4 Ways of Protecting New Technology Related Inventions in the Life Science Field

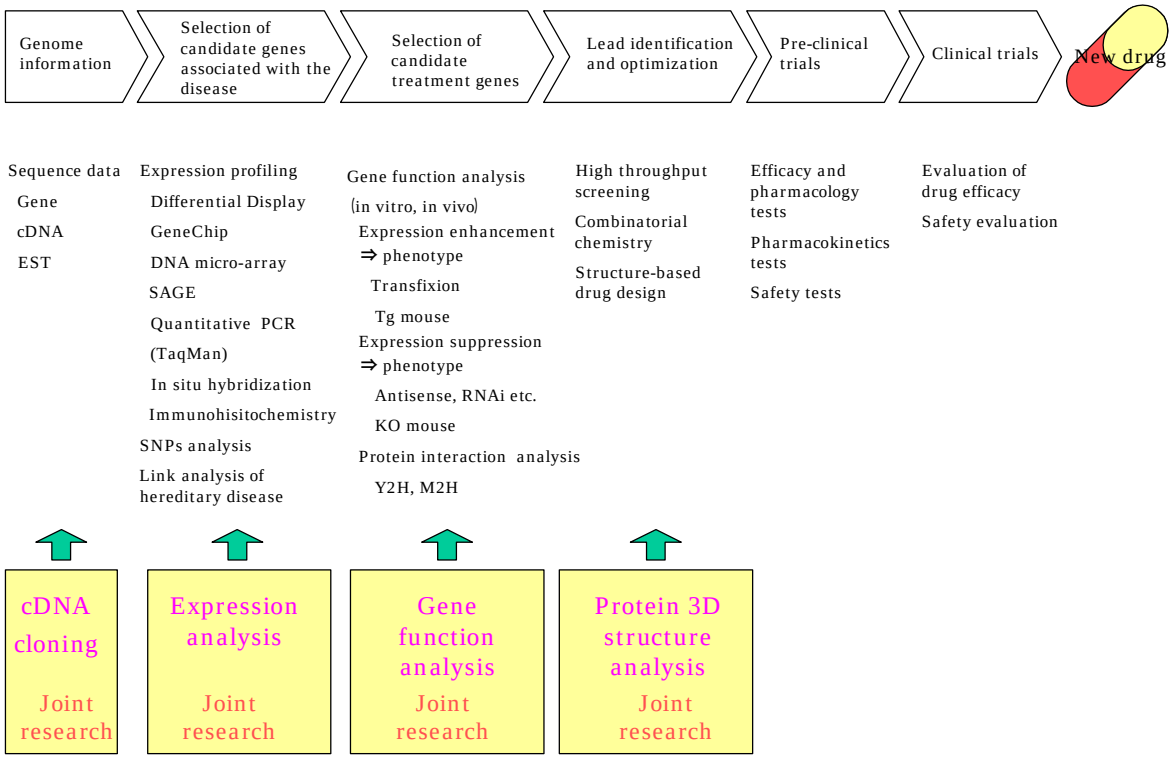
The technologies newly emerging in the life science field are characteristic in the following respects: (1) a shift from micro to macro; (2) an increased role of research tools; and (3) digitization of the findings. In order to appropriately protect inventions relating to such new technologies, it is not only necessary to consider measures for the individual technologies, but it is also important to adjust our basic method of reasoning with respect to issues such as the limits of the scope of protection under the Patent Law and the balance between the scope of protection and disclosure.

In this report, the characteristics of the newly emerging technologies were confirmed and problems that arose with respect to patent protection were highlighted. Then, the gap between the inventors' awareness and the current law was analyzed from the perspectives of description requirements and usefulness. At the same time, the patentability of inventions relating to new technologies was studied in detail to investigate the limits of the scope of protection under the Patent Law and to indicate various problems and methods for solving them. Furthermore, the way in which findings that cannot be protected under the Patent Law could be protected in light of general tort law was also examined.

I Newly Emerging Technologies in the Life Science Field and the Findings

Starting from the genome information accumulated in databases, the development of genome-based drugs can be roughly divided into the following stages: [Selection of candidate genes associated with the disease] → [Selection of candidate treatment genes] → [Lead identification and optimization] → [Pre-clinical trials] → [Clinical trials] (See Figure 1). Of these stages, a great deal of newly emerging technologies are seen in the [Selection of candidate genes associated with the disease], [Selection of candidate treatment genes] and the [Lead identification and optimization], so these stages were used as the focus of these investigations.

Fig. 1 Genome-based drug development process and joint research agreements



[Selection of candidate genes associated with the disease]

At this stage, expression profiling is performed using comprehensive expression analysis methods with samples from a variety of disease patients. For example, the methods used include DNA Chip methods like Differential Display (DD) and GeneChip, DNA micro-array methods in which DNA is affixed to a slide glass at high-density, and SAGE (Serial Analysis of Gene Expression) methods.

The candidate genes related to the disease are selected using these methods; but, at this stage, it is not clear whether the genes are important (candidate treatment genes) for the actual development of the drug.

Therefore, it is necessary to perform gene function analysis and select the genes that will be the candidates for the treatment.

