Technology Transfer By Public Research Organizations

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1. Overview of technology transfer

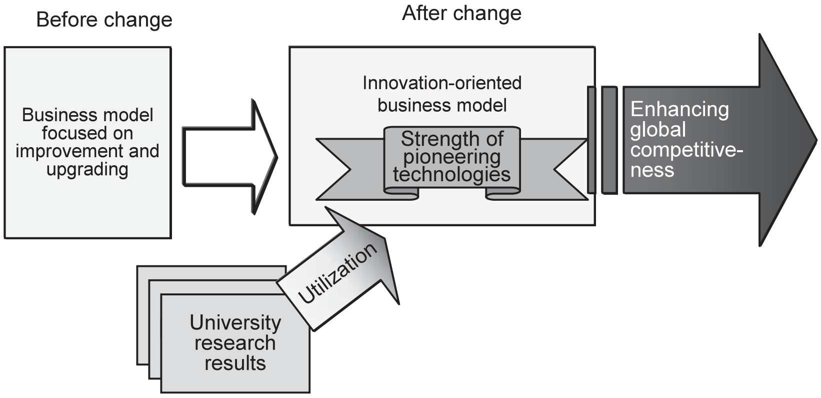
Technology transfer means the transfer of research results or technologies created by a certain organization or company to any other organization or company. Such transfers are made from a university or public research institute to a private company, or from one private company to another private company. In this paper, we discuss some of the issues involved in technology transfer from universities and public research institutes to private companies, otherwise known as academia-industry cooperation.

Why is academia-industry cooperation important right now? Firstly, it is associated with the globalization of economic and industrial activities. Secondly, the roles that universities are expected to play in society are changing. The third reason is the development of the Internet, which enables people all over the world to share information on a real-time basis. In the past, big companies ran their own basic research laboratories because they considered it necessary in order to sustain their development over coming decades. In other words, most big companies relied on the results of their own basic research to expand their business, and come up with new developments that would be expected to be profitable 10 or 20 years later.

However, the globalization of economic and industrial activities and the development of the Internet have prompted a shift in personal values, throwing people into an age of global megacompetition, and further shortening product lifecycles. If companies continued to run their own basic research laboratories in order to try and respond to such changes, they would probably find themselves investing enormous amounts in ways that were unavoidably inefficient. Instead, it is becoming common practice for many companies to abolish or minimize their in-house basic research and entrust those functions to universities or public research institutes. Moreover, in order to survive the modern age of megacompetition, it is essential to do away with the conventional business model in which improvement or upgrading is prioritized and replace it with an innovation-oriented business model (Figure 1). In these changing circumstances, our expectations of universities and public research institutes have been slowly growing.

Figure 1

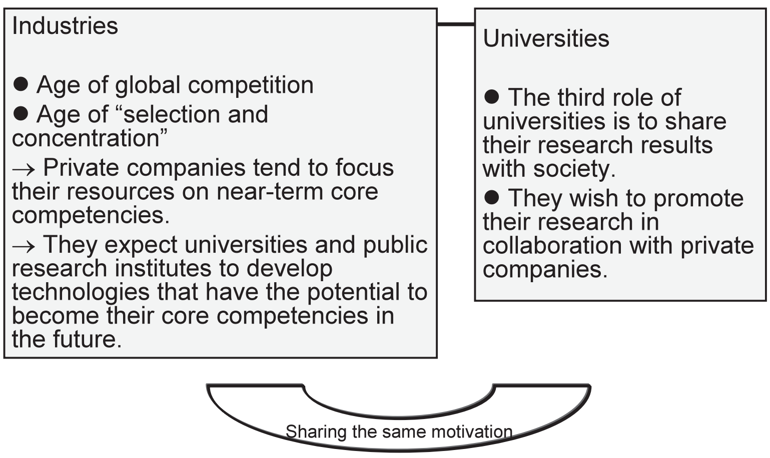
Change public awareness, change society



Universities and public research institutes are actively engaged in basic research and other R&D activities in a variety of areas that lead to creative inventions that are difficult for private companies to develop solely through their own R&D activities. In addition, because universities and public research institutes are non-private organizations, they are not affected or controlled by any specific company or corporate group, and are therefore expected to perform their functions impartially. Since the Fundamentals of Education Act of Japan was amended in 2006, as their third role, Japanese universities have been required to share their research results with society. The results of basic and innovative research conducted by universities and public research institutes will almost certainly help revitalize industry if such results can be successfully used in cooperation with industry players. The process explained in this paragraph shows one path for technology transfer, that of academia-industry cooperation (Figure 2).

Figure 2

Circumstances requiring the promotion of academia-industry cooperation



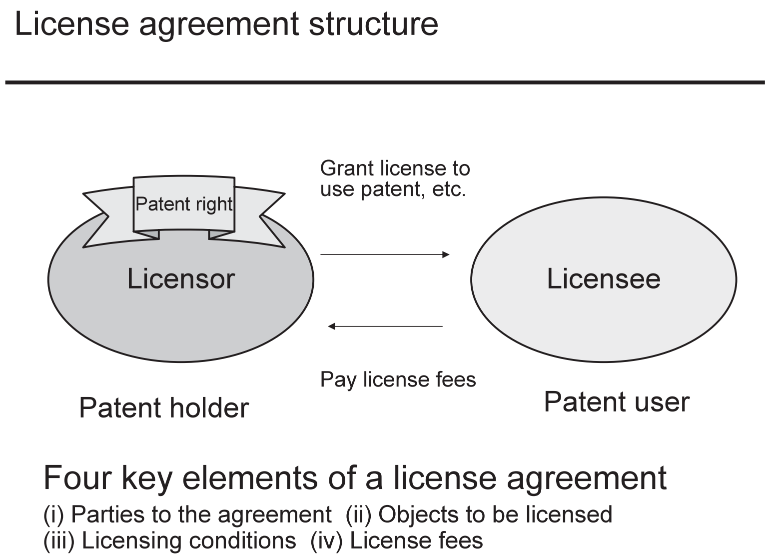
Successful technology transfer through academia-industry cooperation requires a well-designed scheme. This is because research results achieved by universities and public research institutes can rarely be used by private companies in their raw form. Another reason is that the research that universities and public research institutes believe has potential does not necessarily meet the practical needs of private sector companies. Thus, it is said that there is no “royal road” to technology transfer. As is well known, however, by establishing legislation such as the Bayh-Dole Act and the Federal Technology Transfer Act in order to promote academia-industry cooperation, the US achieved a dramatic jump in economic development in the 1980s after suffering economically as a result of the increasing presence of Japan and Germany. These events demonstrate how universities and public research institutes in the US played a significant role in the development of the US economy and industries. Now, let us acquire an overview of technology transfer from universities and public research institutes.

