except up to 2003, which is as of April 1.  
 2. Survey coverage categories were changed in FY2002; numbers up to FY2001 for non-profit institutions use the values of private research institutions.  
 3. Values up to FY2001 are for researchers whose primary duty is research.

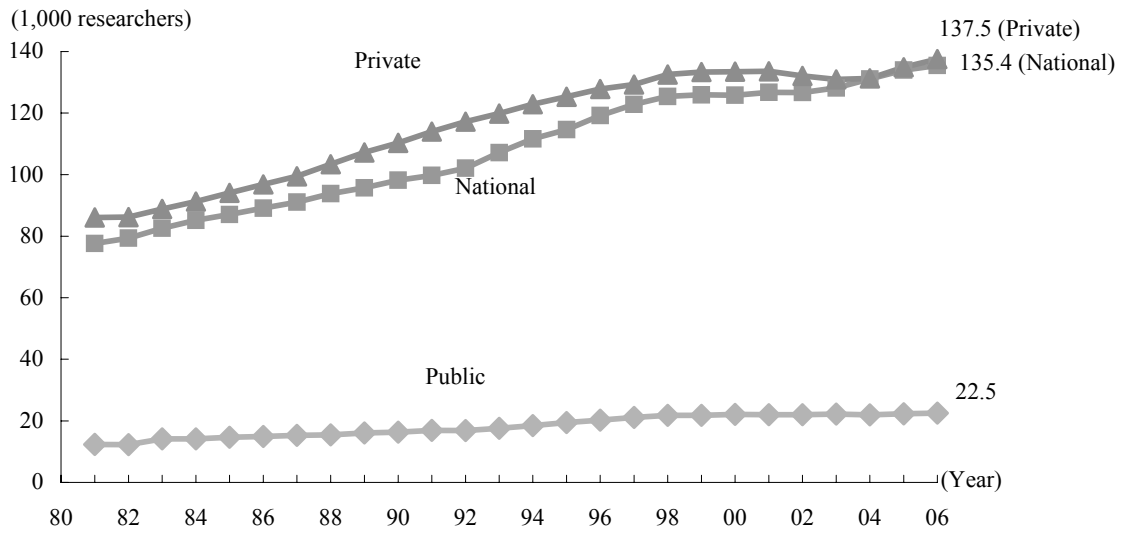
Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (11))



**Figure 2-2-10 Composition of researchers in non-profit institutions and public organizations by organization and field (2006)**

Note: The number of researchers is as of March 31, 2006.

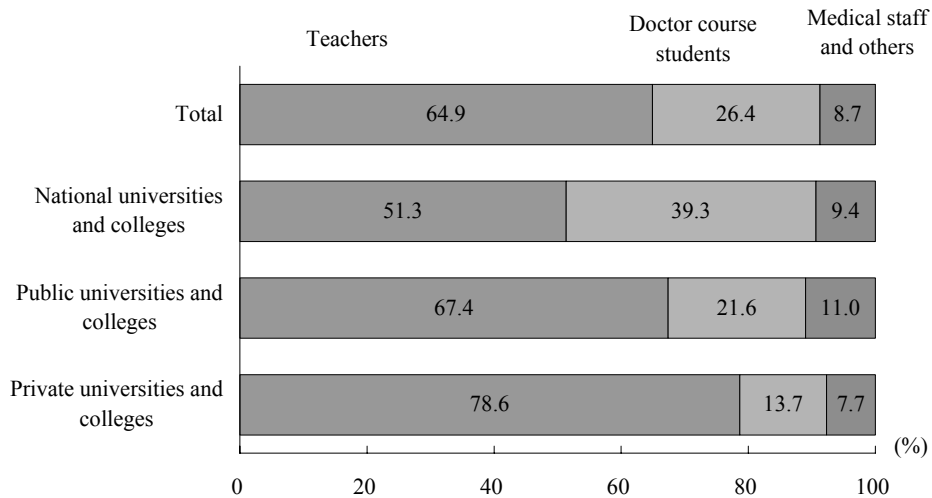
Source: Statistics Bureau. "Report on the Survey of Research and Development"



**Figure 2-2-11 Trends in the number of researchers in universities and colleges**

Note: Numbers include researchers in the humanities and social sciences and are as March 31 of each year, except up to 2001, which are as April 1.

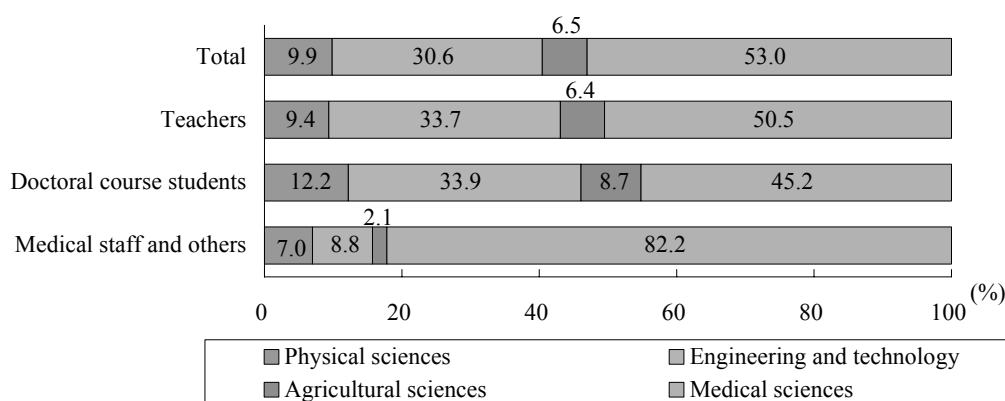
Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (11))



