

14. Survey Results in “Health, Medical Care and Welfare”

14.1. Trends in areas of attention

14.1.1. Malignant neoplasms

Topics relating to cancer ranked high in terms of the degree of importance, indicating a high level of interest. They scored an average 72.3 out of 100 in terms of the degree of importance index, which is extremely high compared to 63.2, the average score for all fields. Notably, 9 out of the 20 topics considered particularly important were cancer-related, including the top three, which were “05: Elucidation of carcinogenic mutation mechanisms”, “44: Improvement in the average five-year survival rate for all types of cancer to more than 70% “ and “06: Elucidation of cancer metastasis mechanisms”. Their forecasted realization times were 2013, 2013 and 2012, respectively. Of these three, topics 05 and 44 were also included in the 5th Survey, which was held five years earlier in 1991. Their forecasted realization times then were 2010 for topic 05 and 2003 for topic 44, with topic 44 recording a 10 year difference between the two surveys. Incidentally, the forecasted realization time for topic 44 in the 4th Survey in 1986 was an even earlier 1999. These results show that, while many people feel that the pathology of cancer is gradually coming to light through research efforts centering on genes such as cancer-causing genes, cancer-suppressing genes and metastasis-related genes, they also feel that this has not been fully reflected in the treatment record.

No epoch-making progress has been made in the leading cancer treatment methods, which consist of chemotherapy, radiation therapy and surgical treatment. Related topics including “46: Widespread use of techniques to overcome the drug resistance of malignant tumors”, “47: Development of radiosensitizers effective in cancer treatment” and “49: Widespread use of heavy particle against cancer” were added. New treatment methods include immunotherapy, biological therapy and gene therapy. The development of various cytokines based on genetic engineering, which began in the 1980s and came to full maturity in the 1990s, may have given rise to the impression that cancer treatment entered a new era and led to the optimistic result obtained in the 1991 survey. Since then, however, many cytokines have not produced the expected treatment effects. Interferon, once dubbed a dream anticancer drug, has turned out to be ineffective for many forms of cancer, and chronic myelocytic leukemia has been the only cancer which has shown a complete response to the drug. Progress in gene therapy is also slow. The only recent major achievements have been the development of the granulocyte colony stimulating factor, which alleviates the fall in the number of leukocytes due to anticancer drugs, and treatments which support radiation therapy and chemotherapy, such as bone marrow transplantation and peripheral blood stem cell transplantation, while the establishment of a bone marrow donor bank, which made bone marrow transplantation from persons outside blood relatives possible, is also noteworthy. However, these are only auxiliary treatment methods, which do not directly attack cancer. Stem cell plantation centering around bone marrow transplantation is used because chemotherapy and radiation therapy performed for hematologic malignancy turned out to be almost ineffective for many types of cancer despite increased dosages.

There is, however, a technology which holds great promise for future progress. It is differentiation therapy for acute leukemia. By just administering all-trans retinoic acid, a vitamin A derivative, orally, acute promyelocytic leukemia, which used to be considered most intractable among the various forms of acute leukemia, can be cured incredibly easily. Unlike conventional anticancer drugs, this drug shows a particularly high specificity for leukemic cells, and therefore accompanies few side effects. Namely, while conventional drugs are designed to kill leukemic cells, it induces leukemic cells to differentiate into normal leukocytes. The leukocytes resulting from differentiation have a finite life, so that they die out after a certain period. If these kinds of drugs can be discovered for other types of cancer, cancer treatment will make a giant leap forward.

It has been 15 years since cancer became the No. 1 cause of death for the first time in 1981. Over these years, the mortality rate of cancer has steadily increased, reaching 196 per 100,000 of population in 1994. Namely, cancer now accounts for 1 in every 3.5 deaths. Although the aging of the population is likely to have greatly contributed to this, there are other factors, as can be seen from the fact that the number of cerebrovascular disease cases, considered prevalent among the elderly, has fallen sharply. Indeed, this seems to give rise to the need for preventive measures, such as changing lifestyles and avoiding carcinogen intake.

“23: Widespread use of a cancer risk assessment technique based on genetic analysis” was a topic included in the latest survey by modifying a similar topic in the previous survey. Among the reasons why this topic was added is thought to have been the discovery of families with higher than usual cancer rates due to the mutation of cancer suppressing genes. Although this technique will lead to cancer prevention, it is necessary to ensure that it is never used as a means of controlling individuals.

Despite the fact that cancer deaths have been steadily increasing as discussed earlier, the number of deaths attributed to cancer does not appear to be so large according to newspaper obituaries etc. Recently, however, the instances of cancer given as the cause of death seem to have increased somewhat, following the issuance by the Ministry of Health and Welfare of guidance recommending the entry of the name of disease directly responsible for the death as the cause of death in death certificates, instead of a vague description of the condition, such as cardiac decompensation or respiratory failure. However, this has not gone far enough. If this is due to a sentiment of wanting to somehow avoid diagnosing cancer, it could quell the trend of squarely facing cancer. It is necessary to seek people’s understanding in this regard, as this will increase their awareness, and take us a step closer towards the eradication of cancer.

(Hideaki Mizoguchi)

14.1.2. Scientific lifestyle guidelines for adult disease (lifestyle disease) prevention

The survey was conducted by presenting the respondents with set technological topics and asking them to specify their forecasted realization times and degree of importance, instead of asking the respondents to come up with topics of their own which they considered would be important in the near future. As a result, topics relating to the development and application of cutting-edge technologies dominated the questionnaire, and there were only a few topics that related to health management. Against this background, it is noteworthy that “20: Widespread use of scientific guidelines for adult-disease-preventing life-styles (nutrition, rest and exercise)” was ranked No. 4 in terms of the degree of importance, despite the fact that survey subjects were researchers from the health, medical care and welfare field, including many who specialized in basic research, instead of lay people. This topic may therefore be taken as a nationwide demand which reflects the trend of the times.

The term adult disease used to evoke the image of a disease the onset of which came with advances in age and which can be delayed but not prevented. However, in recent years, many adult diseases began to be seen as diseases brought on by the effects of people’s daily habits accumulated over sustained periods, i.e. ones lifetime indulgence taking a toll on one’s body. For example, excessive nutritional intake and a dietary imbalance often cause diabetes, arteriosclerosis and cardiovascular diseases, as well as accelerating aging, while these seem to be preventable through moderate exercise and rest. Individuals adult disease risks specified according to their genetic heritage are considered to be reduced dramatically through improvements in everyday life habits. The Ministry of Health and Welfare is trying to promote the prevention of adult diseases by introducing the term lifestyle disease.

In the latest survey, many respondents specified 2006 as the forecasted realization time for “20: Widespread use of scientific guidelines for adult-disease-preventing life-styles (nutrition, rest and exercise)”, but this seems to be more an expression of hope, or perhaps many people thought that considerable scientific data had already been accumulated. While the compilation of guidelines by putting together all the information available at present and their widespread use are likely to be realized fairly soon, a problem remains as to whether this information is scientific enough. Namely, scientific information extracted from human populations (epidemiological study data) does not seem abundant, and, in many cases, basic or animal experiment data is relied on for a scientific basis.

The preparation of scientific lifestyle guidelines aimed at adult disease prevention is an urgent task. However, as it takes a long time to plan and conduct epidemiological studies, obtain results and verify them, the widespread use of scientific guidelines that many researchers would agree to will be pushed back, although some kind of data such as that on smoking habits has already been extensively accumulated, with the only remaining problem being the technicalities of how to spread it.

(Hiroyuki Shimizu and Toshikazu Yoshikawa)

14.1.3. Advances in science and technology, changes in lifestyles and emerging infections

Half a century ago, infectious diseases were the most feared diseases, which posed serious threats to Japanese people's lives and health, and subsequent advances in science and technology played a key role in their control. Municipal water supply, sewage service, food hygiene control (freezers and refrigerators), progress in antibacterial chemotherapy, etc. made a great contribution to this, and many people thought that infectious diseases had ceased to be a medical problem. However, it is becoming apparent that this was an illusion, as changes in lifestyles and living environments provide breeding grounds for new types of infectious diseases. WHO's proposal drawing attention to the importance of emerging infections (new/revival) is based on this point of view. Using actual examples, emerging infections, as a product of advances in science and technology and changes in lifestyles, are discussed in outline below, along with the tasks required to control them in the future.

(1) Opportunistic infections

Advanced medical treatments such as surgical procedures, antineoplastic therapy and organ transplantation have been developed by overcoming various technological challenges including infectious disease control. As a result, people can now survive with extremely low resistance to infection, but this has led to a concentration of low infection-resistant persons, centering around hospitals. For such low infection-resistant persons, microbes whose pathogenicity in the past was rarely a problem can now cause fatal infections. Examples include various drug-resistant bacteria, fungi, cytomegalovirus, *Pneumocystis carinii* and *Cryptosporidium*, for which satisfactory treatment methods have not been developed. Moreover, once they are overcome, their carriers are allowed to live under an even more serious state of infection, giving rise to infectious diseases caused by even weaker pathogens. With infectious diseases of this category, the most important task is to identify pathogens which could cause problems in the future and develop control measures. The development of antitumor agents and immunosuppressant agents which do not reduce infection resistance, and artificial organs and medical supplies (e.g. catheters) which do not easily cause infection are needed.

(2) Multiple-drug-resistant microbe infections

People and microbes both constantly evolve in an ever changing environment. The speed of evolution is linked to the time taken for a generational change, and there is an approximate 25,000-fold difference between humans and staphylococci in this regard. Microbes, therefore, undergo rapid evolution to survive in environments where antibacterial drugs are present. This evolution involves genetic mutations, genetic variations via transposons, plasmid integration, etc. Amid selection pressures applied by antibacterial drugs, drug-resistant microbes selectively propagate. Infestation by drug-resistant microbes is more likely to occur in a hospital environment, where a strong selection pressure applied by antibacterial drugs exists, or a livestock or fish farming industry environment, where antibacterial drugs are added to feed, and the importance of drug-resistant microbe control measures will increase in the future. Technological tasks include i) elucidation of resistance acquisition mechanisms and development of control methods, ii) development of antibacterial drugs for drug-resistant microbes, iii) development of medical facilities and equipment aimed at preventing hospital infections, and iv) measures targeting livestock and fish farming industries.

(3) Changes in lifestyles and emerging infections

Legionella pneumophila, which is a bacillus normally present in natural soil or water environments, has invaded modern buildings featuring characteristic piping or air conditioning systems, and is causing new problems. For example, the bacillus spreads throughout a building by entering the cooling tower as part of the air conditioning system or the water supply system that feeds the hot water supply system. The *Legionella* contamination of 24-hour bath houses and hot springs has also become a problem. While the widespread use of refrigerators made food management easier, *Listeria monocytogenes* favors a refrigerated environment. Once an influenza virus enters a closed space such as an aircraft cabin or building, many people are simultaneously exposed to the virus in high concentrations. If a pathogen enters a large-scale food manufacturing and distribution mechanism, the risk of the simultaneous outbreak of a

large number of infectious cases arises. Mass food poisoning by enteropathogenic *Escherichia coli* O157 via school lunches was a typical example. New diverse artificial spaces always harbor such problems, and infection control involving such spaces will continue to be an important task in the future.

(4) Cross-border infections/tourist-borne infections

People who grow up in a hygienic environment do so without gaining immunity to many microbes as they have limited exposure to pathogens during their growth periods. Today, people can travel anywhere in the world easily by airplane, but this means that they enter foreign environments without developing immunity to pathogens that are native to these environments. A foreign pathogen brought onto virgin soil gives rise to the danger of mounting casualties. The importance of cross-border infection control measures will further increase in the future.

(5) Restoration of nature and new/revival infectious diseases

The spread of Lyme disease in North America and an increase in hydatid disease cases are considered to be linked to the restoration of a local forest environment/wildlife located close to an urban environment. There are concerns over increases in cases of schistosomiasis, malaria, filariasis, etc., which are attributable to the irrigation of desert areas, as well as concerns over an expansion of tropical and semi-tropical regions (areas where tropical diseases such as malaria originate) due to global warming. The implementation of tropical disease control measures in developing countries will be an important task.