2. Methods of technology transfer

Methods of effecting technology transfer include: (i) licensing, (ii) collaborative research or contract research, and (iii) technical assistance. Of these methods, licensing refers to a narrowly defined type of technology transfer. Famous examples of the successful sharing of university research results with society through licensing include Google (with cumulative royalties estimated at over USD300m) and gene recombination technologies (with cumulative royalties estimated at over USD200m), both of which were developed by students at Stanford University. These two examples of university-based research have resulted in considerable economic effects and employment opportunities and have had a huge impact on the US economy and society. Although universities and public research institutes are more focused on sharing the results of their research with society than on earning royalties, the magnitude of such royalty earnings serves as an indication of the economic effects that research can produce. Those earnings can cover expenses incurred by universities and public research institutes with regard to the employment of experts and other staff engaged in making applications for and maintaining and administering patents and other intellectual property rights, technology transfer operations, and contract administration. In this way, continuing to promote technology transfer activities can create a positive synergy of development in which increasing results are subsequently produced.

Licensing means that a holder of some intellectual property right (a licensor) grants another party a license to use it. This other party is called a licensee. In the case of academia-industry cooperation, the licensor is a university or public research institute and the licensee is a private company. A license agreement is entered into between them whereby the licensee will pay fees to the licensor in return for the license granted (Figure 3).

Figure 3

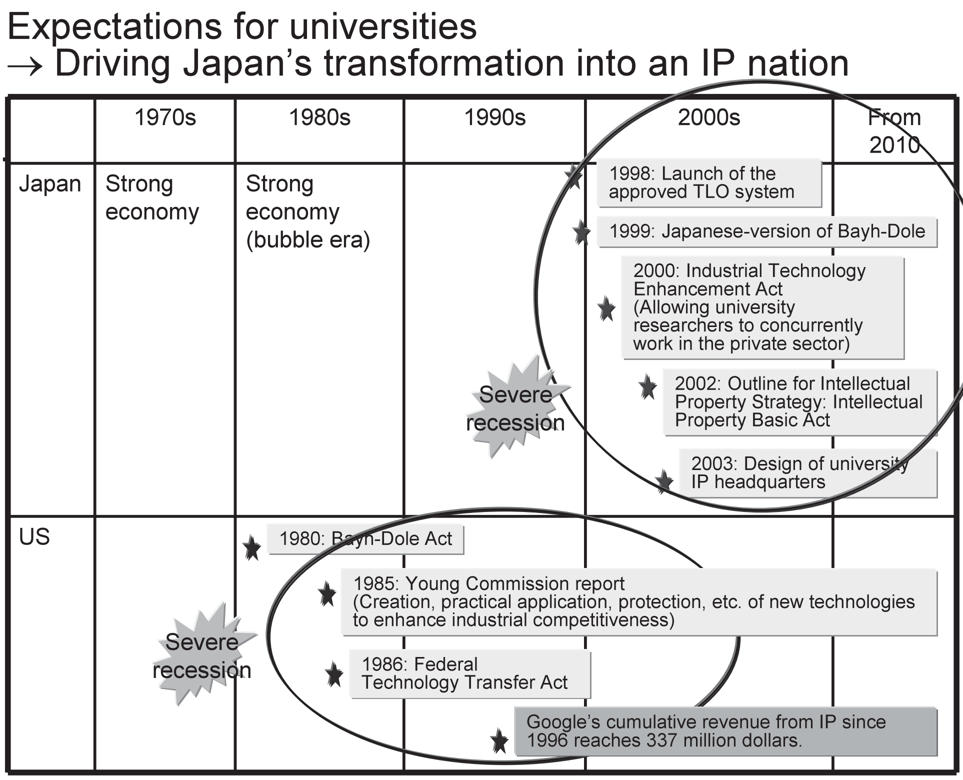


The four key elements of a license agreement are as follows: (i) the parties to the agreement, (ii) the object(s) to be licensed, (iii) licensing conditions, and (iv) license fees. These are the most important elements that must be specified in every license agreement. Out of these elements, the one that each license agreement is centered upon is the thing that will be licensed, that is, a patent, design, trademark, copyright, or other intellectual property right. However, technology transfer will not necessarily be successful merely because there is an intellectual property right available to be licensed. It is necessary to create an enforceable intellectual property right out of the research results and to assign technology transfer experts the task of selecting the most appropriate company to receive the license and granting a license to that company. The organization established to perform this duty is called a technology licensing office or technology licensing office organization (TLO). While the intellectual property rights that are the subject of the license are said to constitute the core of technology transfer, technology transfer can be only be finally achieved after comprehensive efforts have been made to provide know-how and technical assistance and engage in collaborative research or contract research, as these are all integral components of the technology transfer process. For this reason, it is also important that researchers attached to universities and public research institutes actively seek technology transfer. Their motivation to do this can be improved if the results of their research are developed and shared with society or if part of royalties earned from such results are returned to them.

3. Technology transfer legislation

Next, let's look at the history of legislation intended for promoting the transfer of university and public research institute research results to industry. The US is the first country in the world to have achieved great success in the transfer of technology from universities and public research institutes. To overcome the severe recession of the 1980s, the US government decided to begin by building up mechanisms that would encourage researchers at universities and public research institutes to compete to undertake new and innovative research. It then established mechanisms to encourage industry to actively utilize the results of that result. The US government did this by enacting the Bayh-Dole Act in 1980 and the Federal Technology Transfer Act in 1986 (Figure 4).

Figure 4



The Bayh-Dole Act—nicknamed for Senators Birch Bayh and Bob Dole but formally known as the Patent and Trademark Act Amendments of 1980—was firstly intended to enable a university, non-profit organization, or small or medium-sized enterprise to retain intellectual property rights originating from in-house research conducted with federal funding. Before the Bayh-Dole Act, such intellectual property rights were vested in the federal government. The amendment provides research organizations and researchers with a very attractive incentive to pursue outstanding research results. Secondly, the Bayh-Dole Act stipulates certain rules to ensure US enterprises are given higher priority when licenses to use intellectual property are assigned to transferees, with the aim of revitalizing domestic enterprises and industries in the US.

Under the Federal Technology Transfer Act subsequently brought into law, government researchers are obliged to transfer their technologies to private enterprises, and government research agencies are allowed to enter into collaborative research agreements with private enterprises. This is intended to promote technology transfer.

Following the 1980s, Japan entered into the severe recession of the 1990s, sometimes referred to as “the lost decade.” To overcome this recession, the Japanese government implemented a rapid series of measures to encourage industry to utilize the research conducted by universities and public research institutes. The government pushed through the Act on the Promotion of Technology Transfer from Universities to Private Business Operators (commonly known as the “TLO law”) in 1998, the Act on Special Measures for Industrial Revitalization (commonly known as the “Japanese Bayh-Dole”) in 1999, the Industrial Technology Enhancement Act in 2000, and the Intellectual Property Basic Act in 2002.

The TLO law stipulates that the Japanese government will support the establishment of TLOs engaged in the transfer of research results developed by universities or governmental testing or research agencies to private business operators and will provide them with assistance in order to accelerate this type of technology transfer.