**Figure 2-2-12 Composition of researchers in universities and colleges (2006)**

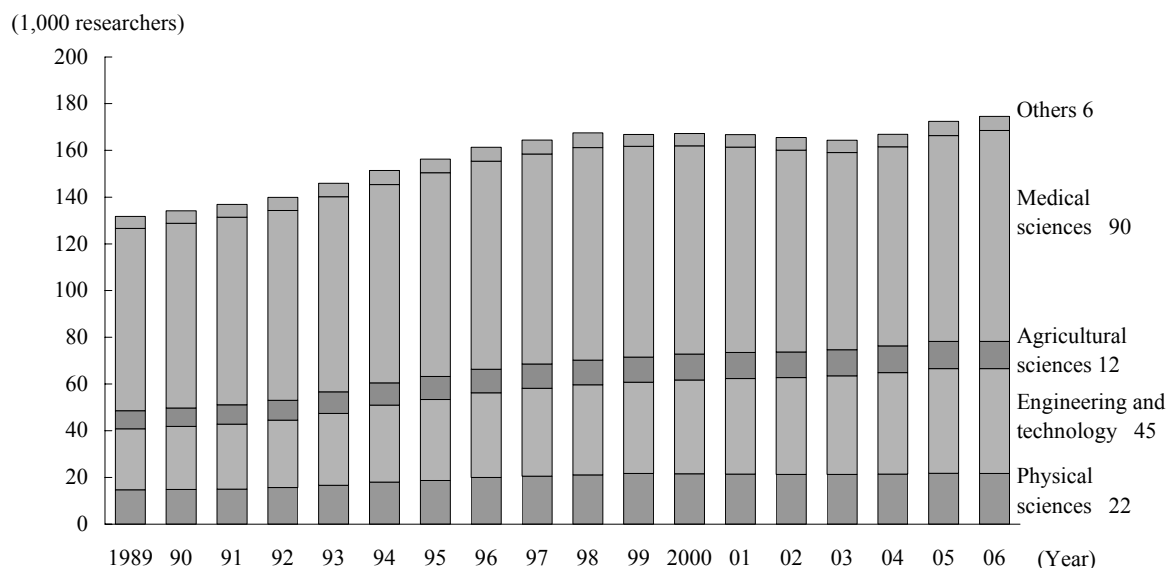
Note: Numbers include researchers in the humanities and social sciences as of March 31, 2006.

Source: Statistics Bureau. "Report on the Survey of Research and Development"



**Figure 2-2-13 Share of researchers in the natural sciences at universities and colleges by field (2006)**

Note: The numbers of researchers is as of March 31, 2006.  
 Source: Statistics Bureau. "Report on the Survey of Research and Development"



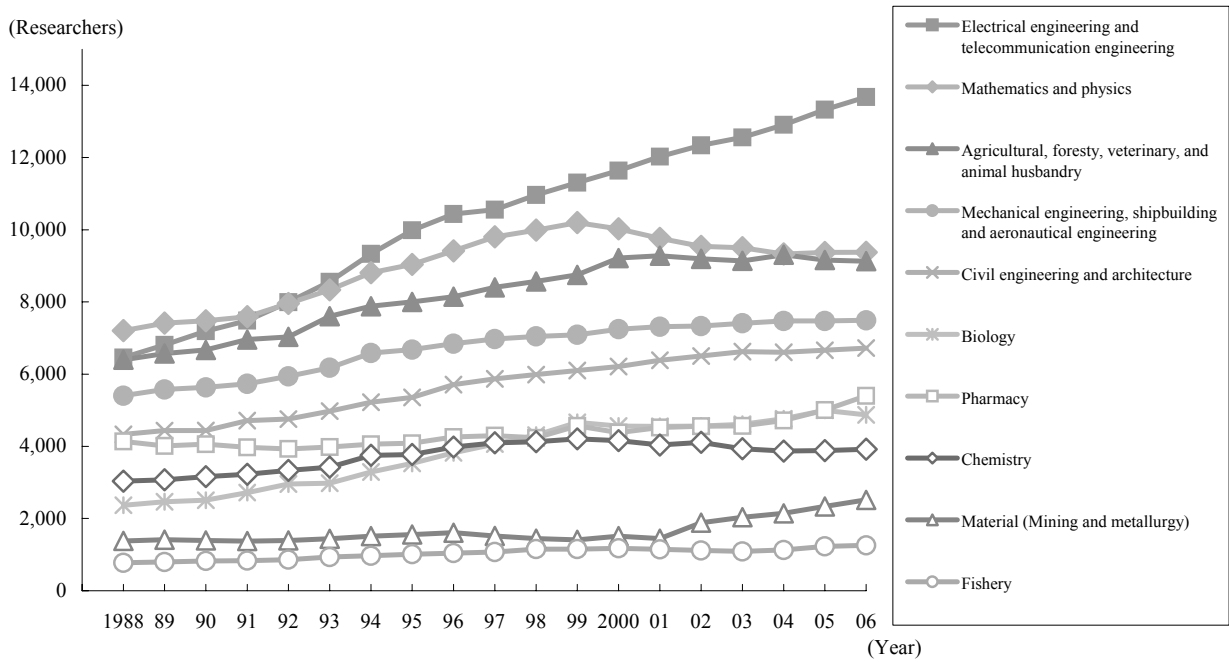
**Figure 2-2-14 Trends in the number of researchers at universities and colleges by field and specialty**

Note: The number of researchers is for the natural sciences only and is as of March 31 of each year, except up to 2001, which are as of April 1.  
 Source: Statistics Bureau. "Report on the Survey of Research and Development"

2.2 Research Personnel

The number of researchers by academic field in the most recent five-year period (2001-2006) increased slightly as seen in the average annual growth rates of the engineering (at 1.89%), agricultural sciences (at 0.74%), medical sciences (at 0.54%) and physical sciences (0.27%) (Figure 2-2-14). Looking at specific sectors, the

materials (mining and metallurgy) (average annual growth rate of 11.74%), pharmaceutical sciences (average annual growth rate of 3.63%), and electrical and telecommunications sectors (average annual growth rate of 2.60%), are showing particularly fast increases in the number of researchers (Figure 2-2-15).