(6) Summary

As discussed above, environmental changes brought about by advances in science and technology, in turn, facilitate the outbreak of new infectious diseases. Efforts to develop a monitoring system and control measures for such new infectious diseases will continue to be necessary.

(Takashi Inamatsu)

14.1.4. Gene diagnosis and therapy

Apart from application to cancer, AIDS and various hereditary diseases, attempts are being made to develop gene therapy techniques for acquired diseases such as rheumatism and atopy. Although various techniques have been developed for the introduction of genes into animal cells and promotion of gene expression, including physical, chemical and biochemical methods, none has proven to be infallible, so that they need to be used on a case by case basis, depending on the cell into which a gene is being introduced and the gene which is being introduced or promoted to manifest. The current problem concerns how to efficiently introduce genes and safely control their expression. For this purpose, it is necessary to elucidate expression mechanisms of disease-causing genes, identify the DNA sequences (control regions) necessary for their control, and prepare the most suitable vectors to activate their control regions. Namely, producing proteins needed by a living organism in large quantities is not enough to maintain its homeostasis, and such proteins need to be adequately controlled. The control of the expression of a gene involves more than one transcriptional control gene, and an ideal vector is one which has a fine gene expression control mechanism. From the viewpoint of both introduction efficiency and safety, the early development of a technique to introduce genes into specific tissues and promote their expression is desired. To do this, several methods are being studied including one aimed at incorporating expression control mechanisms based on tissue-specific promoters/enhancers, one taking advantage of tissue specificity that viruses naturally have, and one trying to introduce a gene through a specific combination of the membrane protein of the target tissue and the vector. The problem is that all methods are still low in introduction efficiency.

The ultimate gene therapy technique is the repairing of gene abnormalities without affecting normal genes, which would make gene therapy targeting reproductive cells possible. Although a technique aimed at replacing a DNA containing abnormal sequences with a healthy one based on homologous recombination is being studied, its recombination frequency is still too low for practical application. Vectors capable of introducing genes at specific locations of chromosomes (i.e. locations with no effects on the cells) rather than random locations have been discovered, and the introduction of a gene at a desired gene locus is becoming a reality. Vectors used for gene introduction are not yet perfectly safe. The development of hybrid vectors that

eliminate viral side-effects as much as possible and combine a viral component necessary for gene introduction and a non-viral chemical compound is under way. At present, the development of a gene introduction system centering on large quantities of purified harmless gene-introducing vectors is the most important task in facilitating practical application of gene therapy.

Notably, the top 20 topics in terms of the degree of importance index contained those relating to adult diseases, such as “20: Widespread use of scientific guidelines for adult-disease-preventing life-styles (nutrition, rest and exercise)” or “09: Elucidation of the arteriosclerosis contraction mechanisms”. In the future, preventive medicine for adult diseases will further make progress, with gene therapy based on an accurate gene diagnosis incorporated into adult disease prevention as a treatment option.

In this regard, guidelines to deal with ethical, legal and social issues (ELSI) associated with the application of genetics in medicine (e.g. gene diagnosis and gene therapy) must be urgently developed.

Advantages of gene diagnosis include clear-cut diagnostic results compared to enzyme-based diagnosis, histological diagnosis and tolerance tests, no need to collect a tissue sample from the gene expression site in some cases and the possibility of pre-implantation diagnosis. Gene diagnosis do, however, have limitations such as a very small number of diseases to which it can be applied due to the involvement of a wide range of disease-causing gene abnormalities in many genetic disorders. There are many issues that must be sorted out, such as the objectives of gene diagnosis and the level of understanding a doctor performing gene diagnosis must have about diseases. It is necessary to prevent gene diagnosis from becoming a threat to the protection of privacy.

(Akihiro Morikawa)

14.1.5. Advances in artificial organs

When an important organ of a living organism ceases to function properly, treatment aimed at replacing the organ or providing a functional support becomes necessary. For organ replacement or support treatment, artificial organs are available and used in clinical applications, although they are still short of being perfected medical devices. At present, the artificial kidney is the artificial organ most widely used in clinical applications. Artificial kidneys provide renal failure patients with a total loss of kidney functions with artificial kidney function support consisting of the removal of extra moisture and uremic toxins from their blood and correction of electrolyte imbalances. Under current practices, hemodialysis and continuous ambulatory peritoneal dialysis (CAPD), which do not replace the multiple functions of the kidney, are used.

At present, 154,413 patients (end of December 1995) receive this treatment in Japan. Of them, 30,000 have survived more than 10 years, with the longest survival record standing at 29 years. The good survival rate, despite a recent increase in the number of dialysis patients developing systemic complications, such as diabetes, due to advances in their age, seems to be attributable to progress in dialysis machine technology and medicine. However, new complications (bone and joint disorders and amyloid accumulation) are emerging in long-term dialysis patients.

The need for a true artificial kidney which would eliminate all those complications is increasing, and it is necessary to step up efforts to develop a next-generation artificial kidney in the future, instead of being complacent about the current machines. The ultimate form of an artificial kidney is a wearable-type (portable) or implantation, but, to attain that goal, several technical hurdles must be cleared. The results of the 6th technology forecast survey confirmed that the practical use of fully implanted artificial kidneys has a high degree of importance to Japan. To develop such artificial organs and put them into clinical application, technological innovation is necessary to improve their performance and safety in terms of materials, modules, overall system and so on to satisfactory levels.

On the other hand, pump-oxygenators and artificial hearts are already in use for temporary functional substitution during open-heart surgery etc. Although hopes are high for the development of fully implanted artificial hearts, technical hurdles currently exist in terms of the antithrombotic property and durability of materials and energy supply systems. Artificial valves, pacemakers, large-size artificial blood vessels, artificial sense organs, artificial skin, etc. have already been successfully implanted in patients, making a

semi-perfect substitution of functions of the living human body possible, though on a limited scale.

Artificial lungs do not pose major clinical problems for use in open-heart surgery lasting several hours as a result of the development of membrane lungs using hollow fibers. However, the practical use of fully implanted artificial lungs will not be realized, unless performance enhancement and down sizing take place, along with the development of membrane materials, which are biological-membrane-like, and circuit materials. Aiming to develop a hybrid (bio) artificial liver, the species of the liver cells, culture medium and modules are being studied in pursuit of a synthetic metabolic function and a detoxication function, but ultimately the developmental goal will be a hybrid artificial liver based on human liver cells.

The pancreas regulates insulin secretion in response to fluctuations in blood sugar levels. The focus of current research is the development of a device that detects blood sugar levels accurately and swiftly. There are expectations for the development of a hybrid artificial pancreas and attempted implementation of human islets of langerhans in the human body after implementation as a microcapsule.

A technology that is common for all the above artificial organs is to improve the biological compatibility of materials, in terms of both blood and tissue affinity. The former includes antithrombotic properties, and points to a study of biomaterials in a broad sense of the term. Expectations for the development and practical use of fully-implanted organs in the near future are high, as has been strongly confirmed by the latest survey.

(Fumitake Gejyo)

14.1.6. Direction of welfare and nursing care

Welfare in Japan has undergone a fundamental conceptual and institutional change, following amendments to its welfare laws in 1990.

As a result, welfare is now considered part of essential social services, instead of government relief for the poor, the old notion of welfare.

It encompasses diverse areas, such as old age, children, and physical and intellectual disability, centering on old age.

Until 1990 old-age welfare revolved around facilities, but this has now shifted to services centering on home visits to support the elderly to enable them to remain independent in their own homes. This is thought to be based on the 10-Year Strategy for Old-age Health and Welfare Promotion (Gold Plan), established in 1989. Its home-based welfare concept consists of three policy pillars, home helpers, short stay and day care, and this was followed up by the New Gold Plan, established in 1994, which proposes an increase in the number of home helpers, day-care centers, visiting nurse stations, home helper stations, etc. Indeed, nursing care is becoming a social agenda, and a systematic approach based on public nursing care security is being called for.

Home-based welfare and nursing care services, which are provided mainly by municipal governments, reflect an increase in the number of households consisting of elderly couples or single elderly persons living alone, as well as the declining family nursing care capabilities as a result of the greater social activity involvement of women.

To enable the elderly and the disabled to live independently in the community, informal support, the development of medical-care and nursing-care technologies, and the like are necessary, and the development of injury/disease prevention and self management techniques is important.

It is also necessary to establish a welfare infrastructure consisting of welfare service providing agencies, economic assistance, man power, etc. and develop programs setting out service methods and content.

To improve welfare and nursing care programs, technological topics should be geared towards making it possible to have health checks and treatment advice in one's everyday life environment, "with 88. Practical use of systems by which an appropriate diagnosis can be given at home in the event of an accident or illness" forecasted to be realized by 2009. It is also necessary to identify the physical and psychological needs of the disabled as quickly as possible, with "83: Development of a device to sense the needs of demented aged people" and "89. Widespread use of portable conversational speech interpretation systems" forecasted to be realized by 2019 and 2010, respectively.

On the other hand, while improvement and innovation in old-age and disability care technology is important, a reduction in the burden placed on carers is also necessary in terms of bathing, moving around and improvement of the living environment, in view of the possibility that care will be required over longer periods of time in the future. The development of care technology aimed at improving the efficiency of nursing care and reducing the burden on carers is necessary, with “90: Widespread use of robots that care for people with severe physical and mental disabilities” forecasted to be realized by 2012.

In Japan, nursing care is considered to be a family matter, and therefore has not been discussed in terms of its social aspect. In fact, a discussion on its institutional framework, system, etc. has only recently begun, with the care and welfare system involving professional carers established in 1987.

The development of advanced care techniques is largely left for the future. At present, there is a need to recruit professional carers and deploy them appropriately, and the development of effective educational techniques for them is an important issue.

(Katsuko Kanagawa)

14.1.7. Conclusions

In the health, medical care and welfare field in the latest technology forecast survey, the five areas of malignant neoplasms, adult diseases (lifestyle diseases) and lifestyles, emerging infections, gene diagnosis/treatment, artificial organs, welfare and nursing care were chosen as areas of attention. A comparison between the top 10 topics in the last two surveys in terms of the degree of importance index shows that Alzheimer's disease scored highest in the previous survey, with arteriosclerosis, cancer and AIDS also included. In the latest survey, on the other hand, cancer (malignant neoplasms) was top, with arteriosclerosis and Alzheimer's disease included as before, but AIDS was replaced by viral hepatitis, with scientific guidelines for adult-disease-preventing life-styles newly included.

In the latest survey, the inclusion of malignant neoplasms as an area of attention was meant to focus on the most common type of diseases, while the other areas of attention represented issues that applied more or less across the board. The inclusion of guidelines on adult disease prevention, which newly appeared in the top 10, was partly because of a perceptual change that is occurring with regard to the term. Namely, hypertension, diabetes, etc., traditionally referred to as adult diseases have recently begun to be called lifestyle diseases, as lifestyles and habits from a younger age play an important role in their prevention. Not limited to AIDS and viral hepatitis, infectious diseases as a whole have begun to attract attention from a new perspective, and were included as an area of attention under emerging infections. Gene diagnosis and artificial organs have been a focus of attention as cutting-age areas of medicine. The trends in the welfare and nursing care area were summarized as an area of attention, as the area was newly included in the health, medical care and welfare field.