The Act on Special Measures for Industrial Revitalization is sometimes called the Japanese version of the Bayh-Dole, since it was drafted with reference to the US's Bayh-Dole Act. This law provides that intellectual property rights created under a contract R&D project funded by the Japanese government are vested in the organization undertaking the research. Since this law was enacted, a steady stream of university-owned invention patents has been created. Coupled with the TLO law, the Japanese Bayh-Dole is undoubtedly contributing to the promotion of the technology transfer from universities to industry in Japan. In addition, the Industrial Technology Enhancement Act stipulates a fee reduction or exemption for universities filing patent applications and allows university faculty to concurrently hold positions in newly launched venture companies based on university research.

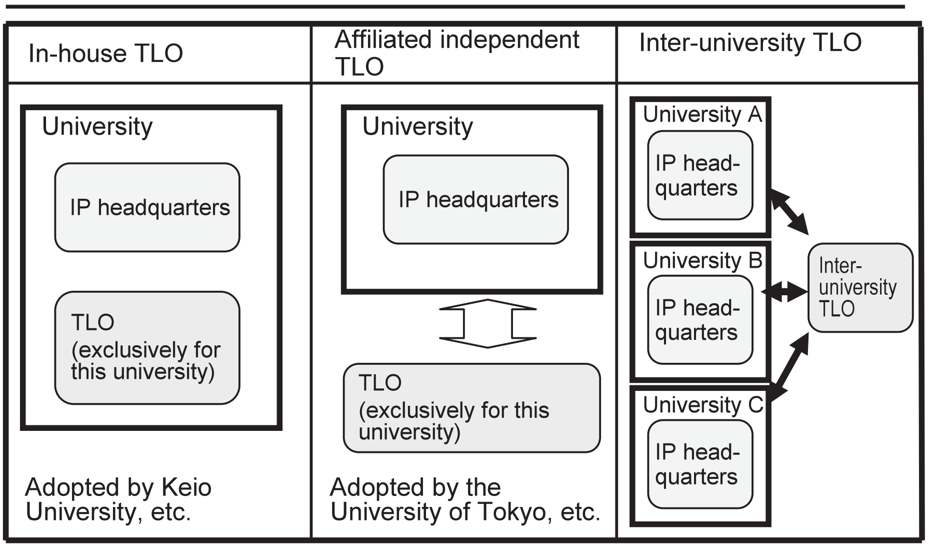
The Basic Education Act as amended in 2006 makes clear that, along with their traditional roles of education and research, universities have a third role: to share their research results with society. This too has a significant impact on the promotion of technology transfer from universities in Japan.

4. Technology licensing offices (TLOs) in Japan

Since the establishment of the Act on the Promotion of Technology Transfer from Universities to Private Business Operators (the TLO law) in 1998, a number of TLOs have been set up within or outside Japan's universities and public research institutes. Depending on the type of relationship between a TLO and its affiliate university or universities, TLOs are classified as either in-house, that is, TLOs that are established as an internal organ of a university, or affiliated independent, or TLOs established outside universities. Affiliated independent TLOs are further classified into dedicated TLOs working for specific universities on a one-to-one basis and inter-university TLOs working for multiple affiliated universities (Figure 5). In addition to universities, the National Institute of Advanced Industrial Science and Technology (AIST) and other former national research institutes have set up their own TLOs as either an in-house or an external independent organ.

Figure 5

TLOs established by Japanese universities



The type of TLO adopted depends on the scope of services to be entrusted to it as well as other factors relating to the particular situation at the university or public research institute. The scope of services that can be performed by a TLO includes seeking out potential inventions, handling patent applications, licensing operations, and the administration of collaborative research agreements. The form that the TLO will take is determined based on a consideration of how such services should be divided in order that all of them are performed efficiently. In Japan, for example, the University of Tokyo has a dedicated TLO in the form of an external independent organ, while Keio University and Waseda University have in-house TLOs. In the US, MIT, Stanford University, and others have in-house TLOs, and the University of Wisconsin and others have external TLOs. In this way, different universities adopt different types of TLOs. In connection with this, it should be noted that national universities in Japan had no choice but to set up external TLOs in the early years because, unlike private universities, they did not have the status of juridical personhood when the TLO law was enacted in 1998.

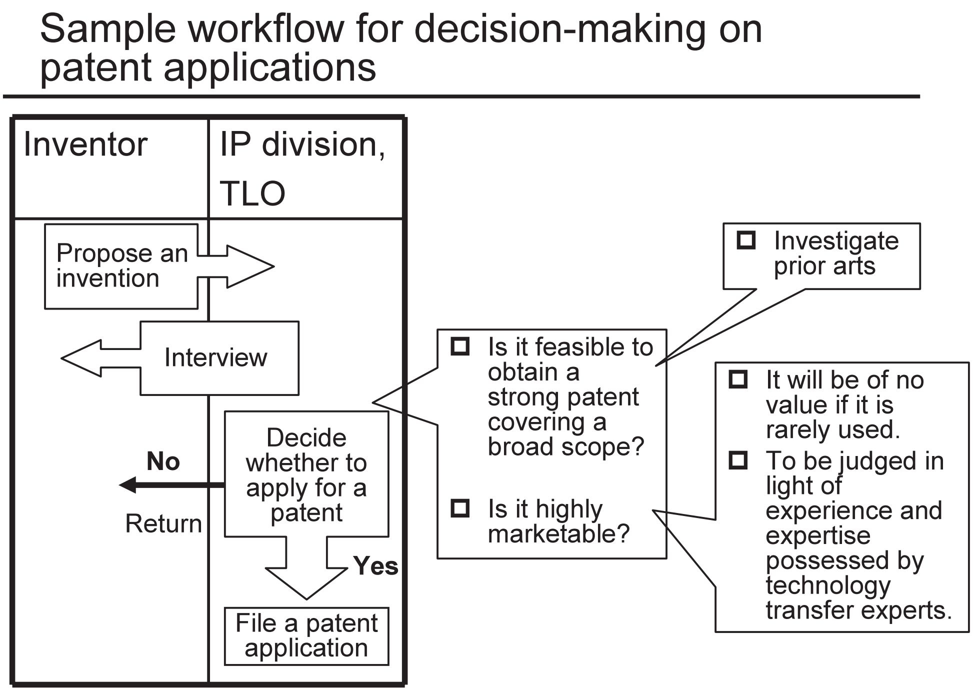
5. University and public research institute research that results in technology transfer

What are the characteristics of research that leads to successful technology transfer from universities and public research institutes?

The first consideration is market size. The primary goal of a commercial organization is to earn profits for its shareholders. For a company manager to learn about certain university-produced research results and get her company to begin commercialization based on them, she needs to be able to convince her boss that the commercialization project, if successful, will deliver profits to the company. This means that when the product is eventually developed and put on the market, the market must be large enough to trade the product in such volumes that will result in profits far in excess of the amounts spent on development. Obviously, it is difficult to estimate future market size because the results of university research are usually basic in nature. Yet, a convincing proposal for future marketability must be developed, regardless of the how basic the results are.