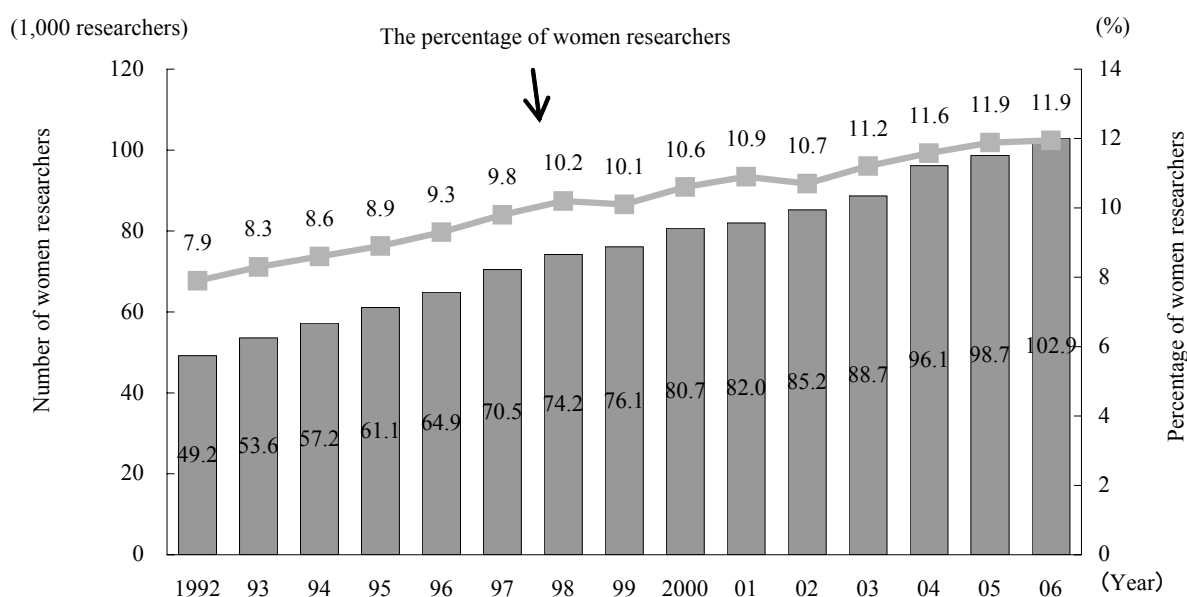
**Figure 2-2-15 Trends in the number of researchers at universities and colleges by detailed field and specialty**

- Notes: 1. The number of researchers is for the natural sciences only and is as of March 31 of each year, except up to 2001, which are as of April 1.  
 2. "Mining and metallurgy" was changed in 2002 to "materials," to which was added materials engineering, raw materials engineering, and materials process engineering, etc.  
 3. The number of researchers excluded those in medical sciences and dentistry.  
 Source: Statistics Bureau. "Report on the Survey of Research and Development"

### 2.2.1.4 Women Researchers

Women researchers, including those in the humanities and social sciences, have steadily increased year by year, reaching 103,000 in 2006, representing about 11.9% of the total number of researchers (Figure 2-2-16). But looking at all workers, 26.52 million women employees accounted for 41.6% of the total of 63.82 million employees in Japan in 2005, according to the "Labor Survey of the Ministry of Internal Affairs and Communications." It is clear that the ratio of women

engaged in the R&D field remains lower than that of women in the labor market in general. The proportion of women researchers by type of organization was 6.5% at companies, etc., 11.1% at non-profit institutions, 12.5% at public organizations, and 21.5% at universities and colleges, clearly demonstrating that universities and colleges provide women researchers more opportunities than elsewhere.



**Figure 2-2-16 The percentage of all researchers that are women**

Note: Numbers include researchers in the humanities and social sciences and are as of March 31 of each year, except up to 2001, which are as of April 1.

Source: Statistics Bureau. "Report on the Survey of Research and Development"

### 2.2.2 Personnel Engaged in R&D

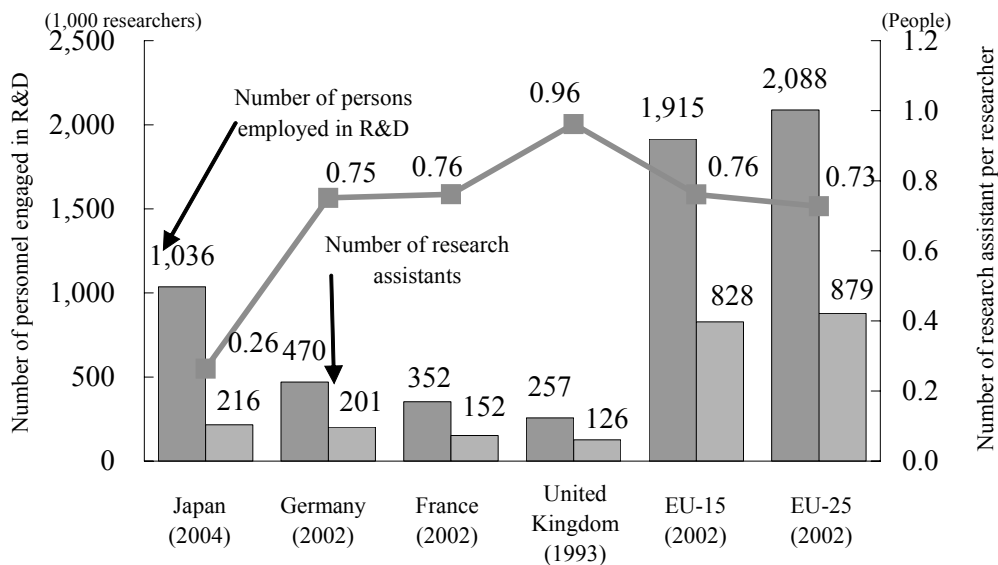
The definition of personnel engaged in R&D, which includes both regular researchers and research support staff, varies in scope from one country to the next, so that simple comparisons are probably untenable. Nevertheless, in just such a comparison with the selected countries of Europe, Japan had the largest number of personnel engaged in R&D at 1,036,000, followed in order by Germany, France, and the United Kingdom. Japan has relatively low numbers of personnel who are engaged in R&D but are not researchers themselves, with 0.26 research support staff for each researcher, a figure that is one-third the standard for European nations (Figure 2-2-17). The number of research and development-related workers in Japan showed a 3.6% of increase in the most recent five-year period (2001-2006). The downward trend in the number of research assistants was in the same

five-year period, declining by 13.3%, an annual average of -2.8% (Figure 2-2-18).