Collectively, malignant neoplasms are the No. 1 cause of death in Japan. Although prevention efforts such as changing lifestyles and habits and stepped-up screening for early detection and attempts at new treatment methods, the progress so far has been far short of dramatically reducing the mortality rate, with the realization of the average five-year survival rate exceeding 70% forecasted to be more than 15 years away. The second and third cause of death are cerebrovascular diseases and heart diseases (e.g. myocardial infarction), respectively, and these closely linked to arteriosclerosis, which was discussed under adult diseases (lifestyle diseases). While the greatest factor for arteriosclerosis is age, lifestyle also plays an important role as a modifying factor. The effectiveness of the use of the term lifestyle diseases in prevention should be fully monitored in the future. This would necessitate the drawing up of clear scientific guidelines on lifestyles for adult disease prevention. Although it was not discussed as an individual topic this time, an increase in the number of old-age dementia cases has become a major social issue, with Alzheimer's disease requiring particularly urgent attention. As no effective prevention or treatment methods are available at present, it was only mentioned in relation to the issue of care under welfare and nursing care. However, basic research is making fairly rapid progress, and there are vigorous treatment drug development efforts. With viral hepatitis, progress was more pronounced in prevention than treatment, and the situation was the same with AIDS. Over time, however, there has also been considerable progress with regard to AIDS treatment drugs.

With the rapid progress in molecular genetics, gene diagnosis has been advancing at a breathtaking pace, although gene treatment has only just begun. This area also faces considerable ethical problems. Although artificial organs that are operated outside the human body or are of a temporary nature have been fairly extensively used for some organs, artificial organs, in the true sense of the word, are largely still to be developed. There are also ethical problems associated with their use.

In the area of welfare and nursing care, while technological issues exist, institutional issues weigh heavily, and the attitudes of administrative authorities can have a great influence over its future course.

(Syunsaku Hirai)

14.2. Forecast topic framework

In the course of compiling forecast topics, a framework representing the organization of technologies in tabulated matrix form was drawn up for each field, with objectives and technological domains defining the rows and columns of the table, respectively. The framework is designed to present an overall picture of technological development in each field in terms of future prospects, importance, etc. as seen from the present perspective, and is also used as a working framework for future reviews of forecast topics.

Table 14.2-1 Forecast Topic Framework for Health, Medical Care and Welfare Field

Domain \ Objective	Infectious diseases, immune disorders, and metabolic/endocrine diseases	Neoplasms	Neurological, mental and muscular diseases	Circulatory, renal and respiratory diseases	Digestive system diseases	Birth trauma and newborn disorders	Injuries (including accidents)	Hereditary diseases	General/common
Health promotion			01						02
Elucidation of disease development mechanisms	03 04	05 06	07	08 09 10					
Improved standard of prevention methods	11 12 13		14 15		16	17 18 19			20
Improved standard of testing and diagnostic methods	21	22 23 24 25 26	27	28 29	30				31 32 33 34
Improved standard of treatment methods	35 36 37 38 39 40 41 42 43	44 45 46 47 48 49 50 51	52 53 54 55 56 57 58	59 60 61 62 63 64 65	66 67 68 69		70 71 72	73 74	75 76 77 78 79
Improved standard of rehabilitation/assistance			80 81 82 83 84				85 86		
Integration (systems approach)				87					88 89 90 91 92
Basic (elucidation of functions and nature of living bodies, etc.)			93 94 95						96 97 98

* Figures appearing in the table represent topic numbers.

14.3. Topics with high degree of importance

Degree of importance index scores (Note 1) averaged at 61.5 for topics in the health, medical care and welfare field as a whole. Topics considered of particular importance to Japan (top 20 topics in terms of degree of importance index score) are listed in the table below. Nine of the top 20 topics, including the top three, were related to cancer, highlighting the high level of importance attached to it. Although disease-related topics dominated the top 20, “20: Widespread use of scientific guidelines for adult-disease-preventing life-styles” (nutrition, rest and exercise), a topic relating to health management, squeezed in 4th place.

Table 14.3-1 Top 20 Topics in Terms of Degree of Importance Index

Topic	Degree of importance index	Forecasted realization time (year)
05 <u>Elucidation</u> of carcinogenic mutation mechanisms.	88	2013
44 Improvement in the average five-year survival rate for all types of cancer to <u>more than 70%</u> (currently about 40% for stomach cancer).	87	2013
06 <u>Elucidation</u> of cancer metastasis mechanisms.	86	2012
20 <u>Widespread use</u> of scientific guidelines for adult-disease-preventing life-styles (nutrition, rest and exercise).	81	2006
45 <u>Practical use</u> of chemotherapy that brings complete remission to digestive organ cancer with low drug-responsiveness.	78	2015
09 <u>Elucidation</u> of the arteriosclerosis contraction mechanisms.	78	2011
46 <u>Widespread use</u> of techniques to overcome the drug resistance of malignant tumors.	77	2013
48 <u>Practical use</u> of effective methods against cancer metastasis.	76	2013
35 <u>Widespread use</u> of drugs that cure viral liver disease.	75	2010
07 <u>Elucidation</u> of the origins of Alzheimer-type senile dementia.	73	2012
50 <u>Widespread use</u> of biological and immunological therapy effective for cancer.	73	2011
53 <u>Development</u> of effective methods of preventing Alzheimer's disease.	73	2013
39 <u>Possible to cure</u> allergic diseases.	72	2018
13 <u>Development</u> of an HIV vaccine.	72	2007
51 <u>Widespread use</u> of gene therapy against malignant tumors.	72	2014
11 <u>Widespread use</u> of prevention methods for the contraction of diabetic complications.	71	2008
95 <u>Elucidation</u> of individual aging mechanisms.	71	2018
36 <u>Practical use</u> of anti-AIDS therapy.	70	2009
24 <u>Widespread use</u> of an early cancer diagnosis technique based on biochemical examination.	69	2007
37 <u>Widespread use</u> of a technique to eliminate viruses from blood.	69	2010

Note 1: Degree of importance index = (number of “high” responses × 100 + number of “medium” responses × 50 + number of “low” responses × 25 + number of “unnecessary” responses × 0) ÷ total number of degree of importance responses

14.4. Forecasted realization times

Forecasted realization times were distributed as shown in the diagram below. The distribution peaked between 2011 and 2015, with many forecasted realization times also falling in the 2006~2010 period. Overall, the distribution was in line with the general trend covering all topics.

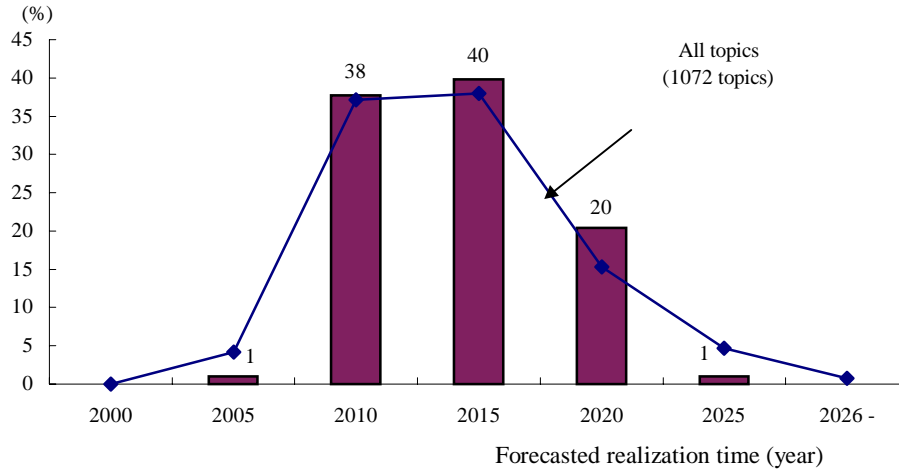


Fig. 14.4-1 Trends in Forecasted Realization Times

14.5. Current leading countries etc.

Responses to the question concerning current leading countries etc. were as shown in the diagram below. The U.S. was named by an overwhelming number of respondents, with its score almost twice that of second-ranking Japan.

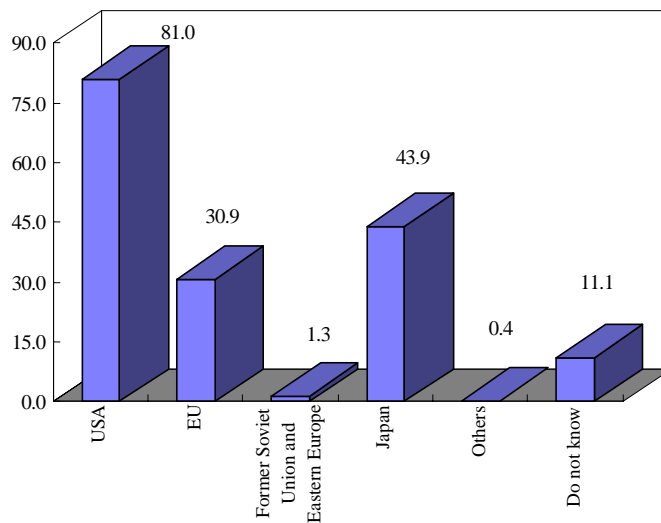


Fig. 14.5-1 Current Leading Countries etc. (%)

14.6. Comparison with the 5th Survey (previous survey)

Of the 98 topics included in the latest survey, 34 (35%) were identical to the previous survey, 34 (35%) were modified, and 30 (31%) were newly introduced. For identical topics, the results of the latest survey were compared with those of the previous survey in terms of degree of importance index scores and forecasted realization times, as shown in the table below.

Degree of importance index scores rose for 2 topics, remained the same for 1 topic and fell for 31 topics. Fourteen topics saw their importance index scores plummet by 15 or more points, including 34. Practical use of a rapid diagnostic method for rejection in organ and tissue transplantation, down 20 points.

From the 4th to the 5th Survey, forecasted realization times were pushed back for all topics. From the 5th to the 6th Survey, on the other hand, forecasted realization times were brought forward for 2 topics (73. Practical use of gene therapy for genetic disorders and 75. Practical use of heterogeneous organ transplantation as means of treatment), remained the same for 1 topic, and were pushed back for 32 topics. 44. Improvement in the average five-year survival rate for all types of cancer to more than 70% saw its forecasted realization time pushed back most (10 years).

Table 14.6-1 Comparison with 5th Survey for Identical Topics

Topic	Degree of importance index / forecasted realization time	
	6th survey	5th survey
02 <u>Practical use</u> of a method to <u>quantitatively</u> assess the level of aging (biological age) in relation to chronological age.	63/2008	63/1999
04 <u>Elucidation</u> of the cause and contracting mechanisms in rheumatoid arthritis.	61/2012	74/2004
07 <u>Elucidation</u> of the origins of Alzheimer-type senile dementia.	73/2012	89/2007
08 <u>Elucidation</u> of contributing factors to bronchial asthma.	64/2010	58/2004
09 <u>Elucidation</u> of the arteriosclerosis contraction mechanisms.	78/2011	93/2004
12 <u>Practical use</u> of a preventive measure against diabetic complications.	56/2009	62/2004
13 <u>Development</u> of an HIV vaccine.	72/2007	88/2003
14 <u>Practical use</u> of prevention methods for stress-induced mental disorders.	60/2011	71/2009
20 <u>Widespread use</u> of scientific guidelines for adult-disease-preventing life-styles (nutrition, rest and exercise).	81/2006	79/2002
21 <u>Elucidation</u> of gout-causing genes.	46/2008	54/2003
26 <u>Widespread use</u> of automatic testing equipment for cancer cytodiagnosis.	63/2006	68/2003
27 <u>Practical use</u> of classification and stage determination of schizophrenia based on diagnostic imaging.	50/2013	61/2012
28 <u>Practical use</u> of diagnosing methods for determining the level and spread of arteriosclerosis focused by a <u>non-invasive process</u> .	62/2008	75/2003
31 <u>Practical use</u> of specialist-level medical diagnosis assistance systems.	53/2008	60/2005
34 <u>Practical use</u> of a rapid diagnostic method for rejection in organ and tissue transplantation.	56/2007	76/2002
36 <u>Practical use</u> of anti-AIDS therapy.	70/2009	88/2006
41 <u>Development</u> of an effective insulin that can be administered orally.	63/2008	65/2004
44 Improvement in the average five-year survival rate for all types of cancer to <u>more than 70%</u> (currently about 40% for stomach cancer).	87/2013	88/2003
48 <u>Practical use</u> of effective methods against cancer metastasis.	76/2013	97/2007*
		86/2011
52 <u>Development</u> of a technique to cause drug delivery to targeted sites in the brain.	59/2015	70/2009
53 <u>Development</u> of effective methods of preventing Alzheimer's disease.	73/2013	89/2011
55 <u>Practical use</u> of a safe pain control method without side effects.	63/2009	78/2004