The second key point is whether the intended research results will give rise to patentable inventions. This is particularly the case in the area of pharmaceuticals. Successful technology transfer does not solely involve a patentable invention, but rather transfer of the entire technology including related copyrights, know-how, and others. However, the patented invention is without a doubt a core part of the technology transfer process. A good patent can be defined as a strong patent with a broad scope (Figure 6). If a patent has only a narrow, limited scope and involves only a few embodiments, it may be possible for other companies to come up with another invention to circumvent the patent and manufacture and market similar products. In this case, the patented invention has little value and will be difficult to license.

Figure 6



When we say that a patent has a broad scope, this primarily means that the scope of the patent application stated in the description (scope of claim) is broadly defined. While it is partly a function of the skill of the patent attorney as to whether the claim is in fact written the broadest terms possible, the most important thing is to ensure that the patent attorney is provided with plenty of topics and features that can be included in the patent application These include the innovativeness of the invention, any distinctive features that are clearly distinguishable from prior arts, possible embodiments, and proposed applications. It will probably fall to researchers or personnel responsible for filing patent applications or overseeing technology transfer operations to gather such information and provide it to the patent attorney. In addition, a well-known strategy is to obtain not only the target patent but also adjacent and related patents, all of which would constitute one IP portfolio and cover a broader range of intellectual property rights. Universities and others that adopt this strategy may find it instrumental in carrying out collaborative research or contract research with private companies.

To say a patent is "strong" means that it has a strongly defensible legal position. A strong patent is that one can be fully differentiated from prior arts by the Patent Office during the examination process. A strong patent would also typically involve some kind of pioneering technology that armors it against requests for invalidation filed after the patent has been registered. Furthermore, a strong patent will demonstrate its superiority if the company authorized to use the patent ever needs to negotiate with its competitors as part of its preparations for commercialization. In the pharmaceutical industry, for example, a substance patent can be a strong patent, but a process patent cannot necessarily be called a strong patent because its use is dependent on the use of the relevant substance patent. As can be seen here, a patented invention that cannot be used without also using a number of other patented inventions belonging to third parties is not a generally regarded as a strong patent.

Thirdly, the period and expenses required for development up to the time of commercialization can be mentioned as other important criteria for evaluating an invention. If the development of a product based on some specific research will take a long time and eat up a considerable amount of funds, it may be difficult to achieve technology transfer for the reason that the processes leading up to commercialization are considered to be high risk. In the pharmaceutical industry, commercialization, including phase 1 to phase 3 clinical trials, takes a very long time and is very expensive. Most companies therefore tend to take a conservative approach. In the case of information and telecommunications technologies, it takes many years to establish technology standards. On the other hand, quite a number of inventions relating to Internet services or software can be commercialized within a relatively short development period for a relatively inexpensive cost.

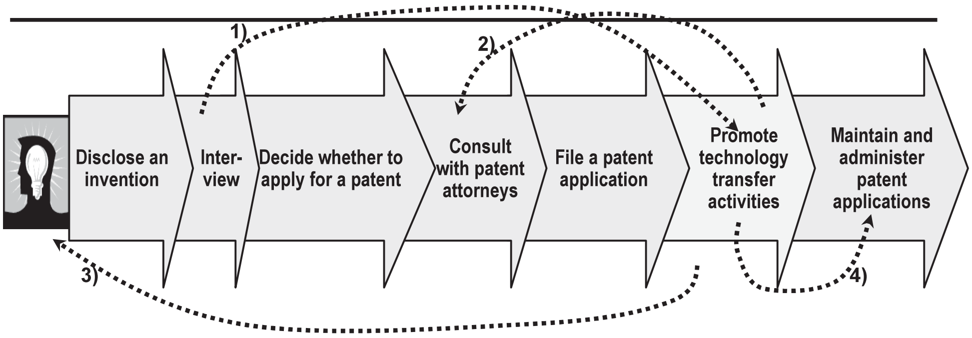
6. Steps from the identification of a potential invention to technology transfer and administration of patent applications

In terms of the number of patent applications actually filed, the percentage of those that are successfully registered and practiced is low. This is because it is not possible to file a backdated patent application long after the pertinent research was conducted based on later developments. Under the first-to-file principle, the first patent application filed will win out over competing applications for the same invention. In this sense, patent applications can be compared to investments. As soon as information about a potential line of research becomes available it is important to quickly judge whether the criteria specified above are satisfied and, if so, file a patent application in the shortest possible time. Even after the patent application has been filed, practical decisions will have to be made regarding various issues, for example, whether to file patent applications overseas or whether to maintain or abandon a patent application already filed, with each decision potentially entailing additional costs.

Because there is a close cause-and-effect relationship between patent applications and their administration and technology transfer activities, all of these must be addressed within the same context (Figure 7). For instance, if, based on a researcher's proposal for using an invention, the inventor must be interviewed in order to obtain information about the invention, It is advisable to make full use of such information in any technology transfer that occurs subsequently. And asking a patent attorney to prepare a description for the patent application, ensure that the description will cover everything likely to be needed for any technology transfer that happens in the future. If a proposal for technology transfer is rejected by the company to which it has been proposed□ not an uncommon situation—it is important to react strategically and find out how the proposal was evaluated by the company and why it has not been adopted, and then pass that information onto the researchers involved as feedback for them to incorporate in their ongoing work. The feedback should also be used in the administration of patent applications.

Figure 7

Sample workflow from invention-creation to technology transfer



1) Reflect the findings from the interview in licensing activities
2) Prepare a draft description for a patent application with an eye to future licensing activities
3) Give feedback about the outcomes of licensing activities to the researchers
4) Maintain and administer patent applications based on the outcomes of licensing activities

7. Patent survey and technology transfer

With the enhancement of the Internet environment, patent offices in Japan, the US, and the EU, other major patent offices around the world, and the World Intellectual Property Organization (WIPO) now make searchable patent literature available on their website for free. Users with a good knowledge of patent classification can perform refined searches, but even without such knowledge, a reasonably refined level of searches can be done using technical terms. When found, documents can also be downloaded free of charge.

Conducting this kind of search or patent surveys will help you judge whether or not to file a patent application, or whether or not to request examination after an application has already been filed. These surveys can also be instrumental in identifying prospective licensees for future technology transfer. Technology transfer from a university or public research institute is more likely to be successful when the transferee already known to the researchers. In many cases, however, technology transfer managers have to seek our new candidates to receive technology transfers. In this type of situation, technology transfer activities will probably be focused on identifying companies that have filed patent applications relating to an invention similar to the technology invented by the university or public research institute and endeavoring to license or sell the technology to one of them.