Regarding R&D-related personnel in 2006, the number of researchers increased to 820,000, assistant research workers to 72,000, technicians decreased slightly to 66,000 and clerical and other support staff increased slightly to 79,000 (Figure 2-2-18).

The number of research assistants per researcher in Japan continued to decrease, but such decline has come to a stop in public organizations and non-profit institutions (Figure 2-2-19).

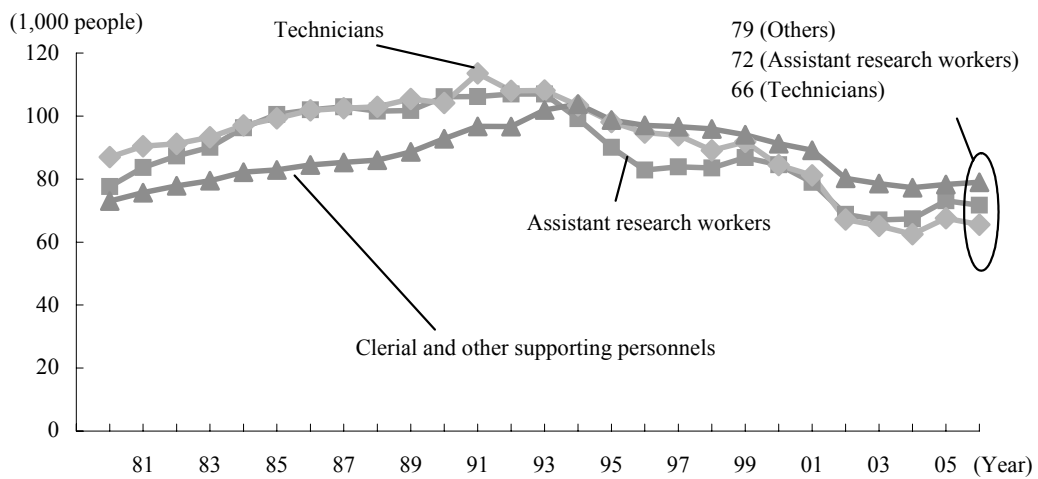
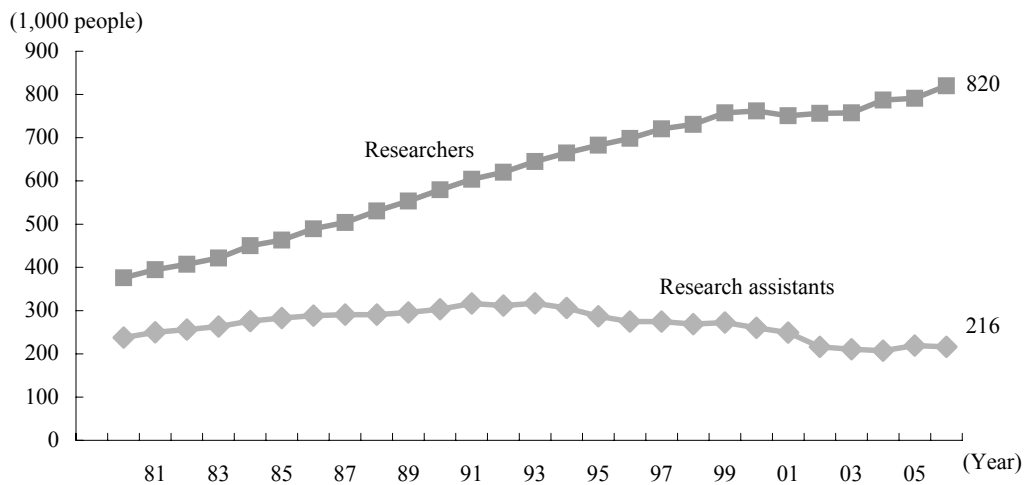
The composition by organization of the number of personnel engaged in R&D in Japan reveals that all universities and colleges, including both public and private schools, have the lowest number of research support staff per researcher (Figure 2-2-20).



**Figure 2-2-17 Number of research assistants per researcher in selected countries**

- Notes: 1. For comparison, figures for all countries include social sciences and humanities.  
 2. Figures for EU-15 and EU-25 are OECD estimates.  
 3. Research assistants refers to people who assist researchers, people who provide technical services that add value to research, and people employed in research administration, which in Japan is referred to as assistant research workers, technicians, and clerical and other supporting personnel.

Source: Japan-Statistics Bureau. "Report on the Survey of Research and Development" Others-OECD. "Main Science and Technology Indicators"



**Figure 2-2-18 Trends in persons engaged in R&D in Japan**

Note: Numbers include personnel in the humanities and social sciences and are as of March 31 of each year, except up to 2001, which are as of April 1.

Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (10))

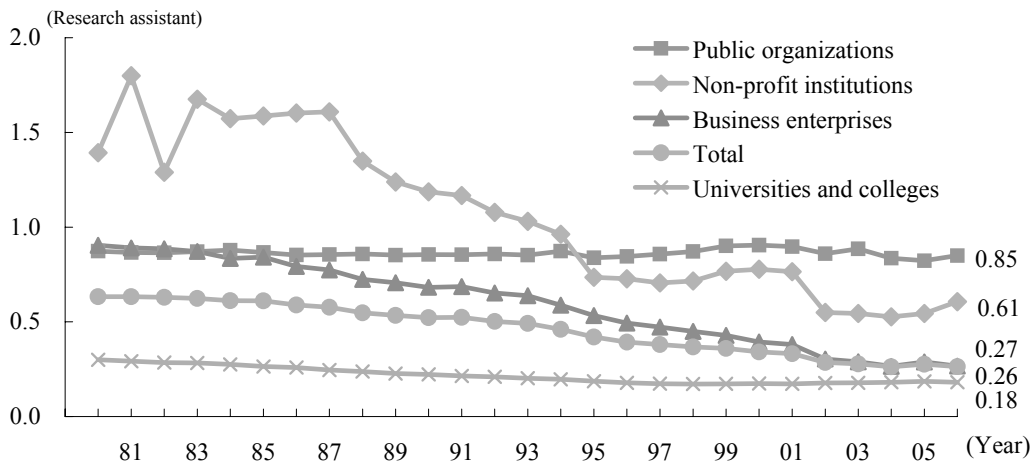


Figure 2-2-19 Trend in the number of research assistants per researcher in Japan

- Notes: 1. The numbers of researcher and research assistants include those in the humanities and social sciences and are as of March 31 of each year, except up to 2001, which are as of April 1.  
 2. Survey categories were changed in 2002; numbers up to 2001 are for researchers at the following organizations:

Up to 2001	After 2002
Companies	Enterprises
Private research institutions	Non-profit institutions
Government research institutions excluding public research institutions	Public organizations
Universities and colleges	Universities and colleges

Source: Statistics Bureau. "Report on the Survey of Research and Development" (See Appendix 3. (10))

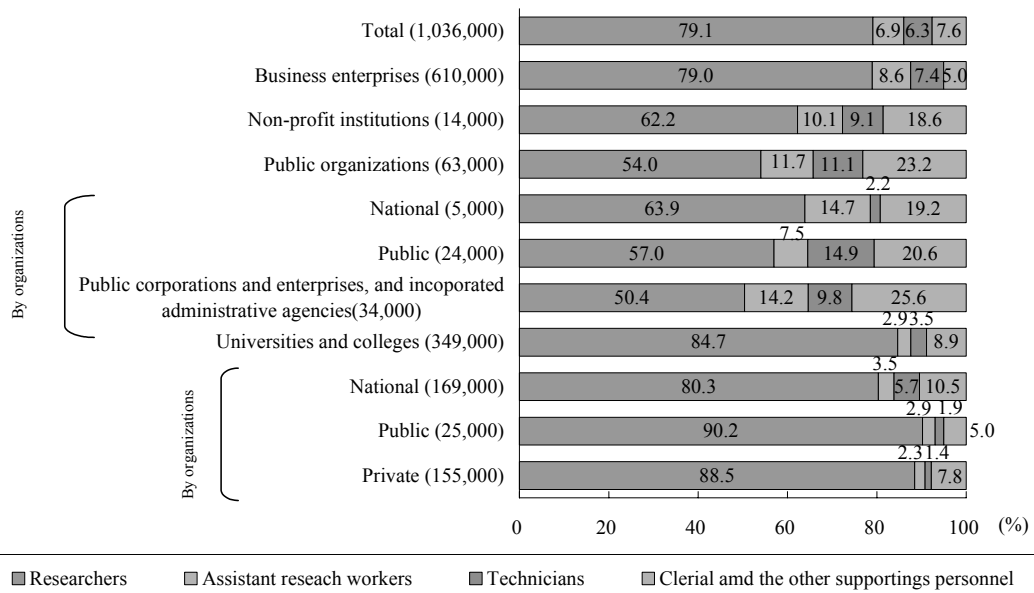


Figure 2-2-20 Composition of personnel engaged in R&D by sector in Japan (2006)

Note: Numbers for all personnel engaged in R&D include those in the humanities and social sciences and are as of March 31, 2006.

Source: Statistics Bureau. "Report on the Survey of Research and Development"



## 2.2.3 Production and Employment of Research Personnel

### 2.2.3.1 Overall Degree Trends

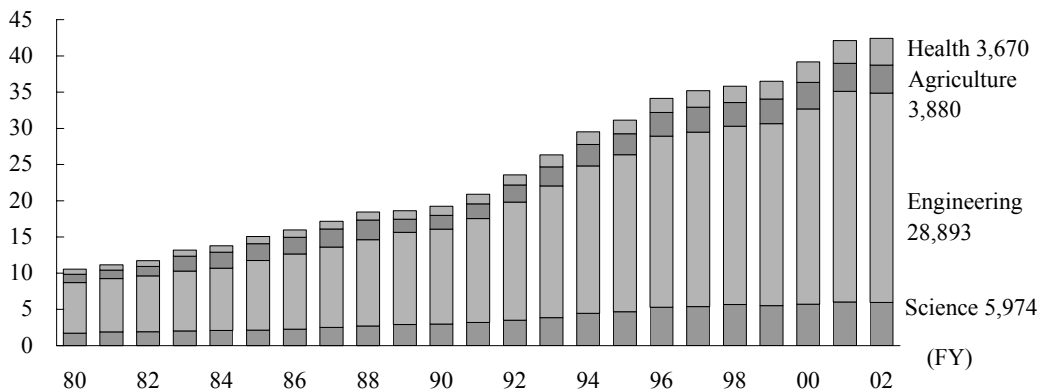
The number of people acquiring a master's degree or doctoral degree in the natural sciences in Japan has been rising alongside an expansion of graduate schools. While the number of doctorates decreased in 1999, those conferred in 2000 exceeded those conferred in 1998. During the five-year period from 1997 to 2002, the number of master's degrees conferred rose by 1.11 times (average annual growth rate of 2.1%), and the number of doctorates by 1.11 times (average annual growth rate of 2.2%). Looking at degrees by major for 2002, the engineering field accounted for the largest number of new master's degree holders at 28,893, while the largest

number of new Ph.D.s was in the health science field at 6,853 (Figure 2-2-21).