Topic	Degree of importance index / forecasted realization time	
	6th survey	5th survey
57 <u>Development</u> of effective treatment for amyotrophic lateral sclerosis.	49/2018	68/2011
60 <u>Practical use</u> of batteries of artificial organs implanted in the living body.	54/2014	71/2006
67 <u>Development</u> of artificial liver (external devices supporting liver functions) usable on a long-term, continuous basis.	61/2016	78/2011
73 <u>Practical use</u> of gene therapy for genetic disorders.	58/2012	74/2016
75 <u>Practical use</u> of heterogeneous organ transplantation as means of treatment.	58/2016	63/2017
81 <u>Development</u> of artificial eyes featuring electronic circuitry that can be connected to nerve and brain cells.	49/2019	68/2019
82 <u>Development</u> of methods for recombining disconnected central nerves.	65/2018	80/2015
85 <u>Development</u> of controlling devices which help the cooperative muscular actions enabling object-oriented movement.	55/2014	67/2007
86 <u>Widespread use</u> of artificial legs featuring a small power source and computer control.	51/2010	66/2004
88 <u>Practical use</u> of systems for monitoring health condition and providing information for an appropriate diagnosis <u>at home</u> in event of accident or diseases.	63/2009	70/2005
93 <u>Elucidation</u> of molecular mechanism of memory.	65/2018	68/2014
94 <u>Development</u> of <u>hybrid-type</u> artificial intelligence that combines ICs and living cells.	55/2019	57/2018

* Identical topic from life science field

Note: Up until the 5th Survey, realization meant realization in Japan unless otherwise specified. However, this was changed to mean realization somewhere in the world in the 6th Survey. Therefore, care should be taken when comparing forecasted realization times from the two surveys.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Health promotion	1	Realization of the quantification of stress levels.	1	119	9	35	55	59	30	49	19	2	20	1	92	18		6	16	74	26	6	18	1	22	61	48	15	8	54	2	2	3	30	52	1			
			2	91	9	31	60	60	31	49	19	1	19	2	92	18		3	8	81	27	5	19	1	11	71	49	12	5	56	0	0	1	30	63	0			
			X	8	100	0	0	88	75	25	0	0	0	0	88	38		0	0	88	63	13	25	13	0	75	50	13	13	75	0	0	0	25	88	0			
Health promotion	2	Practical use of a method to quantitatively assess the level of aging (biological age) in relation to chronological age.	1	132	15	36	49	62	35	45	18	2	23	6	94	27		2	5	68	33	4	30	1	20	62	38	21	31	53	2	2	5	33	61	2			
			2	104	14	33	53	63	36	47	14	3	17	4	94	17		1	2	71	28	3	34	0	17	70	42	11	30	55	1	1	5	28	68	1			
			X	15	100	0	0	90	80	20	0	0	20	0	100	13		0	0	100	40	0	47	0	0	67	53	13	20	73	0	0	7	33	60	0			
Elucidation of disease development mechanisms	3	Elucidation of the contracting mechanisms in autoimmune diseases.	1	130	12	35	53	68	40	52	7	1	15	2	92	37		0	8	88	44	2	50	1	8	68	29	27	39	54	0	2	9	18	28	3			
			2	100	10	35	55	66	36	57	6	1	15	2	96	28		0	5	91	39	0	48	0	5	72	27	20	37	58	0	0	4	17	33	2			
			X	10	100	0	0	90	80	20	0	0	20	0	100	40		0	0	100	20	0	70	0	0	90	30	20	30	60	0	0	0	30	40	0			
Elucidation of disease development mechanisms	4	Elucidation of the cause and contracting mechanisms in rheumatoid arthritis.	1	115	13	33	54	61	28	59	12	1	13	3	96	26		0	5	83	40	2	49	1	9	67	29	24	37	56	0	2	5	17	27	3			
			2	87	9	39	52	61	28	63	8	1	16	3	98	21		0	3	90	36	0	49	1	6	74	22	18	37	59	0	0	3	9	33	1			
			X	8	100	0	0	88	75	25	0	0	25	0	100	25		0	0	100	25	0	75	0	0	63	38	0	38	50	0	0	0	13	50	0			
Elucidation of disease development mechanisms	5	Elucidation of carcinogenic mutation mechanisms.	1	147	19	31	50	87	76	21	2	1	21	6	95	50		3	9	95	55	3	61	1	3	65	31	30	47	65	0	2	7	15	40	3			
			2	113	17	32	51	88	78	20	2	1	22	4	94	42		2	6	96	46	1	59	1	3	76	23	25	42	69	0	1	1	11	45	2			
			X	19	100	0	0	100	100	0	0	0	32	11	89	37		0	5	100	42	0	68	0	0	74	11	16	47	68	0	0	0	16	37	5			
Elucidation of disease development mechanisms	6	Elucidation of cancer metastasis mechanisms.	1	147	18	31	51	83	69	26	4	1	19	4	95	39		2	7	89	44	3	51	1	8	68	35	27	39	67	1	1	5	9	40	3			
			2	113	16	32	52	86	75	21	3	1	20	4	94	29		2	4	94	38	1	53	1	5	75	32	25	34	67	0	1	2	11	43	1			
			X	18	100	0	0	96	94	0	6	0	39	11	89	39		6	6	94	39	0	61	6	6	78	22	28	44	61	0	0	0	17	50	0			
Elucidation of disease development mechanisms	7	Elucidation of the origins of Alzheimer-type senile dementia.	1	106	11	24	65	72	49	40	11	0	27	0	96	33		4	5	92	38	1	41	0	8	69	29	31	33	59	1	1	5	22	45	2			
			2	87	10	25	64	73	48	47	5	0	31	1	95	23		2	3	92	33	1	40	0	6	77	26	26	26	63	0	0	0	18	53	1			
			X	9	100	0	0	100	100	0	0	0	11	0	100	33		0	0	89	22	11	56	0	0	89	11	22	33	44	0	0	0	44	56	0			
Elucidation of disease development mechanisms	8	Elucidation of contributing factors to bronchial asthma.	1	108	13	30	57	62	31	57	11	1	16	4	98	22		0	5	80	44	2	49	0	13	66	37	26	31	57	0	2	17	9	25	3			
			2	85	12	31	58	64	30	64	6	0	16	1	99	19		0	2	87	39	0	52	0	8	72	34	21	20	64	0	0	11	8	36	1			
			X	10	100	0	0	80	60	40	0	0	20	0	100	30		0	0	90	60	0	50	0	0	70	40	20	30	60	0	0	20	0	40	0			
Elucidation of disease development mechanisms	9	Elucidation of the arteriosclerosis contraction mechanisms.	1	120	13	34	53	73	50	44	6	0	28	8	97	29		2	4	89	46	3	47	1	7	65	35	31	30	61	0	1	7	13	32	3			
			2	91	10	34	56	78	59	36	6	0	26	1	97	26		1	3	96	43	0	49	1	2	73	34	20	20	67	0	0	2	9	41	1			
			X	9	100	0	0	94	89	11	0	0	11	11	100	44		11	0	100	44	0	44	0	0	67	22	22	11	67	0	0	0	0	44	0			
Elucidation of disease development mechanisms	10	Elucidation of factors contributing to chronic nephritis (primary) contraction.	1	88	10	22	68	56	23	53	23	0	23	2	99	22		1	7	78	42	2	47	0	16	65	34	26	25	63	0	1	6	9	28	5			
			2	71	7	18	75	58	21	67	11	0	23	1	97	17		1	6	86	37	0	45	0	11	76	28	15	20	65	1	0	1	7	34	4			
			X	5	100	0	0	80	60	40	0	0	0	20	100	60		20	20	100	40	0	60	0	0	60	60	20	20	40	0	0	0	20	20	20			

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)						Potential problems (%)							
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Improved standard of prevention methods	11	Widespread use of prevention methods for the contraction of diabetic complications.	1	112	9	38	54	70	43	51	6	0	21	2	96	16		3	3	83	46	1	51	0	12	65	33	26	25	54	4	1	4	15	37	4			
			2	88	9	33	58	71	45	48	7	0	23	0	95	13		1	1	89	43	0	49	0	7	78	28	22	19	60	1	1	0	11	40	2			
			X	8	100	0	0	81	63	38	0	0	38	0	100	25		0	13	100	38	0	38	0	0	75	50	25	25	63	0	0	0	25	38	0			
	12	Practical use of a preventive measure against diabetic complications.	1	95	11	31	59	57	23	59	18	0	23	1	91	16		5	9	74	42	2	40	0	19	63	39	22	32	49	0	1	2	11	37	1			
			2	77	10	25	65	56	18	70	12	0	23	0	92	14		8	6	82	42	0	43	0	14	74	34	18	23	60	0	1	0	8	36	1			
			X	8	100	0	0	66	38	50	13	0	13	0	63	38		38	0	88	50	0	50	0	0	88	38	25	50	38	0	0	0	13	38	0			
	13	Development of an HIV vaccine.	1	113	6	26	68	69	45	42	12	1	24	6	91	25		4	5	94	36	1	23	0	5	65	35	22	31	61	4	3	5	30	43	0			
			2	87	1	29	70	72	48	44	8	0	23	6	94	20		1	2	94	41	0	24	1	3	67	38	24	25	66	1	3	0	26	51	0			
			X	1	100	0	0	100	100	0	0	0	100	0	100	0		0	0	100	100	0	100	0	0	100	100	0	100	0	0	0	0	0	100	0			
	14	Practical use of prevention methods for stress-induced mental disorders.	1	83	7	33	60	62	32	50	18	0	27	2	94	17		7	10	78	37	2	27	1	17	71	37	25	11	42	2	2	2	31	53	1			
			2	65	6	35	58	60	27	61	13	0	26	2	94	14		9	5	83	40	5	18	2	9	80	35	23	5	51	2	3	0	25	60	0			
			X	4	100	0	0	81	75	0	25	0	0	0	100	0		0	25	100	50	0	0	25	0	75	50	50	0	50	0	0	0	25	75	0			
	15	Widespread use of presbyopia prevention methods.	1	59	7	24	69	51	22	38	38	2	24	0	92	14		17	10	49	24	7	32	0	31	49	25	20	8	39	0	3	3	15	32	2			
			2	47	6	15	79	46	15	38	47	0	26	0	87	6		19	4	60	28	2	38	0	28	68	17	19	4	49	0	2	0	6	34	2			
			X	3	100	0	0	67	33	67	0	0	0	0	67	0		0	0	67	33	0	67	0	33	100	0	0	0	67	0	0	0	33	0	0			
	16	Widespread use of a laser-applied tooth decay treatment method.	1	35	6	17	77	50	18	48	30	3	31	3	86	14		0	9	66	34	0	51	0	20	49	57	11	3	40	9	0	9	20	23	9			
			2	33	6	12	82	55	22	53	25	0	33	0	88	9		3	6	70	45	0	64	0	12	61	55	15	0	48	0	3	3	15	27	3			
			X	2	100	0	0	75	50	50	0	0	50	0	100	0		0	0	100	50	0	100	0	0	100	0	50	0	100	0	0	0	0	0	0			
	17	Widespread method of prevention against a premature delivery through the progression of management system of fetal information.	1	52	17	29	54	54	26	40	32	2	21	4	94	13		2	4	75	42	2	54	0	13	50	27	25	19	48	2	4	4	21	50	4			
			2	46	13	28	59	54	22	50	28	0	28	0	96	11		2	4	76	43	2	59	0	11	67	22	20	11	61	0	0	0	24	54	2			
X			6	100	0	0	83	67	33	0	0	33	0	100	0		0	17	67	67	17	83	0	17	67	33	50	0	67	0	0	0	17	17	0				
18	Practical use of the prevention against congenital anomaly originating in the embryonic or fetal period.	1	70	16	21	63	54	25	44	29	1	17	9	91	19		10	7	74	39	3	39	1	19	57	19	14	49	50	9	3	4	34	67	1				
		2	58	14	19	67	53	19	57	24	0	22	0	91	17		7	3	84	43	0	33	2	7	66	12	3	50	55	9	0	0	29	66	0				
		X	8	100	0	0	69	38	63	0	0	25	0	100	25		13	0	75	25	0	50	13	13	63	13	13	50	63	13	0	0	38	63	0				
19	Widespread use of preventive measure for cerebral palsy.	1	61	16	23	61	60	32	42	25	0	15	8	95	10		2	10	67	34	3	38	0	26	79	23	23	23	48	5	3	5	21	48	2				
		2	49	14	22	63	56	24	49	27	0	20	2	96	6		0	8	80	39	2	39	0	16	86	14	14	18	57	2	2	2	18	59	0				
		X	7	100	0	0	71	43	57	0	0	29	0	100	0		0	14	86	71	0	57	0	14	100	14	14	14	57	0	0	0	43	71	0				
20	Widespread use of scientific guidelines for adult-disease-preventing life-styles (nutrition, rest and exercise).	1	131	22	29	49	76	56	37	7	0	35	9	94	14		1	3	75	46	2	47	0	8	50	53	25	20	46	5	2	5	11	47	2				
		2	101	26	30	45	81	65	31	4	0	40	5	95	10		1	1	80	45	1	56	0	5	63	48	21	17	56	4	1	3	10	54	1				
		X	26	100	0	0	92	85	15	0	0	35	4	96	19		0	0	88	35	4	54	0	8	69	46	27	8	81	4	4	4	4	58	4				