8. Importance of incentives for inventors

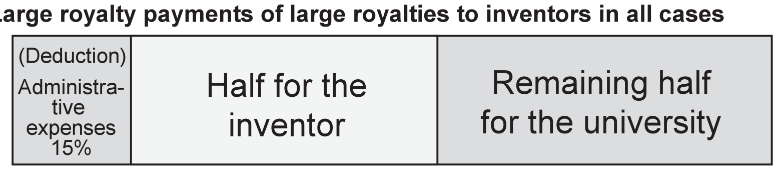
There are limitations to what can be achieved by technology transfer managers at universities or public research institutes in their requests or efforts to encourage researchers to create inventions with the potential for practical application. It is true that researchers have a responsibility to share their research results with society by virtue of the Industrial Technology Enhancement Act (2000), the Intellectual Property Basic Act (2002), and the amended Basic Education Act (2006), but the most effective way of securing transferable technology is to establish a mechanism for providing researchers with incentives to work on research with commercial potential. What’s more, technology transfer will not occur merely because a patentable invention exists. For technology transfer to be successful, it is essential to obtain the cooperation of inventors, including technical assistance and disclosure of their know-how. To achieve this too requires adequate incentives. The kind of incentive program designed by a TLO for its affiliated researchers will depend on its stage of development or track record.

According to the principle adopted by Keio University of rewarding successful technology transfers that result in earnings in the form of either a lump sum payment or royalties, 15% of the amount earned is allocated to administrative expenses and the remainder is shared equally between the inventor(s) and the university (42.5% each), which is a considerable incentive for inventors (Figure 8). The university can use its share to cover expenses related to for patent applications and the costs involved in hiring technology transfer managers. The inventor has the choice of treating his share as part of his personal income or putting it toward research-related expenses. In light of the influx and outflow of researchers, licensing revenues earned from an invention created by a researcher while she was employed by Keio are also to be paid to her even after she has left the university. In addition, under Keio's commendation systems, the director of research annually honors the individual who has made the most distinguished achievement in the area of technology transfer.

Figure 8

Sample of attractive incentives for inventors

1) Large royalty payments of large royalties to inventors in all cases



(These payments are distributed to researchers even after they leave the university.)

2) Commendation

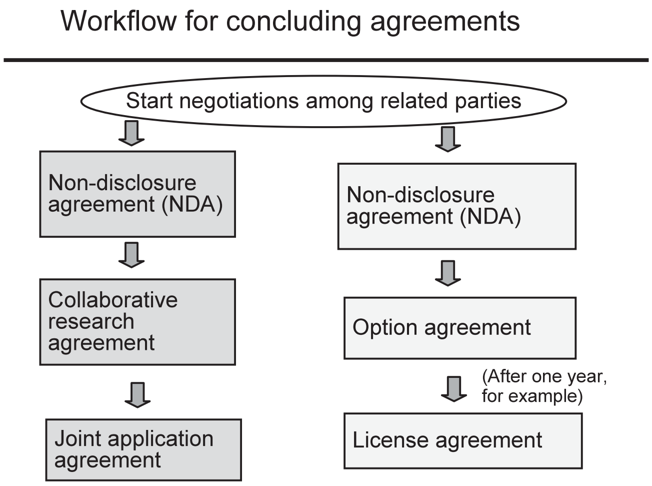
Each year, the university's director of research commends the inventors who have significantly contributed to technology transfer.

Looking at the rule adopted by the National Institute of Advanced Industrial Science and Technology (AIST) as an example of the incentive schemes run by public research institutes, 25% of revenues are paid to the inventor or inventors, another 25% are paid to the laboratory, another 25% are paid to the university, and the remaining 25% are paid to the TLO. This scheme is intended to ensure continuing cooperation from laboratories or other organizations by also providing them with valuable incentives, in addition to those given to individual inventors.

9. Procedure for concluding a technology transfer agreement

Typically, a technology transfer agreement is concluded in the form of a license agreement under which a license to use a certain patent and other intellectual property rights owned by a university or public research institute is granted to a private company. Another typical form of technology transfer is collaborative research conducted jointly by a university or public research institute and a private company based on certain research results developed by the university or public research institute with the aim of applying them for a practical purpose. As each of these situations require both parties to collaborate for R&D activities for a certain period of time, it is normal practice to conclude an agreement stipulating the roles, responsibilities and obligations of the respective parties, how to the results acquired will be treated, and other terms and conditions (Figure 9).

Figure 9



9-1. Non-disclosure agreement (NDA)

Before concluding a license agreement or a collaborative research agreement, both parties may need to disclose confidential information to the other party. To be more specific, a university or public research institute discloses confidential details of its patent application to a potential licensee in stages, after filing a patent application relating to the research results, in order to sound out the possibility of licensing to the company. For these disclosures to be made, the university or public research institute needs to gain the cooperation of the company to keep the contents of the patent application and other confidential information secret. The contents of the patent application must be kept confidential if related patent applications are expected to be subsequently filed to incorporate additional data or embodiments to enrich the original patent. There is also the possibility that the company intends to file its own patent application based on the contents of the invention disclosed by the university or public research institute. In anticipation of such situations, the university or public research institute will require the company to give prior notice for mutual consultation.

Likewise, it is necessary for the company to cause the university or public research institute to protect confidentiality, because the company may need to disclose confidential information about its business needs. For these reasons on both sides, a non-disclosure agreement (NDA) is usually executed before the conclusion of a definitive license agreement. In connection with this, it should be noted that if the company is already in possession of certain research results that are similar to those to be disclosed by the university or public research institute under the NDA, such disclosure may cause problems in some cases. Generally speaking, if a recipient is already in possession of a similar invention, once it has received information about an invention from its counterparty under an NDA, it will be very difficult for it to prove the prior possession at a later date. Even if the recipient is able to do so, such a situation may be detrimental to the company’s reputation. According to the particular circumstances, therefore, it may be preferable for the company to refrain from concluding an NDA.

Similarly, in the case of collaborative research or contract research, it is normal practice to enter into an NDA and start discussions on the conditions and other details of the research before concluding a definitive research agreement.

9-2. License agreement

As explained in Section 2 “Methods of technology transfer,” a license agreement is an instrument that enables the holder of certain intellectual property rights (a licensor) to grant a license for their use to a third party. Formerly, a license agreement was usually concluded after a patent relating to the technology in question had been registered. However, with the increase in technology transfer from universities and public research institutes, the Patent Act of Japan was amended to clearly stipulate conditions in situations where a license is executed after the patent application has been filed and before the patent is registered. This can be seen in the system for provisional non-exclusive licenses and provisional exclusive licenses introduced in April 2009 under the amended Patent Act.

Licensing is conducted in the form of either an exclusive license or non-exclusive license. Based on the concept of exclusive licensing, Japan has its own unique system: the registered exclusive license (Figure 10). Whether a license is exclusive or non-exclusive is primarily determined according to the licensee’s intention, but the societal roles played by the university or public research institute must be also considered in determining the form most appropriate for successful commercialization.