Master's and doctoral degrees differ from country to country due to differences in culture and educational systems. Social factors such as industrial structure and numbers of students can affect the number of awarded degrees. Thus, it is difficult to compare the data at face value. It is useful, however, to compare trends, and this section describes the degree trends in the natural sciences and engineering in selected countries.

The United States awards the largest number of degrees, a little over three times as many as does Japan. Compared to 1980, the ratio of engineering and health science degrees to total degrees has increased. Japan is second in number of degrees awarded, following the U.S., and has a higher ratio in engineering. The United Kingdom, France and Germany follow in the order named. Of these

(1) Master's degree  
(1,000 people)



(3) Doctorates  
(1,000 people)

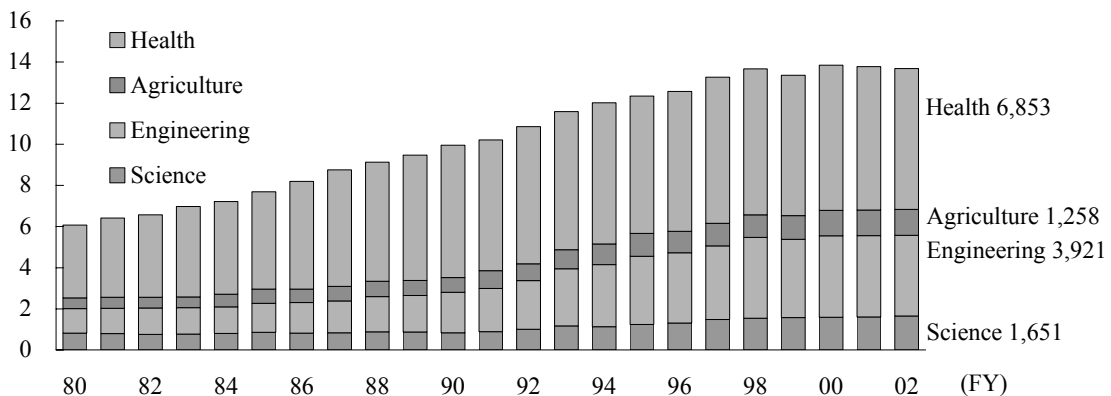


Figure 2-2-21 Degree trends in Japan (natural science)

Note: The figures are awarded degrees in FY2002.

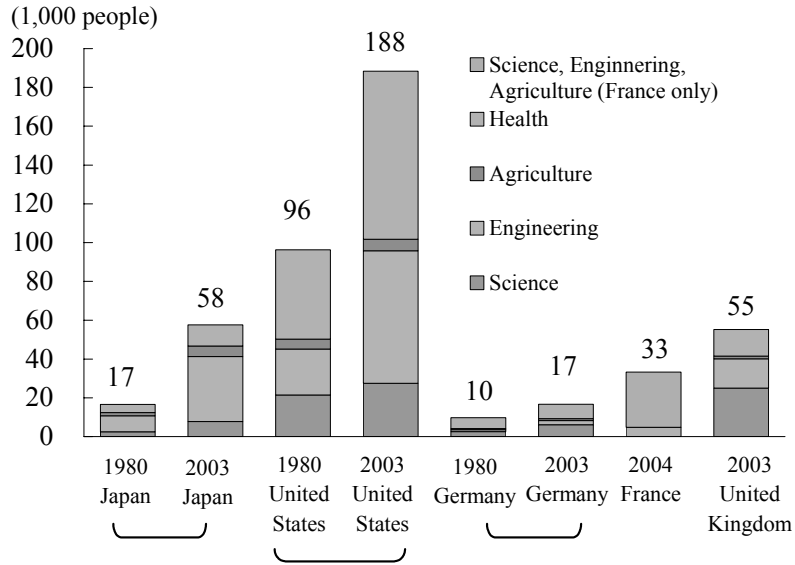
Source: MEXT. "Statistical Abstract of Education, Science and Culture 2006."

countries, Germany has a higher ratio in the physical science and health science fields, and the U.K. is higher in physical science and engineering. Also, if we look at doctorates only, the number in physical science fields in Japan is quite a bit lower than in other selected countries

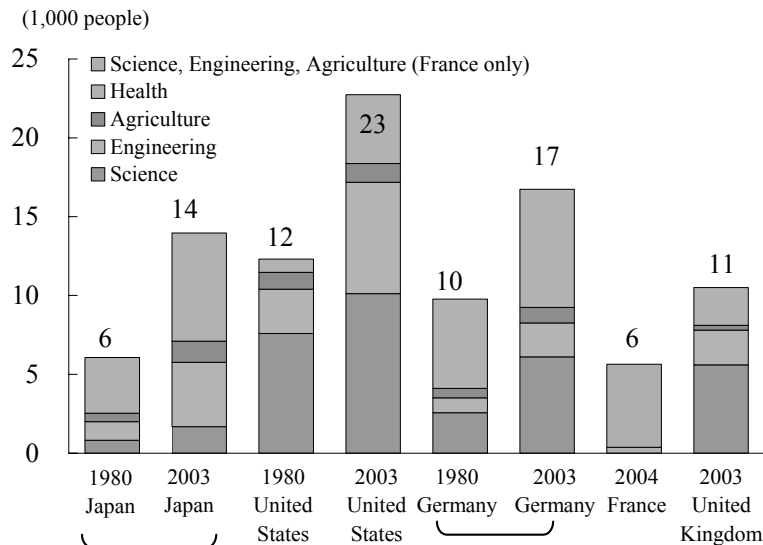
(Figure 2-2-22).

The number of graduate students as a proportion of all university students is also lowest in Japan among selected countries (Figure 2-2-23).