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Improved standard of testing and diagnostic methods	21	Elucidation of gout-causing genes.	1	78	3	23	74	45	8	58	32	3	10	5	92	23		0	5	82	37	3	28	0	13	63	24	17	44	45	0	0	4	18	28	1			
			2	65	2	26	72	46	6	64	30	0	15	3	94	20		0	2	85	38	2	37	0	9	80	23	12	45	49	0	0	0	17	32	2			
			X	1	100	0	0	100	100	0	0	0	100	0	100	0		0	0	100	100	0	0	0	0	100	0	0	100	100	0	0	0	0	100	0			
	22	Widespread use of a cancer spread diagnosis technique based on 3-D imaging.	1	114	15	32	54	66	37	51	12	0	30	1	91	17		0	4	82	37	1	68	0	11	54	54	35	8	55	2	1	1	19	21	2			
			2	89	10	38	52	63	30	62	8	0	33	0	94	15		0	1	84	35	2	75	0	3	56	54	29	10	58	1	0	1	19	27	2			
			X	9	100	0	0	67	33	67	0	0	56	0	100	11		0	0	78	33	0	89	0	0	67	67	22	0	78	0	0	0	22	44	0			
	23	Widespread use of a cancer risk assessment technique based on genetic analysis.	1	124	13	26	61	66	38	51	10	1	21	4	90	23		3	6	92	48	2	52	1	6	54	33	19	57	52	5	1	2	38	52	2			
			2	95	9	24	66	66	36	56	7	0	26	2	94	25		2	0	94	47	2	56	1	2	67	25	15	56	55	4	0	1	21	57	1			
			X	9	100	0	0	94	89	11	0	0	56	11	78	44		0	0	89	56	0	56	11	0	78	33	11	67	56	0	0	0	33	56	0			
	24	Widespread use of an early cancer diagnosis technique based on biochemical examination.	1	134	18	28	54	69	44	47	7	2	26	1	93	18		9	5	81	37	3	64	1	11	55	41	19	29	57	2	1	1	25	31	1			
			2	104	14	24	62	69	43	50	7	1	31	1	93	12		9	1	79	36	1	65	1	12	60	38	16	23	63	2	0	0	17	35	1			
			X	15	100	0	0	83	67	33	0	0	33	0	100	20		13	7	80	40	7	73	7	7	87	27	7	20	73	0	0	0	27	33	0			
	25	Widespread use of against of cancer cells drug sensitivity measurement method.	1	118	19	25	55	66	42	40	16	2	34	3	87	17		2	6	78	39	2	60	1	11	58	41	24	25	54	2	1	3	15	23	2			
			2	93	17	29	54	65	37	50	12	1	32	0	87	12		1	3	84	33	0	62	1	6	63	40	20	23	53	0	0	0	14	26	1			
			X	16	100	0	0	80	63	31	6	0	44	0	75	0		0	6	88	44	0	75	6	0	81	44	31	19	63	0	0	0	38	19	0			
	26	Widespread use of automatic testing equipment for cancer cytodiagnosis.	1	106	16	29	55	63	38	40	22	1	32	2	91	13		3	7	75	28	2	61	0	12	57	53	25	18	48	1	1	1	20	24	5			
			2	81	17	28	54	63	36	46	17	1	33	0	93	9		4	2	77	28	1	65	0	9	62	53	22	17	44	0	0	0	17	28	1			
			X	14	100	0	0	75	57	29	14	0	50	0	86	0		7	0	86	43	0	64	0	0	64	50	21	21	57	0	0	0	29	21	0			
	27	Practical use of classification and stage determination of schizophrenia based on diagnostic imaging.	1	53	9	23	68	51	15	60	23	2	13	2	87	30		8	6	77	38	6	34	0	17	70	42	25	11	53	6	0	0	34	53	2			
			2	48	10	19	71	50	10	69	21	0	15	0	92	27		6	6	79	38	2	35	2	17	71	35	25	8	54	4	0	0	33	58	2			
			X	5	100	0	0	80	60	40	0	0	20	0	100	40		0	20	100	80	0	20	20	0	100	20	40	20	80	0	0	0	60	40	0			
	28	Practical use of diagnosing methods for determining the level and spread of arteriosclerosis focused by a non-invasive process.	1	81	15	37	48	64	36	47	16	1	22	1	90	19		0	1	80	40	1	53	0	9	56	53	37	10	49	1	0	1	16	25	4			
			2	66	11	38	52	62	28	63	9	0	27	2	92	17		0	2	80	44	0	55	0	9	73	48	38	9	50	2	0	0	17	32	3			
			X	7	100	0	0	79	57	43	0	0	14	0	86	43		0	0	86	57	0	71	0	0	86	57	43	0	57	0	0	0	57	29	0			
	29	Establishment of a correct diagnostic measure for kidney diseases without renal biopsy.	1	70	9	30	61	53	19	56	24	1	19	0	90	17		6	13	63	30	0	46	0	27	63	34	21	14	54	0	0	1	17	20	3			
			2	57	7	25	68	54	16	67	18	0	19	0	95	12		4	4	77	30	0	61	0	16	74	33	18	11	56	0	0	0	14	28	2			
			X	4	100	0	0	75	50	50	0	0	0	0	75	50		0	25	100	75	0	100	0	0	100	50	25	25	75	0	0	0	50	50	0			
	30	Development of a capsule-type total gastro intestinal tract monitoring system.	1	70	11	26	63	57	26	52	17	4	39	1	89	19		7	7	60	14	0	56	1	16	53	56	24	10	51	4	3	3	10	27	3			
			2	53	8	28	64	59	25	62	13	0	40	0	91	15		8	2	62	13	0	68	0	15	60	57	21	4	47	4	0	0	11	28	2			
			X	4	100	0	0	63	50	0	50	0	25	0	100	0		0	0	25	25	0	75	0	0	50	50	25	0	50	0	0	0	0	25	0			

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)			Expected effect (%)			Forecasted realization time					Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)									
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026					USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects															
Improved standard of testing and diagnostic methods	31	Practical use of specialist-level medical diagnosis assistance systems.	1	114	12	31	57	55	24	47	29	0	45	2	89	18		3	5	81	27	3	46	0	10	46	61	20	14	46	4	1	3	25	27	4		
			2	90	10	34	56	53	17	62	21	0	44	2	91	12		2	0	90	18	3	51	0	6	51	60	24	14	52	2	0	0	24	31	1		
			X	9	100	0	0	72	44	56	0	0	56	22	89	11		0	0	100	22	0	78	0	0	67	56	33	11	56	0	0	0	44	22	0		
	32	Development of non-invasive cell-level diagnostic imaging.	1	94	12	29	60	59	30	48	22	0	41	0	90	26		6	9	73	28	1	51	0	15	48	60	26	13	49	0	1	3	14	23	2		
			2	83	8	25	66	59	26	57	17	0	43	0	90	20		4	5	81	22	1	58	1	12	49	60	27	6	57	0	1	0	13	29	1		
			X	7	100	0	0	71	57	14	29	0	71	0	100	14		0	0	100	29	0	71	0	0	57	43	14	0	71	0	14	0	14	14	0		
	33	Practical use of a non-invasive technique to obtain blood biochemical examination data using body surface sensors.	1	84	11	31	58	63	33	51	16	0	49	2	86	23		5	10	68	25	2	49	0	23	54	64	24	11	52	0	2	4	18	24	4		
			2	71	10	24	66	57	24	59	15	1	46	1	86	15		6	6	77	20	0	63	0	15	59	62	25	1	59	0	4	1	17	27	1		
			X	7	100	0	0	75	57	29	14	0	71	14	57	29		0	0	86	29	0	100	0	0	57	43	29	0	57	0	29	0	14	29	0		
	34	Practical use of a rapid diagnostic method for rejection in organ and tissue transplantation.	1	90	17	26	58	59	28	52	19	0	19	0	93	22		0	4	91	44	1	43	0	6	61	47	22	24	54	3	0	4	16	31	2		
			2	70	21	14	64	56	20	64	16	0	23	0	87	19		0	1	94	41	1	47	0	3	73	44	17	17	64	3	0	1	13	33	1		
			X	15	100	0	0	68	40	53	7	0	20	0	93	20		0	0	100	67	0	60	0	0	73	67	20	20	73	0	0	0	13	27	0		
Improved standard of treatment methods	35	Widespread use of drugs that cure viral liver disease.	1	97	13	26	61	76	53	44	3	0	36	3	94	21		5	4	76	40	3	64	0	8	62	47	22	23	59	3	1	2	15	28	5		
			2	74	9	24	66	75	51	46	3	0	38	1	97	15		4	1	80	35	1	72	0	5	69	42	18	16	69	1	0	1	14	28	1		
			X	7	100	0	0	93	86	14	0	0	29	14	100	29		0	0	71	14	0	86	0	0	71	57	0	14	100	0	0	0	14	43	0		
	36	Practical use of anti-AIDS therapy.	1	111	10	22	68	74	51	40	9	0	36	5	93	24		1	5	96	40	2	25	2	1	69	37	28	18	59	1	2	3	28	41	1		
			2	85	6	21	73	70	45	45	10	0	28	7	92	18		1	1	95	44	1	27	0	1	75	38	25	14	65	1	1	0	24	45	0		
			X	5	100	0	0	90	80	20	0	0	20	0	100	20		0	0	100	80	20	40	0	0	60	60	40	20	80	0	0	0	40	40	0		
	37	Widespread use of a technique to eliminate viruses from blood.	1	81	10	17	73	69	45	41	13	1	38	6	86	31		10	10	74	28	0	37	0	20	67	49	21	12	53	1	0	5	14	31	5		
			2	63	5	24	71	69	43	46	11	0	38	2	90	22		8	3	84	30	0	48	0	11	79	51	19	8	59	2	0	2	22	32	2		
			X	3	100	0	0	100	100	0	0	0	0	0	100	33		0	0	100	33	0	100	0	0	100	100	0	33	67	0	0	33	33	33	0		
	38	Widespread use of malaria vaccines.	1	54	4	15	81	33	8	26	51	15	24	19	76	20		4	7	52	30	7	28	6	22	70	17	9	13	56	0	4	15	9	28	4		
			2	43	2	14	84	34	7	23	63	7	35	9	84	14		5	5	63	33	2	30	2	26	74	14	12	16	63	2	0	16	7	26	2		
			X	1	100	0	0	0	0	0	0	0	100	0	100	0		100	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0	0	0	0		
39	Possible to cure allergic diseases.	1	110	12	27	61	70	46	43	11	0	34	6	97	24		13	11	78	45	2	50	2	14	64	36	21	32	55	2	1	6	10	22	2			
		2	85	11	28	61	72	48	43	8	0	33	5	91	20		18	8	80	40	0	53	1	11	71	34	20	22	61	0	0	1	11	24	1			
		X	9	100	0	0	83	67	33	0	0	56	22	89	11		11	0	67	44	0	78	11	0	89	44	11	44	78	0	0	11	11	33	0			
40	Possible to cure autoimmune diseases.	1	110	8	26	65	65	36	51	12	0	28	1	95	24		14	15	81	42	3	45	1	15	68	35	23	32	60	1	1	3	9	28	1			
		2	82	6	32	62	67	37	56	7	0	28	0	95	20		16	13	85	37	0	52	0	11	80	34	22	22	68	0	0	0	12	26	1			
		X	5	100	0	0	100	100	0	0	0	20	0	100	20		0	0	100	20	0	100	0	0	80	60	0	20	100	0	0	0	20	20	0			