Figure 10

Forms of licensing from universities, etc.

- □ Exclusive license
  - ・Licensed to pharma companies, etc., for example, by granting the right to use the patent for each type of drug to a single licensee
  - ・Licensed to a venture company founded by the university
- □ Non-exclusive license
  - ・License for basic technologies or standardization technologies
  - ・License for technologies for research tools
  - ・Licensed to engineering firms (in the industries where the cross licensing scheme is frequently used)
- □ Registered exclusive license and transfer (sale) of the patent right
  - ・Licensed to a venture company founded by the university

× Cross licensing and defensive publication are not made, because they are improper in light of the missions assumed by universities.

Regarding revenues from licensing, there are multiple types of payment conditions including a lump sum payment at the time of execution of the license agreement, milestone payments whereby certain phases in the commercialization process are set as milestones and a specified amount is paid when each of them is achieved, and running royalties, a specified percentage of net revenues earned from the sale the products produced under the license.

In some cases, before concluding a definitive license agreement, the parties may enter into an agreement under which the questions of whether to introduce the license or not and whether the license is to be exclusive or non-exclusive are considered within a specified period such as one year. This agreement is usually called an option agreement. Once a university or public research institute has given this kind of option to a company, the university or public research institute is unable to share the contents of the same invention with any other company during the term of the option agreement. Therefore, it is normal practice that an option fee is paid in a lump sum to the university or public research institute when the option agreement is concluded.

9-3. Collaborative research agreement and contract research agreement

Most researchers at universities and public research institutes wish to deepen and further develop their research. For this purpose, it is necessary to procure research funds from external sources. Some research funds are obtained in the form of competitive funds subsidized by the government. Another approach quite frequently used is collaborative research or contract research, in which a private company provides research funding and other things and the researchers undertake the research using facilities and other research resources owned by the university or public research institute. This approach seems to be adopted in more than a few cases for the transfer of research results achieved by universities and public research institutes to private companies. When concluding a collaborative research agreement, it is necessary to make clear the theme of the collaborative research, the term, the respective roles of the university or public research institute and the company, their rights and obligations, how research results will be treated, and other conditions and put them in a written agreement. The parties will therefore usually enter into a non-disclosure agreement (NDA) before starting discussions on a definitive collaborative research agreement. This same process occurs with respect to contract research as well.

It is said that the default position on collaborative research is that all the parties (the university or institute, the company, and others, if any) will participate in the intended research on an equal footing and are free to use the results of the research at their own discretion. Regarding how research results are to be treated, there is a significant difference between the US patent act and the Patent Act of Japan. According to the US patent act, each of the joint owners of a patent is able to engage in activities based on the patent with a very high degree of freedom, except where there is a special agreement among the joint owners. For example, each joint owner is allowed to sell the patented invention to someone else, without being accountable to the other joint owners. Consequentially, in the US, joint ownership tends to be avoided, and instead, it is preferred that inventions resulting from collaborative research by universities or institutes and private companies are owned solely by the universities or institutes, which then grant licenses for their use to the counterparty companies. On the other hand, the Patent Act of Japan allows each of the holders of a jointly owned patent to derive benefits from that patent independently from other co-holders, unless otherwise specifically agreed by them, but requires each of them to obtain the consent of the other co-holders before licensing to a third party. Therefore, if a university or public research institute or any other entity that has no intention of using a patented invention for commercial purposes itself but intends to secure some kind of return from a jointly owned invention, it is necessary to include a provision specifically referring to such situations in the applicable agreement.

Contract research means research entrusted by a private company and undertaken by a university or public research institute. In general, patents and other intellectual property rights created as a result of the contract research are wholly owned by the university or public research institute and the exclusive license to use them is granted to the company. This scheme is considered to be instrumental in motivating researchers to produce good research results.

Article 73 (Jointly owned patent rights) of the Patent Act of Japan

(1) Where a patent right is jointly owned, no joint owner may assign or establish a right of pledge on the said joint owner's own share without the consent of all the other joint owners.

(2) Where a patent right is jointly owned, unless otherwise agreed upon by contract, each of the joint owners of the patent right may work the patented invention without the consent of the other joint owners.

(3) Where a patent right is jointly owned, no joint owner may grant an exclusive license or non-exclusive license with regard to the patent right to any third party without the consent of all the other joint owners.

§262. Joint owners, the Patent Act of the US

In the absence of any agreement to the contrary, each of the joint owners of a patent may make, use, offer to sell, or sell the patented invention within the United States, or import the patented invention into the United States, without the consent of and without accounting to the other owners.

9-4. Material transfer agreement (MTA)

The term "materials" or "research materials" refers to reagents, samples, laboratory animals (knockout mice, etc.), strains, microorganisms, cell lines, prototypes, or the like to be produced in the course of research. In the past, it was common practice for a researcher who had published a paper to supply related research materials, generally without compensation, to other researchers upon their request. Recently, some research materials such as iPS cells and iPS cell antibodies have been receiving broad attention from various fields. These research materials are neither covered by patent applications filed with the Patent Office, nor made public in the manner of copyrighted works. In addition, research materials are different from know-how in that most research materials do not fall under the category of confidential information. Above all, research materials are not intangible items, like know-how. Such research materials as these, while differing greatly from patented intangible processes and the like, are often encompassed by other patents as the results of research.

In light of these characteristics, it is important to conclude a material transfer agreement (MTA) when supplying or receiving research materials. A draft MTA is usually prepared on the part of the supplier. If research materials are supplied to a private company, such supply is conceived as a kind of technology transfer and, in general, made on a fee-paying basis. In some cases, even where an MTA is concluded between universities or public research institutes, the recipient of the research materials is requested to accept the condition that the supplier will have a non-exclusive, sub-licensable license to use any patent that may be produced by the recipient based on the research materials to be supplied.

The terms and conditions of an MTA depends on the scarcity, value and other aspects of the research materials to be supplied, but most typical MTAs include the provisions concerning: (i) prohibition of use for unauthorized purposes, (ii) prohibition of supply to third parties, (iii) duty of confidentiality, (iv) conditions precedent to disclosure, (v) how intellectual property rights created based on the use of research materials will be treated, (vi) supply fees, and (vii) disclaimers.