(1) Total (awarded at graduate schools)

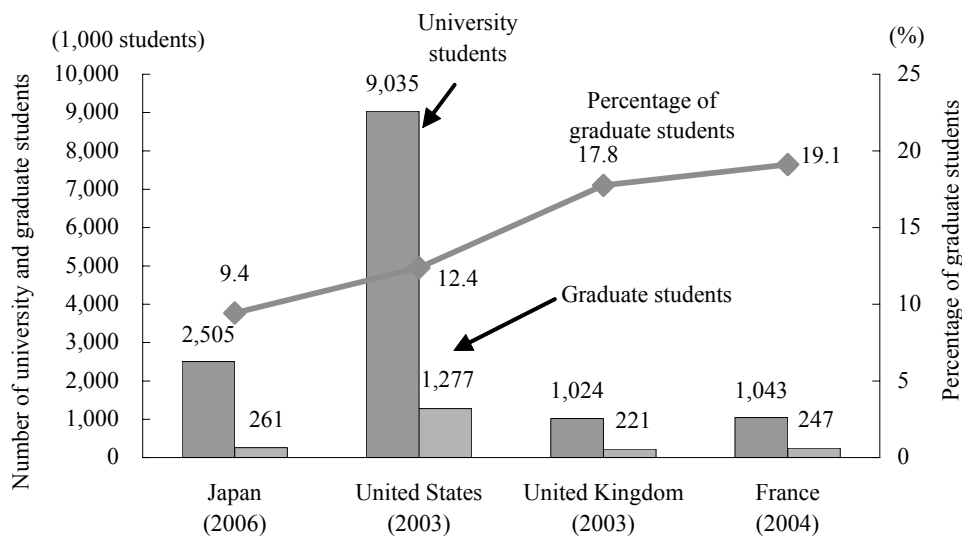


(2) Doctorates



**Figure 2-2-22 Number of awarded degrees in selected countries (natural science)**

- Notes: 1. Totals include master's and doctoral degrees (Germany: only doctorates). U.S. health sciences include first-professional degrees.  
 2. 1980 data for Germany are for the former West Germany.  
 3. France does not distinguish between physical sciences, engineering, and agricultural sciences.  
 Source: MEXT. "International Comparison of Education Indexes 2003, 2006"



**Figure 2-2-23 Number of graduate and university students, and percentage of graduate students in selected countries**

Note: Numbers for the United States and the United Kingdom are for fulltime students.  
Source: MEXT. "International Comparison of Education Indexes 2007"

### 2.2.3.2 Employment of Research Personnel

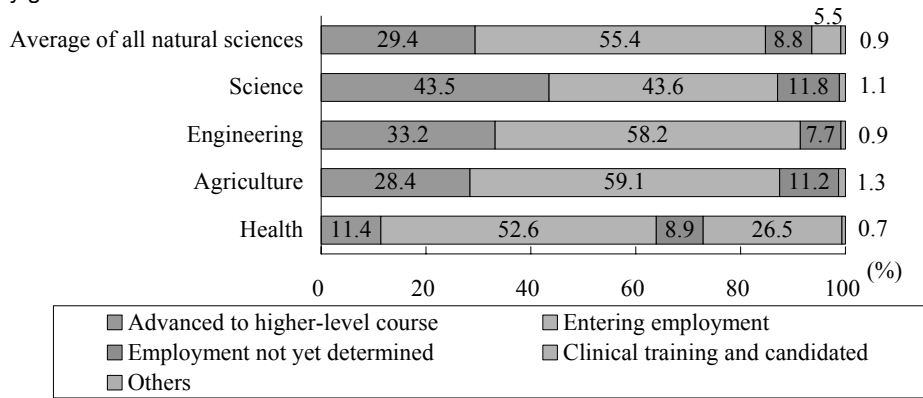
In order to enable the utilization of the skills of research personnel who have received a university education, it is important that they would be ensured an easy transition into industry or research institutions, etc. after graduation.

Here, we shall look at the employment situation for Japan's research personnel from the viewpoint of careers chosen by people in the natural sciences after graduating from university, or after completing master's or doctoral courses. At the university graduate stage, 43.5% of science specialists continue on to graduate work, a proportion that is higher than other specialties. After completing master's degrees, the proportion of engineering specialists who continue on with education drops (to 7.1%), with the vast majority (87.4%) turning to employment. After completing doctoral courses, a large proportion (about 40%) of people in physical science and agricultural science fields do not have definite plans for

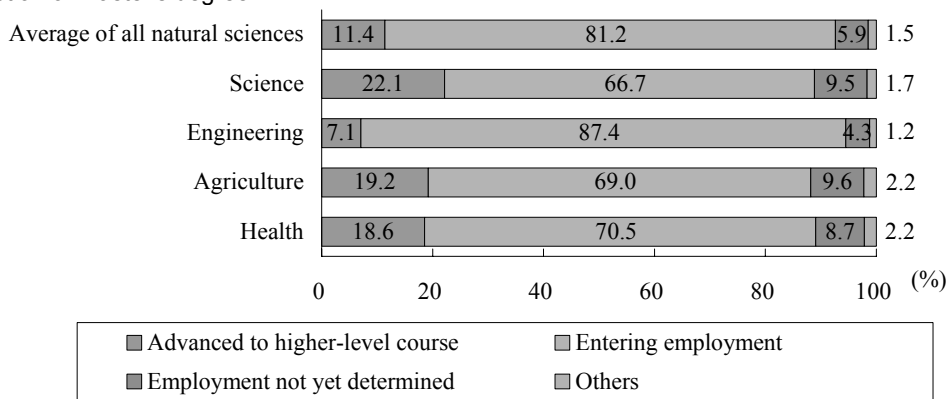
the time after receiving their doctorates (Figure 2-2-24).

If we look at a number of industries to examine their characteristics in terms of which field of the natural sciences their employees tend to come from, manufacturing industries such as the electrical machinery and tools industry, and the transport machinery and tools industry, consist almost entirely of engineering specialists. By contrast, other manufacturing industries, such as the chemicals industry, take people broadly from all four fields: the physical sciences, engineering, agricultural sciences, and health sciences. In addition, while the electrical machinery, tools manufacturing and other manufacturing industries have a high proportion of personnel who have completed master's courses, they also have an exceptionally low proportion of people who have completed doctoral courses (Figure 2-2-25).