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Revolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Improved standard of treatment methods	41	Development of an effective insulin that can be administered orally.	1	85	7	31	62	66	39	52	7	2	38	4	95	18		9	8	71	38	1	38	0	20	56	52	21	16	49	1	0	1	12	24	6			
			2	72	8	25	67	63	31	63	6	1	44	1	97	13		4	6	83	40	0	42	0	10	67	64	19	11	56	1	0	0	10	32	1			
			X	6	100	0	0	79	67	17	17	0	50	0	100	17		17	0	83	17	0	33	0	0	67	83	17	0	50	0	0	0	17	17	0			
	42	Practical use of gene therapy for diabetes.	1	93	9	25	67	66	39	47	13	1	27	2	95	22		11	11	88	39	1	33	0	10	59	34	22	45	53	5	0	2	19	39	2			
			2	74	11	19	70	62	30	58	12	0	32	1	96	16		9	7	92	43	0	32	0	4	66	32	20	46	57	7	0	0	22	50	3			
			X	8	100	0	0	72	50	38	13	0	38	0	100	13		25	13	88	13	0	38	0	0	50	38	25	38	38	0	0	0	25	50	0			
	43	Widespread use of gene therapy for familial hypercholesterolemia.	1	90	8	27	66	52	21	48	30	1	21	2	94	17		9	12	86	32	2	30	0	10	59	34	17	42	54	4	0	2	19	38	1			
			2	69	6	20	74	54	22	52	26	0	26	0	97	14		6	9	93	38	0	29	1	4	71	33	16	39	58	6	0	0	20	48	1			
			X	4	100	0	0	88	75	25	0	0	25	0	100	25		25	0	100	0	0	50	0	0	75	75	25	25	50	0	0	0	25	25	0			
	44	Improvement in the average five-year survival rate for all types of cancer to more than 70% (currently about 40% for stomach cancer).	1	124	22	33	45	82	66	28	6	0	31	2	96	15		3	6	82	41	4	69	0	9	64	47	31	27	57	2	0	3	13	31	4			
			2	97	20	30	51	87	75	22	3	0	32	0	98	11		4	4	86	39	2	76	0	6	69	43	27	18	69	1	0	0	12	29	1			
			X	19	100	0	0	92	84	16	0	0	32	0	100	16		5	11	89	58	11	79	0	5	79	47	16	32	74	0	0	0	21	32	0			
	45	Practical use of chemotherapy that brings complete remission to digestive organ cancer with low drug-responsiveness.	1	93	23	25	53	74	52	40	8	0	33	1	94	18		22	14	75	33	1	56	0	12	61	51	26	17	57	2	0	2	12	27	4			
			2	74	23	26	51	78	58	39	3	0	39	0	95	11		23	5	85	34	1	62	0	7	70	49	24	14	65	0	0	1	12	27	1			
			X	17	100	0	0	81	65	29	6	0	35	0	88	6		29	6	88	47	0	82	0	0	76	53	12	6	88	0	0	0	12	24	0			
46	Widespread use of techniques to overcome the drug resistance of malignant tumors.	1	103	21	23	55	71	49	38	13	0	26	3	90	22		10	15	75	34	1	50	0	16	62	50	20	26	54	0	0	3	11	26	3				
		2	78	21	23	56	77	56	37	6	0	33	0	95	15		14	8	81	33	0	56	0	10	68	51	18	17	60	0	0	1	12	24	1				
		X	16	100	0	0	86	75	19	6	0	31	0	100	13		13	6	100	44	0	81	0	0	75	50	19	31	88	0	0	6	6	19	0				
47	Development of radiosensitizers effective in cancer treatment.	1	91	12	27	60	64	35	51	14	0	32	2	96	16		2	14	76	34	2	44	0	16	64	53	30	18	56	3	0	5	12	21	5				
		2	68	10	25	65	65	34	57	9	0	41	1	94	15		0	12	84	35	0	51	0	10	68	56	22	12	59	3	0	4	12	26	1				
		X	7	100	0	0	61	29	57	14	0	57	0	100	29		0	0	100	57	0	57	0	0	86	57	14	0	57	14	0	0	29	14	0				
48	Practical use of effective methods against cancer metastasis.	1	115	17	30	53	73	50	42	9	0	24	2	94	25		7	13	80	36	2	50	0	16	70	43	26	27	57	0	0	4	12	22	4				
		2	85	13	32	55	76	56	36	7	0	32	1	93	18		7	9	84	34	0	54	0	14	76	46	24	19	59	0	0	1	13	26	1				
		X	11	100	0	0	89	82	9	9	0	55	0	91	36		9	9	100	45	0	82	0	0	91	55	0	45	73	0	0	0	27	27	0				
49	Widespread use of heavy particle against cancer.	1	69	10	25	65	53	22	50	24	4	25	1	90	19		10	17	72	28	9	54	0	14	46	52	33	6	55	0	1	6	19	26	4				
		2	52	6	25	69	56	23	54	23	0	33	0	92	15		8	10	69	31	2	56	0	13	54	54	31	2	67	2	0	4	17	37	2				
		X	3	100	0	0	42	0	67	33	0	33	0	100	33		33	0	67	0	0	100	0	0	100	33	67	0	100	0	0	0	33	33	0				
50	Widespread use of biological and immunological therapy effective for cancer.	1	118	15	32	53	70	47	41	12	0	29	2	93	20		8	9	77	35	5	57	1	13	62	50	21	27	59	1	0	3	11	20	3				
		2	85	13	31	56	73	50	42	8	0	34	0	94	12		8	5	80	35	1	62	0	9	73	52	18	21	68	2	0	0	13	25	1				
		X	11	100	0	0	86	73	27	0	0	45	0	91	18		0	9	100	45	0	91	0	0	100	91	9	18	82	0	0	0	27	18	0				

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Improved standard of treatment methods	51	Widespread use of gene therapy against malignant tumors.	1	119	16	24	61	70	47	39	12	1	26	3	92	24		8	14	89	33	3	35	0	6	69	38	20	44	54	3	0	3	18	36	3			
			2	88	14	25	61	72	48	43	9	0	27	2	92	24		8	6	94	33	0	38	0	3	81	34	18	43	59	3	0	2	16	44	1			
			X	12	100	0	0	100	100	0	0	0	42	0	83	25		17	8	100	50	0	58	0	0	92	50	0	75	83	0	0	0	50	50	0			
	52	Development of a technique to cause drug delivery to targeted sites in the brain.	1	77	8	36	56	56	23	57	19	1	30	0	91	26		4	12	75	23	1	35	0	14	68	42	34	8	51	1	0	1	16	31	5			
			2	65	6	35	58	59	25	59	16	0	29	2	95	26		2	8	85	17	0	40	0	11	74	45	34	5	49	2	0	0	18	37	2			
			X	4	100	0	0	75	50	50	0	0	25	0	100	25		0	0	100	25	0	25	0	0	75	25	0	25	25	0	0	0	50	25	0			
	53	Development of effective methods of preventing Alzheimer's disease.	1	87	10	22	68	68	43	48	7	2	25	1	92	28		3	18	87	40	0	39	0	7	68	41	24	24	62	0	0	0	14	37	3			
			2	72	11	21	68	73	49	46	6	0	33	0	99	24		1	13	92	38	0	42	0	4	72	33	33	22	64	0	0	0	14	33	1			
			X	8	100	0	0	100	100	0	0	0	25	0	100	25		0	13	100	50	0	63	0	0	75	38	25	38	63	0	0	0	0	13	0			
	54	Development of a cure method for schizophrenia.	1	61	5	21	74	63	34	52	12	2	21	2	89	36		20	20	67	34	3	21	0	23	59	38	28	21	51	5	0	2	11	43	2			
			2	54	7	20	72	64	31	61	7	0	30	2	96	30		30	17	70	35	2	22	4	22	65	26	35	17	50	4	0	0	13	39	2			
			X	4	100	0	0	100	100	0	0	0	25	25	100	75		25	25	100	50	0	50	25	0	75	0	50	25	75	25	0	0	0	50	0			
	55	Practical use of a safe pain control method without side effects.	1	100	12	36	52	65	37	50	13	0	22	1	97	19		4	11	77	44	6	38	1	16	66	45	17	9	53	3	0	3	7	29	3			
			2	84	10	26	64	63	31	59	10	0	25	0	99	15		4	7	81	46	2	31	0	15	73	52	15	5	61	5	0	0	11	32	1			
			X	8	100	0	0	81	63	38	0	0	50	0	100	25		0	13	100	63	13	63	0	0	75	50	0	0	63	13	0	0	13	50	13			
	56	Widespread use of gene therapy for muscular dystrophy.	1	66	9	30	61	47	16	42	39	3	18	2	89	18		5	9	83	33	2	35	0	11	71	33	15	50	42	2	2	3	18	32	3			
			2	49	6	29	65	48	17	44	38	2	27	0	94	16		2	4	86	31	0	39	0	6	73	24	18	45	43	6	2	0	22	41	2			
			X	3	100	0	0	42	0	67	33	0	33	0	100	33		0	0	100	67	0	100	0	0	67	67	33	100	33	0	0	0	33	33	0			
	57	Development of effective treatment for amyotrophic lateral sclerosis.	1	55	9	29	62	48	19	41	37	4	20	0	89	24		5	11	75	27	2	31	0	15	71	40	18	18	47	2	0	2	15	29	4			
			2	45	2	27	71	49	18	43	36	2	24	0	93	18		2	11	87	27	0	33	0	7	76	29	24	11	51	2	0	0	13	31	2			
			X	1	100	0	0	50	0	100	0	0	0	0	100	0		0	0	100	100	0	100	0	0	100	100	0	0	100	0	0	0	0	0	0	0		
	58	Practical use of artificial muscles for limbs.	1	46	13	30	57	51	20	49	24	7	43	0	87	26		11	15	61	24	2	26	0	22	57	54	24	11	59	0	0	2	13	28	4			
			2	40	8	25	68	47	13	54	28	5	50	0	90	13		10	13	78	23	3	33	0	13	73	48	30	5	55	0	0	0	10	30	5			
			X	3	100	0	0	75	50	50	0	0	67	0	100	33		0	0	100	33	0	33	0	0	67	100	33	0	100	0	0	0	33	33	0			
59	Practical use of a technique to induce the differentiation of fibroblasts into cardiac muscle and its application to the treatment of myocardial infarction.	1	65	9	29	62	59	32	45	16	6	26	0	88	35		15	23	68	14	0	18	0	20	65	51	29	15	52	0	0	3	11	26	5				
		2	50	6	26	68	56	20	67	8	4	28	0	90	24		14	14	82	18	0	26	0	14	78	40	24	6	54	0	0	0	10	30	4				
		X	3	100	0	0	67	33	67	0	0	33	0	67	0		0	0	100	0	0	0	0	0	100	0	0	0	33	0	0	0	0	67	0				
60	Practical use of batteries of artificial organs implanted in the living body.	1	55	5	35	60	55	24	51	22	4	44	13	87	22		5	13	69	18	0	44	0	20	62	62	25	7	49	4	2	5	18	24	5				
		2	41	7	27	66	54	20	60	18	3	44	5	88	12		7	5	85	15	0	51	0	10	80	56	24	2	46	2	0	2	17	32	2				
		X	3	100	0	0	75	50	50	0	0	67	0	100	0		33	0	100	0	0	67	0	0	33	33	33	0	0	0	0	0	0	0	0	0			