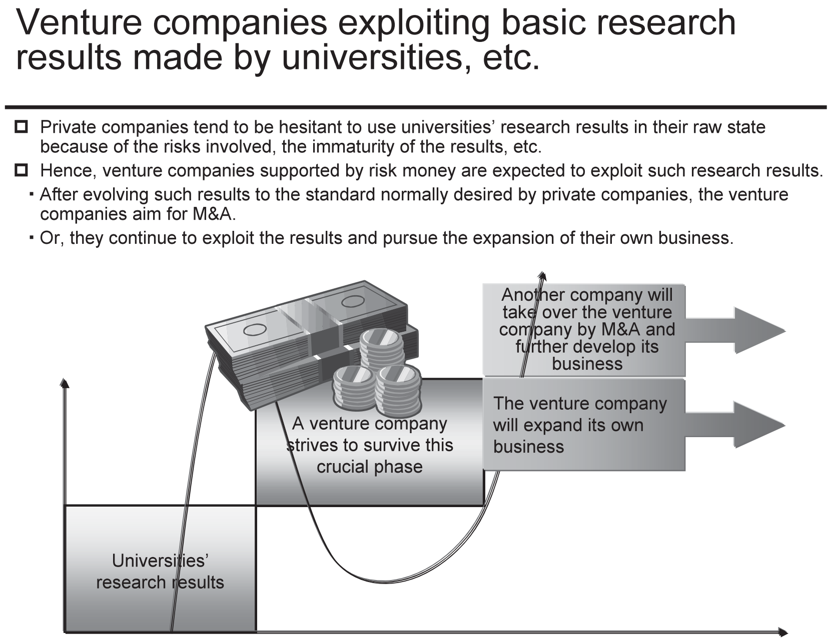
10. Technology transfer by starting a venture company

In general, research results created by universities, etc. are so basic that they tend to need a very long and high-risk incubation period before they can be shared with society. In biomedical and other areas, the period and costs needed for the commercialization of research results are even greater. Therefore, big companies and other private companies already operating often shy away from the risks involved in introduce and use such research results, particularly where the research is still at an early stage. It is generally believed that most existing companies are not willing to assume such risks in the course of their business.

Under these circumstances, one effective approach is to launch a university-backed venture company with the aim of refining basic research results or high-risk, high-return innovative research results produced by the university into a more advanced form in preparation for commercialization. A venture company is said to be the most effective type of entity for evolving high-risk, university-originated research results, because it receives funding (risk money) from investment organizations looking for high-risk, high-return businesses. In the case of MIT, in America, for example, it is reported that 35% of its licensees are venture companies and that big companies make up less than 20%.

There are two major exit strategies for venture companies (Figure 11). One is to list shares on a stock exchange and continue to expand. Sony, Panasonic, Honda, and many other Japanese companies have been growing in this way. The other strategy is to seek out an M&A. In this case, the role of the venture company is to bring certain basic research to a level at which big companies and other existing companies will recognize the feasibility of commercialization. After this has been achieved, the venture company's whole business is sold to a big company, etc.

Figure 11



11. Networking for technology transfer

It is important for TLO managers at universities or public research institutes to keep in touch with private sector managers who have any kind of work-related contact with the organization and maintain and to develop human networks with such companies and individuals. After filing a patent application based on new research, it is advisable for the TLO manager to make full use of such networks to let others know about the new technology in order to improve the success rate of technology transfer.

The most basic networking approach is to directly contact and visit the appropriate individuals at various companies. As other conceivable approaches, a university's TLO managers may utilize partnering systems offered at international exhibitions (for example, the BIO's conference annually held in the US for biotechnology research and business), organize their own technology briefing meetings or seminars for the purpose of exchanging views with relevant managers at participating companies, obtain information from the researchers about the companies that showed interest in the research results announced at briefing sessions or workshops held by the university and the appropriate contact persons, and implement other activities. One example of such other activities is the KEIO TECHNO-MALL, held in Tokyo every year under the auspices of Keio University's Faculty of Science and Technology. About 70 trial models are exhibited at this exposition to afford the roughly 1,200 annual visitors the opportunity to visually observe, touch or actually use them (Figure 12).

Figure 12

Expositions for university research results

Source: Keio University's website

12. Model cases of technology transfer

To give some concrete examples of technology transfer based on patents that originated at Keio University among Dept. of Science and Technology researchers, five model cases have been selected and are introduced as follows .

The first is a technique for measuring the size of small droplets invented researchers at the Faculty of Science and Technology. Using the conventional method, called interferometric laser imaging, it is difficult to measure the diameter of a droplet under high-density conditions where multiple droplets appear overlapping on a graphical image. However, this invention enables measurements to be made by means of special optical systems that compress the graphical image unidirectionally and separate the image of each droplet from the others. This invention was initially licensed to a Japanese company and subsequently licensed to a foreign company.

Software for creating handwritten-like character fonts, as introduced in the second model case, make it possible for a printer connected to a computer to print out text in a font that looks like the user's own handwriting from printers. This technology was licensed to a small Japanese company.

Software for the creation and distribution of contents of server computers, as introduced in the third model case, is used for Internet-based meeting systems. This method was invented by Naoaki Mashita while he was a student at Keio. He launched a venture company based on this invention and the company continued to grow, winning the No. 1 market share for web-based conference services in Japan in 2008.

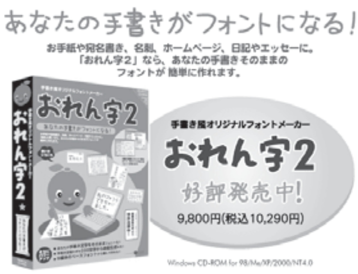
The fourth model case shows a method for separation and analysis of anionic compounds, and is the first technology in the world to enable the high-speed qualitative analysis of metabolome (metabolic substances found within living organisms). Professor Tomoyoshi Soga and the other inventors of this technology founded a venture company called Human Metabolome Technologies, Inc. (HMT). HMT is now one of the world's major centers for metabolomic analysis and research.

The technique for diagnosing scleroderma, as introduced in the fifth model case, was invented by Assistant Professor Masataka Kuwana from the School of Medicine and licensed to Japanese medical company.

Cases where Keio University's patented inventions have been utilized

Inventor	Summary of the invention	Form of technology transfer
A professor from the Faculty of Science and Technology	Technique for measuring the diameter of a small droplet	Licensing to domestic and foreign companies
A professor from the Faculty of Science and Technology	Technology for creating handwriting-like character fonts	Licensing to a domestic company
A then-student of the Faculty of Science and Technology	Method of creating and distributing contents of server computers	Launch of a venture company
A professor from the Faculty of Environment and Information Studies	Metabolome analysis technology	Launch of a venture company
An assistant professor at the School of Medicine	Diagnostic agents for scleroderma	Licensing to a domestic company

Software for creating handwriting-like character fonts

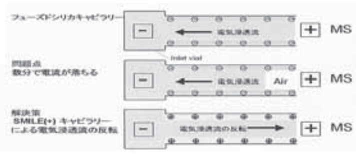


Model case of venture company launched by Keio

Naoaki Mashita
代表取締役兼CEO
(Inventor)

Metabolomic data analyzer

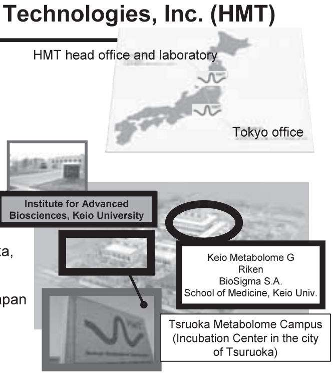
- This is a method of separation and analysis of anionic compounds.
- In a world first, this epoch-making technology enables high-speed qualitative analysis of metabolome (a generic term referring to metabolic substances found within living organisms).
- The method was developed by the Institute for Advanced Biosciences, Keio University (located at Tsuruoka-shi, Yamagata, Japan)
- This is an important technology that could make a significant contribution to the post-genome era.
- Its practical application is being pursued in collaboration with a venture company, HMT.