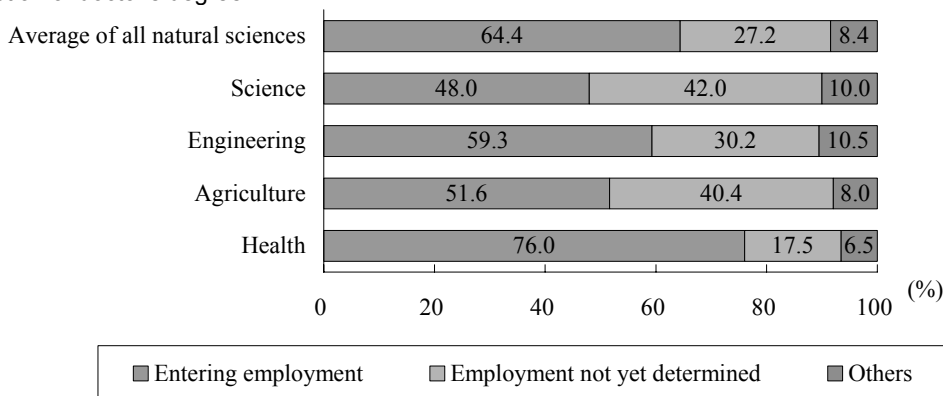
(1) Upon university graduation



(2) Upon completion of master's degree



(3) Upon completion of doctor's degree

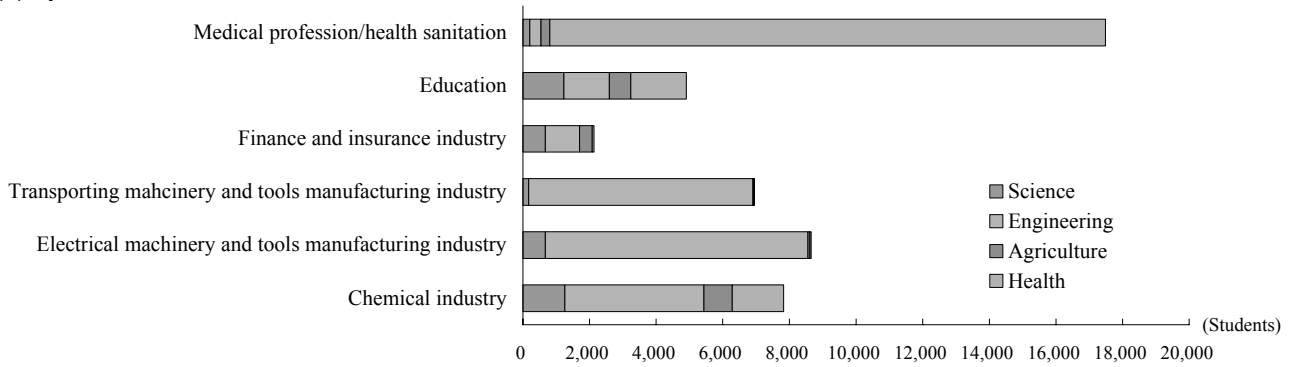


**Figure 2-2-24 Trends in career choice, by university degree level (March 2006)**

- Notes :
1. "Average of all natural sciences" is the average value of science, engineering, agricultural, and health.
  2. "Employment not yet determined" refers to people who are employed in a temporary work, engaged in housework, are not still at school working as a researcher, have not entered a technical school or other type of school, a school in a foreign country, or an employment skills development facility, etc., or are clearly neither engaged in any employment nor enrolled in advanced education.
  3. "Others" for those who are university graduation and have completed a master's degree refers to people who are deceased or unidentified.
  4. "Other" for those who have completed a doctor's degree refers to people who have advanced to higher-level course, are engaged in clinical training to be a physician, or who are deceased or unidentified.

Source : MEXT. "Basic Survey Report on Schools 2006."

(1) By academic field



(2) By academic degree

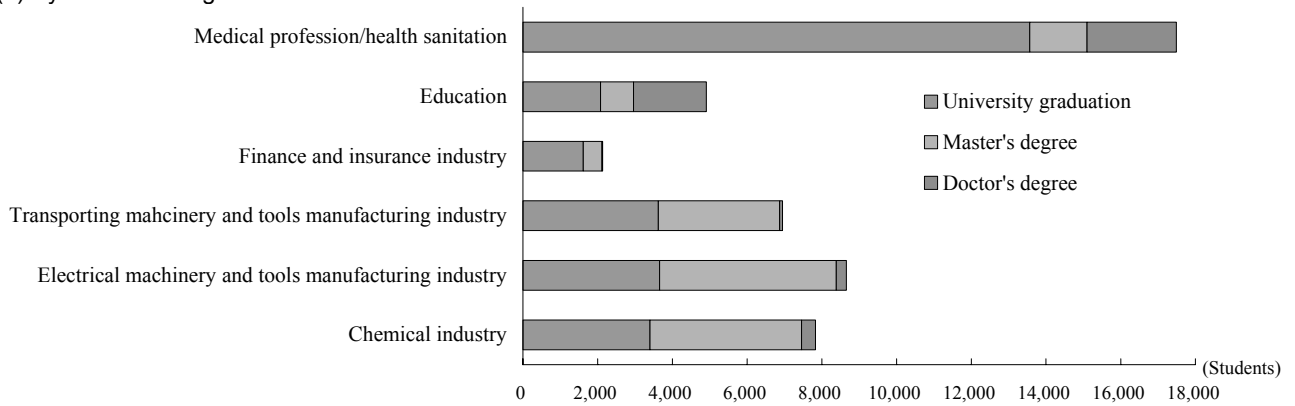


Figure 2-2-25 Employment situation in major industries, by academic field and by degree (March 2006)

Source: MEXT. "Basic Survey Report on Schools 2006"