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)				Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)								
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Improved standard of treatment methods	61	Widespread use of functional blood purifiers that selectively remove specified components from blood.	1	79	10	28	62	56	22	62	14	3	41	1	91	20		0	9	70	28	3	52	0	20	59	62	30	10	54	6	0	4	11	23	5			
			2	61	13	23	64	57	21	66	13	0	39	2	97	16		0	7	80	26	3	57	0	11	56	64	26	5	56	5	0	3	16	33	2			
			X	8	100	0	0	75	50	50	0	0	50	13	100	13		0	0	88	25	0	100	0	0	88	88	13	0	50	0	0	25	13	25	0			
	62	Widespread use of artificial hemoglobin as a red blood cell substitute.	1	77	13	30	57	61	31	53	13	3	45	1	91	19		5	8	75	26	4	49	1	16	58	55	29	10	52	5	0	4	12	29	3			
			2	63	13	24	63	61	27	62	11	0	49	3	92	16		5	6	83	21	0	56	0	13	68	60	22	5	54	5	0	0	13	38	2			
			X	8	100	0	0	72	50	38	13	0	63	0	88	13		0	13	88	50	0	88	0	13	75	50	13	25	50	0	0	0	0	38	0			
	63	Development of fully implanted artificial hearts.	1	73	11	22	67	63	34	49	15	1	45	0	97	22		5	4	82	25	1	55	0	11	58	63	36	5	49	3	0	1	19	38	1			
			2	56	9	20	71	65	34	57	9	0	48	2	95	13		2	4	91	20	0	61	0	4	57	59	32	0	52	2	0	0	14	45	2			
			X	5	100	0	0	80	60	40	0	0	80	0	100	20		0	0	100	0	0	100	0	0	60	80	40	0	60	20	0	0	40	40	0			
	64	Practical use of fully implanted artificial lungs.	1	63	11	27	62	56	24	53	19	3	38	2	97	19		11	10	71	24	5	25	0	21	56	65	29	6	52	3	0	3	17	29	2			
			2	51	10	20	71	61	26	64	10	0	37	2	96	14		12	10	80	12	0	25	0	14	61	65	22	2	55	2	0	2	18	33	2			
			X	5	100	0	0	60	20	80	0	0	60	0	80	20		0	0	80	40	0	0	0	20	80	60	40	0	40	0	0	0	0	20	0			
	65	Practical use of fully implanted artificial kidneys.	1	59	15	14	71	63	34	52	12	2	44	3	93	22		12	7	73	25	0	34	0	24	59	61	32	3	49	3	0	3	15	29	3			
			2	47	17	11	72	63	30	62	9	0	45	2	98	15		13	4	81	17	0	36	0	13	68	64	21	0	53	4	0	2	17	36	2			
			X	8	100	0	0	78	63	25	13	0	63	13	88	25		0	0	88	25	0	75	0	0	100	75	25	0	38	0	0	13	50	50	0			
	66	Practical use of fully implanted artificial pancreas.	1	60	10	13	77	60	31	49	19	2	40	2	90	22		13	13	65	20	0	33	0	25	60	58	27	10	50	0	0	3	15	27	5			
			2	46	15	17	67	66	37	52	11	0	43	2	93	13		11	15	78	15	0	37	0	15	67	57	22	2	52	2	0	2	15	35	2			
			X	7	100	0	0	71	57	14	29	0	57	14	86	14		14	14	86	29	0	57	0	14	71	57	29	0	43	0	0	14	29	43	0			
	67	Development of artificial liver (external devices supporting liver functions) usable on a long-term, continuous basis.	1	59	7	17	76	62	32	54	13	2	42	2	92	24		5	12	66	24	0	36	0	22	64	66	24	10	56	3	0	2	15	24	5			
			2	44	9	23	68	61	26	67	7	0	48	0	93	18		2	9	77	20	0	41	0	16	61	64	16	7	55	2	0	0	14	39	2			
			X	4	100	0	0	75	50	50	0	0	75	0	100	0		0	0	100	0	0	100	0	0	100	75	25	0	75	0	0	0	25	50	0			
	68	Development of hybrid-type artificial endocrine organs in which living cells and artificial objects coexist.	1	52	8	29	63	53	21	52	23	4	40	0	90	25		4	27	56	17	0	33	0	33	62	67	25	6	52	0	0	2	17	29	4			
			2	45	9	27	64	57	22	60	18	0	49	0	93	18		7	11	71	9	0	36	0	20	64	64	22	2	58	0	0	0	16	40	2			
			X	4	100	0	0	56	25	50	25	0	75	0	100	25		0	25	75	25	0	75	0	0	75	100	0	0	75	0	0	0	50	50	0			
69	Widespread use of prevention and treatment methods for tooth decay and periodontitis to ensure the retention of 20 or more teeth at 80 years of age.	1	59	3	14	83	61	33	47	14	5	32	2	97	15		8	3	39	24	0	31	2	41	58	41	20	7	41	7	2	2	12	29	8				
		2	49	4	12	84	66	38	50	13	0	33	0	96	10		8	0	47	16	2	41	2	37	69	29	14	6	53	4	4	0	10	35	2				
		X	2	100	0	0	100	100	0	0	0	100	0	100	0		0	0	50	0	0	0	0	50	50	50	50	50	100	0	0	0	50	50	0				
70	Widespread use of a technique to store, cultivate and transplant one's own tissues.	1	87	8	28	64	63	37	46	15	2	28	6	95	20		2	11	80	28	6	38	0	14	72	45	28	16	62	6	0	2	11	34	3				
		2	66	15	20	65	62	31	57	12	0	32	3	95	15		2	6	88	24	6	38	0	9	79	45	18	9	70	6	0	0	12	38	2				
		X	10	100	0	0	85	70	30	0	0	60	10	100	30		0	0	100	40	20	80	0	0	90	80	0	30	90	0	0	0	10	30	0				

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)			Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)									
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	2001 2006 2011 2016 2021 2026						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects																
Improved standard of treatment methods	71	Widespread use of a wound healing acceleration technique as a general treatment method through the elucidation of anagenetic mechanisms.	1	87	16	25	59	55	22	57	20	1	34	1	91	20		2	11	69	25	2	31	0	22	68	46	23	16	59	1	0	2	14	26	6			
			2	65	14	25	62	55	22	57	20	2	29	2	95	14		3	6	78	25	2	38	2	15	72	46	20	15	60	2	0	0	15	28	3			
			X	9	100	0	0	69	44	44	11	0	22	0	100	33		0	11	78	44	0	44	0	22	89	44	22	22	100	0	0	0	22	11	11			
	72	Practical use of implanted bladder control devices.	1	47	19	28	53	53	20	54	26	0	32	0	96	9		2	9	57	17	0	26	0	34	66	57	30	9	60	0	2	2	19	26	9			
			2	43	12	23	65	54	21	53	26	0	37	0	95	9		0	5	72	21	0	37	0	19	74	58	19	2	49	5	2	0	26	33	5			
			X	5	100	0	0	65	40	40	20	0	40	0	100	0		0	0	60	20	0	20	0	20	60	100	40	0	40	0	0	0	0	20	20			
	73	Practical use of gene therapy for genetic disorders.	1	96	14	21	66	58	28	48	24	0	20	1	97	22		3	7	91	33	2	27	1	7	66	31	24	51	45	7	0	3	21	50	1			
			2	73	11	19	70	58	22	64	14	0	21	0	96	16		1	4	96	37	0	32	0	0	70	25	16	48	51	8	0	0	18	53	0			
			X	8	100	0	0	63	25	75	0	0	50	0	100	25		0	0	100	38	0	75	0	0	88	38	13	75	63	0	0	0	0	50	0			
	74	Availability of genetherapy based on oral deliverly.	1	78	15	19	65	54	26	45	24	5	32	1	90	23		31	24	63	17	3	19	0	24	56	40	23	38	42	3	1	4	18	42	0			
			2	62	11	18	71	54	21	56	20	3	26	0	89	13		27	15	73	16	0	15	0	19	61	35	21	26	45	5	0	3	18	47	0			
			X	7	100	0	0	64	29	71	0	0	43	0	100	29		14	14	100	14	0	57	0	0	86	43	14	57	71	0	0	0	43	57	0			
	75	Practical use of heterogeneous organ transplantation as means of treatment.	1	85	14	15	71	53	23	46	27	4	27	7	91	22		15	11	88	24	2	19	0	6	65	39	21	20	41	9	0	4	16	61	2			
			2	59	14	14	73	58	27	49	24	0	37	2	92	12		12	8	97	20	0	19	0	2	69	42	20	14	47	8	0	0	20	61	2			
			X	8	100	0	0	72	50	38	13	0	38	0	75	38		25	0	100	25	0	38	0	0	88	63	25	25	63	0	0	0	38	63	0			
	76	Widespread use of a worldwide organ supply system.	1	92	14	17	68	60	32	44	23	0	28	14	89	18		8	10	87	45	7	17	2	10	42	27	20	30	43	30	0	0	25	64	1			
			2	65	12	11	77	61	33	44	23	0	28	8	91	11		8	5	94	42	0	9	2	2	54	28	15	25	48	29	0	0	22	68	2			
			X	8	100	0	0	84	75	13	13	0	38	0	88	13		13	0	100	88	0	25	13	0	50	25	38	25	63	50	0	0	38	75	0			
	77	Development of a partial tissue destruction method non-invasive to the living body.	1	62	8	24	68	53	20	52	28	0	27	6	92	18		0	18	63	27	0	31	0	26	68	48	21	11	52	2	0	2	19	29	5			
			2	52	8	19	73	53	18	58	24	0	25	0	88	12		2	10	81	27	0	29	0	15	71	42	25	6	62	6	0	0	21	33	2			
			X	4	100	0	0	88	75	25	0	0	50	0	100	25		0	25	100	50	0	75	0	0	75	50	25	0	75	0	0	0	50	25	0			
	78	Widespread use of a complete cure method for myopia.	1	45	9	20	71	59	32	41	27	0	38	0	91	20		18	13	51	27	18	31	2	29	60	44	18	9	40	2	2	2	18	33	4			
			2	39	8	13	79	59	31	44	26	0	33	0	90	13		15	15	72	33	10	36	0	18	77	46	13	3	46	3	0	3	21	36	5			
			X	3	100	0	0	83	67	33	0	0	0	0	100	0		0	33	100	67	0	100	0	0	100	33	0	0	100	0	0	0	33	67	0			
79	Practical use of a drug safety verification method (mutagenicity, teratogenicity and toxicity) without relying on animal tests.	1	83	13	33	54	68	43	46	10	1	52	16	63	28		17	13	70	41	2	30	0	19	60	47	19	20	42	12	0	8	11	41	4				
		2	63	10	33	57	65	35	56	8	2	59	14	62	19		11	6	86	44	0	30	0	8	63	57	17	13	41	5	0	2	13	41	2				
		X	6	100	0	0	75	67	17	0	17	67	50	33	33		17	17	100	67	0	17	0	0	67	67	33	0	50	17	0	0	17	50	0				
Improved standard of rehabilitation assistance	80	Practical use of implanted artificial cochleas effective for both conductive hearing loss and perceptive hearing loss.	1	40	15	18	68	61	28	59	13	0	53	0	95	25		13	10	63	38	0	35	3	23	65	55	20	10	55	3	0	3	18	33	5			
			2	37	11	14	76	60	27	59	14	0	49	0	89	16		3	8	78	38	0	35	3	16	68	59	16	3	51	3	0	0	16	38	5			
			X	4	100	0	0	75	50	50	0	0	75	0	100	25		0	0	100	75	0	50	0	0	75	75	25	0	50	0	0	0	0	0	0	25		

(Note) See page 7 for the interpretation of the graphs.