Model case of a venture company launched by Keio

Human Metabolome Technologies, Inc. (HMT)

- Business activities
  - Metabolomic analysis
  - Biomarker research support
  - Metabolomic solution
  - Expert dispatching service
- Founders: Masaru Tomita,
  Tomoyoshi Soga
- Representative: Ryuji Kanno
- Head office:
  246-2 Mizukami Kakuganji, Tsuruoka, Yamagata, Japan
- Tokyo office:
  3-5-3 Kyobashi, Chuo-ku, Tokyo, Japan
- Established: July 1, 2003



In the following, we introduce some of the products developed through R&D under the Program for Industrial Technology Research and Development by Medium and Small Enterprises, as model cases of technology transfer from a public research institute (the National Institute of Advanced Industrial Science and Technology; AIST) to small and medium-sized companies.

Flaw and defect inspection system using laser diffraction

Sigma Corporation (Kure, Hiroshima, Japan), Japan System Design Co., Ltd. (Hiroshima, Japan)

Inspection system capable of high-precision, high-speed, automatic detection of small flaws and defects on inner and outer cylindrical surfaces of car engines, using an optical probe with integrated combination of semiconductor laser and optical fiber

Research Institute of Instrumentation Frontier

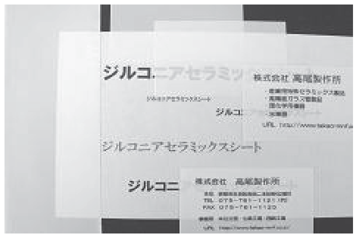
Ceramic thin plate

Takao Manufacturing Co., Ltd. (Kyoto, Japan)

Ceramic plate not more than 0.3 mm thick, manufactured using a water-based doctor blade system rather than the conventional method , which uses a large amount of organic solvents

Materials Research Institute for Sustainable Development

Industrial Technology Center, Kyoto Municipal Industrial Research Institute



Baggage holder made of flame-retardant magnesium alloys for Shinkansen trains

Tobata Seisakusho Co., Ltd. (Kitakyushu, Fukuoka, Japan)

Using flame-retardant magnesium alloys, with combustion inhibition improved by the addition of calcium and about 300°C higher than conventional materials

Materials Research Institute for Sustainable Development

MICRO WATER SYSTEM® (Chemical-free water treatment system)

Igaden Co., Ltd. (Joso, Ibaraki, Japan)

Mini-sized pollutant removal system using electrical, physical and chemical reactions, free from chemicals, without secondary pollution, with minimum power, and capable of processing persistent substances

Photonics Research Institute

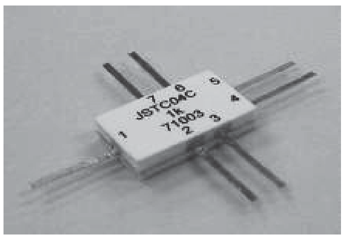
Thermal Converter JSTC04

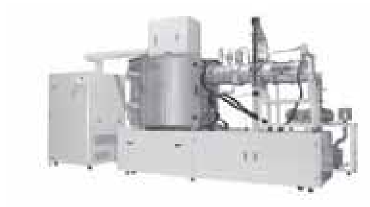
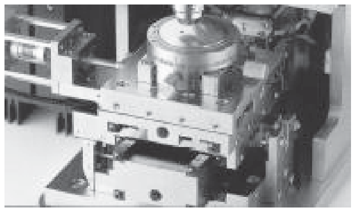
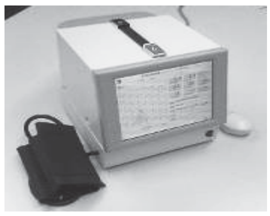
Nikkohm Co., Ltd. (Misawa, Aomori, Japan)

Thermal converter used to measure AC voltage, with frequency characteristic of better than 0.01% in a wide frequency range from 100 kHz to 1 MHz for alternating current

Nanoelectronics Research Institute

Metrology Institute



Fully automated DLC coating system Kurita Seisakusho Co., Ltd. (Kyoto, Japan) System for uniform and omnidirectional coating through plasma based ion implantation—characterized by self-discharge using the material being coated as an antenna—without rotating the material being coated Diamond Research Center	
Nano indentation tester Elionix Inc. (Hachioji, Tokyo, Japan) Reliable hardness tester capable of measurement with only a lightly-loaded, small area (thin film) and conforming to ISO 14577-1 Metrology Institute	
Real-time omnifocal microscope system (Focuscope FV-100C) Photron Limited (Chiyoda-ku, Tokyo, Japan) Microscope system capable of providing images focused on all points of depth up to 100 μm and acquiring the data on image depth simultaneously and on a real-time basis Inteligent Systems Research Institute	
Automatic Xenon Hyperpolarizer Toyoko Kagaku Co., Ltd. (Kawasaki, Kanagawa, Japan) Generator of hyperpolarized xenon by irradiation of circularly polarized light at a wavelength of 795 nm in a rubidium cell operating in static magnetic field of permanent magnet, focused on the feature of hyperpolarized xenon that can enhance the sensitivity of measurement by nuclear magnetic resonance (NMR/MRI) by ten thousand times Photonic Research Institute	
High-precision goniometer for chilled samples in UHV environment R-DEC Co., Ltd. (Tsukuba, Ibaraki, Japan) Device to manipulate samples in ultrahigh vacuum environment, characterized by mini size, nonmagnetic type, high precision, multi-axis rotation control, and temperature control ranging from ambient temperature to ultralow temperature Nanoelectronics Research Institute	
Simplified apparatus for measurement of arteriosclerosis Shisei Datum Co., Ltd. (Machida, Tokyo) Apparatus for measurement of arteriosclerosis by merely adding the programs for computing the degree of arteriosclerosis to a sphygmomanometer Institute for Human Science and Biomedical Engineering	

Pulse injector Cluster Technology Co., Ltd. (Higashi-Osaka, Osaka) Injector featuring a large driving force for droplets, a wide range of droplet size control, a wide range of drive frequency, and droplet disposition of high precision, and suitable for ejection of DNA, protein and other biomaterials Health Technology Research Center	
Phelios AB-2350 Atto Corporation (Bunkyo-ku, Tokyo) 96-well plate luminometer with multicolor measurement system, suitable for reporter assay (a technique to identify chemical substances and gene activators) Research Institute for Genome-based Biofactory Research Institute for Cell Engineering