Division	Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)			Expected effect (%)			Forecasted realization time						Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)									
					High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	Forecasted realization time						USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects
					Forecasted realization time						Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others	Adverse effect on the natural environment	Adverse effect on safety	Adverse effect on morals, culture or society	Other adverse effects										
Improved standard of rehabilitation/assistance	81	Development of artificial eyes featuring electronic circuitry that can be connected to nerve and brain cells.	1	46	15	28	57	50	18	49	31	2	33	2	96	33		22	22	59	17	9	20	0	24	63	52	24	13	59	2	2	4	22	20	4			
			2	44	11	23	66	49	14	58	26	2	36	0	93	32		18	16	80	16	5	25	0	14	73	41	23	5	55	0	0	0	25	30	5			
			X	5	100	0	0	38	0	50	50	0	40	0	100	60		20	0	80	20	20	40	0	20	80	40	80	0	60	0	0	0	40	20	20			
	82	Development of methods for recombining disconnected central nerves.	1	63	13	33	54	65	38	48	14	0	24	0	89	38		13	24	63	29	3	30	0	21	68	40	30	8	48	0	2	2	16	29	5			
			2	55	13	29	58	65	33	59	7	0	27	0	95	33		15	13	78	27	0	27	0	16	82	33	33	2	53	0	0	0	18	33	4			
			X	7	100	0	0	50	0	100	0	0	43	0	86	43		0	0	100	14	0	29	0	0	86	14	57	0	86	0	0	0	29	29	14			
	83	Development of a device to sense the needs of demented aged people.	1	61	15	23	62	64	41	37	20	2	36	2	92	28		16	15	46	31	0	25	0	34	64	48	33	10	54	3	3	0	16	36	8			
			2	56	13	20	68	67	44	35	19	2	34	0	89	18		14	9	54	25	0	27	0	30	68	45	23	2	52	4	4	0	14	38	4			
			X	7	100	0	0	54	33	33	17	17	29	0	86	29		14	0	71	57	0	29	0	0	71	43	43	0	14	0	0	0	14	14	14			
	84	Elucidation of the pathogenesis of autism.	1	50	10	12	78	43	10	43	45	2	14	0	82	34		6	16	48	30	4	22	0	32	52	34	22	22	42	0	0	2	24	30	4			
			2	49	10	12	78	43	8	50	38	4	16	0	88	29		10	12	63	35	0	24	0	22	63	27	18	6	45	0	0	0	20	31	2			
			X	5	100	0	0	50	0	100	0	0	0	0	100	80		0	0	80	40	0	40	0	0	80	20	40	0	60	0	0	0	20	40	0			
	85	Development of controlling devices which help the cooperative muscular actions enabling object-oriented movement.	1	55	13	22	65	56	24	54	20	2	40	0	96	24		5	9	58	33	0	36	2	27	64	51	24	7	58	2	2	2	24	16	4			
			2	45	9	20	71	55	23	53	21	2	42	0	93	18		4	9	73	29	0	47	0	13	69	47	22	0	64	0	0	0	27	20	4			
			X	4	100	0	0	50	0	100	0	0	75	0	100	0		0	0	50	75	0	75	0	0	75	50	50	0	50	0	0	0	0	0	25			
	86	Widespread use of artificial legs featuring a small power source and computer control.	1	54	17	24	59	53	17	62	19	2	41	0	98	7		0	6	61	35	2	57	0	20	61	67	22	6	56	6	2	2	24	20	6			
			2	48	10	19	71	51	15	62	21	2	35	0	96	8		2	4	79	33	0	67	0	6	71	60	17	2	44	2	0	0	23	19	4			
			X	5	100	0	0	88	75	25	0	0	40	0	100	0		0	0	80	60	0	80	0	0	80	100	40	0	40	0	0	0	0	0	20			
Integration (systems approach)	87	Practical use of a blood cell production and supply technique based on industrial-scale cultivation.	1	58	21	28	52	61	34	43	21	2	40	9	84	24		9	9	76	22	0	40	0	19	62	52	26	24	48	12	0	5	12	41	3			
			2	49	18	22	59	63	35	46	17	2	39	6	88	20		8	4	82	18	0	49	0	10	61	57	16	8	51	8	0	0	18	37	0			
			X	9	100	0	0	83	67	33	0	0	67	22	100	33		0	0	100	44	0	89	0	0	67	78	22	11	44	11	0	0	11	33	0			
	88	Practical use of systems for monitoring health condition and providing information for an appropriate diagnosis at home in event of accident or diseases.	1	110	12	31	57	63	36	46	18	0	50	2	95	12		4	7	62	27	1	45	0	19	47	58	19	12	47	15	3	2	33	32	2			
			2	86	14	24	62	63	34	48	18	0	51	1	94	6		5	3	77	26	0	59	0	9	51	66	14	7	53	12	1	1	37	36	1			
			X	12	100	0	0	65	40	40	20	0	58	8	100	17		0	8	58	17	0	75	0	8	42	58	8	8	33	17	8	0	33	17	0			
	89	Widespread use of portable conversational speech interpretation systems.	1	66	6	20	74	62	37	40	22	2	67	3	70	29		0	6	52	21	0	59	2	15	48	68	30	3	41	5	0	0	11	35	3			
			2	58	5	17	78	58	26	56	16	2	66	2	78	17		2	2	64	14	0	72	0	7	50	67	24	0	43	2	0	0	14	36	2			
			X	3	100	0	0	100	100	0	0	0	100	0	33	33		0	0	100	67	0	67	0	0	67	100	67	0	0	0	0	0	0	33	0			
	90	Widespread use of robots that care for people with severe physical and mental disabilities.	1	71	14	15	70	62	33	49	18	0	49	3	97	13		6	7	58	31	1	55	0	18	51	77	27	4	49	8	1	0	25	38	4			
			2	57	14	11	75	60	30	50	20	0	47	0	96	12		2	4	68	25	2	68	0	9	61	68	23	0	46	9	0	0	21	39	2			
			X	8	100	0	0	86	71	29	0	0	75	0	100	25		0	0	50	38	0	75	0	13	63	75	38	0	25	13	0	0	13	38	0			

(Note) See page 7 for the interpretation of the graphs.

Division Topic serial No.	Topic	Questionnaire round	Number of respondents	Degree of expertise (%)			Importance (index, %)			Expected effect (%)			Forecasted realization time					Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)										
				High	Medium	Low	Index	High	Medium	Low	Unnecessary	Socioeconomic development	Resolution of global problems	People's needs	Expansion of intellectual resources	Forecasted realization time					Leading countries (%)					Measures the government should adopt (%)					Potential problems (%)							
																		2001	2006	2011	2016	2021	2026	Will not be realized (%)	Do not know (%)	USA	EU	Former Soviet Union and Eastern Europe	Japan	Other countries	Do not know	Foster human resources	Promote exchanges among industrial, academic and government sectors and different fields	Upgrade advanced facilities and equipment	Develop a research base	Increase government research funding	Adjust regulations (relax/toughen)	Others
Integration (systems approach)	91 Advancements in patient and hospital information management, leading to a reduction in waiting time at Japanese hospitals to 15 minutes or less.	1	129	21	29	50	66	40	45	16	0	38	3	96	6		9	4	56	29	2	36	0	23	26	50	11	11	31	30	5	0	21	29	5			
		2	98	19	29	52	68	42	46	11	1	35	1	94	3		7	3	58	27	1	35	0	21	23	53	9	11	35	38	3	0	16	26	3			
		X	19	100	0	0	82	63	37	0	0	42	0	100	5		5	11	79	42	5	42	0	5	26	37	21	0	32	47	5	0	5	26	5			
	92 Practical use in Japan of an ID card system that thoroughly covers an individual's health conditions and medical data.	1	125	11	30	59	62	32	52	16	0	50	3	90	11		1	5	56	24	2	47	0	19	27	56	13	18	34	29	2	0	46	34	2			
		2	97	13	28	59	63	32	56	10	1	46	3	90	7		0	2	62	16	0	58	0	18	24	59	12	16	36	32	1	0	40	32	1			
		X	13	100	0	0	75	54	38	8	0	69	0	92	8		0	8	92	38	0	62	0	0	38	46	23	0	38	38	8	0	38	31	0			
Basic (elucidation of functions and nature of living bodies, etc.)	93 Elucidation of molecular mechanism of memory.	1	68	15	25	60	66	39	47	13	2	32	4	71	74		9	15	78	47	3	43	0	13	69	40	32	15	60	0	1	1	13	41	1			
		2	58	14	21	66	65	36	52	10	2	33	2	72	67		7	16	86	40	0	41	0	9	74	34	29	7	64	0	0	0	17	48	2			
		X	8	100	0	0	81	63	38	0	0	38	0	88	63		13	0	100	63	0	50	0	0	100	38	38	0	50	0	0	0	25	25	0			
	94 Development of hybrid-type artificial intelligence that combines ICs and living cells.	1	46	15	15	70	57	24	56	20	0	52	4	65	50		20	20	72	17	4	30	0	22	57	54	24	11	48	0	0	2	22	52	0			
		2	42	14	17	69	55	21	55	24	0	55	2	74	43		14	19	83	19	2	36	0	12	69	62	24	0	52	0	0	0	24	57	0			
		X	6	100	0	0	54	17	67	17	0	50	0	83	17		17	0	100	33	0	33	0	0	83	33	50	0	33	0	0	0	33	33	0			
	95 Elucidation of individual aging mechanisms.	1	112	13	26	62	67	45	32	21	2	32	12	81	46		5	16	79	42	3	44	0	15	70	37	26	35	62	1	0	8	13	42	3			
		2	84	15	15	69	71	52	26	20	1	33	5	88	36		8	14	92	43	1	48	0	5	77	40	21	20	63	0	0	1	17	43	1			
		X	13	100	0	0	96	92	8	0	0	38	8	92	54		8	8	100	46	8	62	0	0	85	15	8	8	77	0	0	8	15	38	0			
	96 Elucidation of the mechanism whereby living organisms undergo changes in the space environment.	1	40	10	25	65	42	10	38	49	3	38	30	63	63		5	15	83	10	28	8	0	15	68	43	28	10	63	0	3	15	15	25	3			
		2	36	3	25	72	41	12	29	59	0	31	25	67	53		3	22	86	14	39	8	0	11	78	39	19	6	58	0	3	11	11	31	3			
		X	1	100	0	0	100	100	0	0	0	100	100	100	100		0	0	100	100	0	100	0	0	100	100	100	0	0	0	0	100	0	0	0			
	97 Elucidation of the biological clock, leading to drug administration that takes it into consideration.	1	87	8	31	61	53	21	49	27	2	20	2	90	18		3	13	76	33	1	32	1	21	69	44	20	16	47	3	1	2	13	25	3			
		2	73	8	25	67	53	18	60	21	1	23	1	96	10		1	7	78	41	0	42	0	18	75	52	14	7	59	1	0	0	12	30	3			
		X	6	100	0	0	71	50	33	17	0	17	17	100	17		0	17	100	67	0	50	0	0	83	67	17	0	67	0	0	0	0	33	17			
	98 Practical application of the production of artificial cells with organ characteristics.	1	53	13	21	66	58	28	47	23	2	40	0	79	34		11	13	68	17	0	23	2	26	62	49	19	19	55	2	0	4	15	42	0			
		2	48	13	23	65	58	25	58	17	0	40	0	88	23		8	6	81	17	0	35	2	15	75	46	17	15	60	0	0	0	21	50	0			
		X	6	100	0	0	58	33	33	33	0	50	0	67	33		17	17	67	50	0	50	0	33	100	67	17	33	50	0	0	0	67	83	0			

(Note) See page 7 for the interpretation of the graphs.