[Selection of candidate treatment genes]

For this stage, an analysis is performed of the specific functions of the candidate genes associated with the disease, as well as the work to select the candidate treatment genes that are useful for drug development. In comparison with the technologies for the selection of the candidate genes associated with the disease stage, there are many technologies here that are not yet fully developed, and are time-consuming. For this reason, this stage is the rate-limiting step in the genome-based drug development process. Technologies used include full-length cDNA cloning, transgenic animal, knock-out animals, antisense oligo DNA methods, ribozyme methods, dsRNAi methods, and Mammalian Two-Hybrid methods.

Table 1 summarizes each of the above technologies and the issues.

Table 1 Technologies and issues for the selection of candidate treatment genes (gene function analysis) stage

Technology	Issue
Full-length cDNA cloning	Development of technology to obtain full-length cDNA with better efficiency than the oligo-capping or 5'-RACE sequencing, and technology to reduce PCR misinterpretation
Vectors used to enhance gene expression	Development of technology to improve introduction and expression efficiency, technology to differentially introduce and express cells (tissue), and virus vectors with low cytotoxicity
Transgenetic mouse	Development of tissue and time differentiation promoters for introduction of exogenous genes
Antisense oligo DNA	Development of modification oligos, to improve elements such as cell membrane permeability, nuclease resistance, and hybridization
Ribozyme	Development of handling and planning improvement methods
dsRNAi method (double-stranded RNA interference)	Development of improvement methods (such as a decrease in antiviral response), and of search and retrieval methods for optimal sequencing
Knock-out mouse (Cre/loxP)	Shorter production time (high throughput, conditional knock-out mouse production technology)
Protein interaction (Mammalian Two-Hybrid method, etc.)	Improved detection sensitivity, and shorter assay times

[Lead identification and optimization]

For this stage, the work is performed to screen the small nucleus compounds (lead compounds) that act on proteins coded by the candidate treatment genes. The technologies used include techniques for actual screening, such as target-base assay, cell-base assay, and binding assay, as well as virtual screening techniques like LBDD and SBDD. The screening technologies for ADME/Tox are also used.

Ⅱ Technology that Requires International Cooperation and Technology that Requires Competition

A major characteristic of the newly emerging technologies in the life science field is a shift from micro to macro, i.e., technologies that come from a broad range of comprehensive research.

This type of research cannot be performed by an individual or at a single laboratory. It must be conducted nationally or regionally, and international

scientific organizations' activities for connecting such research are also active.

The results from this comprehensive research are shared assets of humankind. Therefore, the world is oriented toward setting the principle that the results of research projects, which are conducted with public funding for the purpose of improving the international efficiency of research by worldwide sharing, are to be made public (principle of public access). For example, the ISGO is an international scientific organization working on the analysis of the tertiary structure of proteins. It has decided that guidelines (Airlie Agreement) will be strictly observed, including: (1) the structural coordinates obtained will be entrusted to PDB immediately after the structure is determined, and will be made public, and (2) the status of progress of the research will be reported on official sites.

In addition, the Human Proteome Organization (HUPO), which is the international scientific organization for the field of proteome and proteomics, is also proceeding to build a system based on the promotion of fair information distribution, and steps are being taken to request public access to research results.

In this respect, technology that is based on wide-ranging, comprehensive research can be considered technology that should be developed through international cooperation. However, there are countries (research projects) that first try to promote utilization in the domestic industries without making public the results obtained during the research by using the point that the principle of public access in the Airlie Agreement only applies to purely public research projects. In other words, such technologies require competition as well as international cooperation.

In this way, the policy to not publish intermediate research results to file patent applications during the unpublished period or to obtain head-start advantage for a certain period means, for researchers, that they cannot freely publish their own research results, which may actually lower the incentive for researchers.

In the relationship between the principle of public access and the patent system, the harmonization of a grace period for all countries is required. Furthermore, since most of the results of comprehensive research are fundamental data, there is a need to investigate means of legal protection other than those available under the Patent Law.

Ⅲ Problems with Protection in the Life Science Field

This section analyzes the gap between inventors' awareness and the current law from the viewpoints of the description requirements of specifications and usefulness, on the basis of the above-mentioned characteristics and problems of newly emerging technologies. This part then searches the limits of the scope of protection under the Patent Law through specific investigation of patentability of new technology-related inventions that use data on the tertiary structure of proteins. Moreover, the desirable handling of findings that cannot be protected under the Patent Law is also considered in light of general tort law and others.

1 Gap between Inventors' Awareness and Current Law (Examination Standards)

As a result of the analysis of examples under the current examination standards, the following problems were extracted in terms of the description requirements of specifications and usefulness.

Problem ① [Enabling requirement]

In contrast to the United States, the description of the entire claim is not judged in a uniform way under the current law, so the fulfillment of the enabling requirement may be generously judged on parts other than modes for carrying out the invention described in specifications, thereby causing the possibility that broad rights beyond inventors' awareness are granted.

Therefore, if there arise any doubts on the fulfillment of the enabling requirement, examiners need to actively require applicants to clarify the enablement. Through this measure, applicants' awareness at the examination stage is at least retained for records, and claims for illegally broad rights in infringement suits can be prevented.

Problem ② [Enabling requirement]

Under the current law, to describe one mode of use in the detailed description of the invention is considered sufficient to judge the relevant invention of product as "usable" and thus fulfills the enabling requirement. However, since "information" is the essence of many new technology-related inventions in the life science field, the modes of use of such inventions are wide-ranging. Therefore, if a strong right, "patent for substance," is granted to such inventions, the right is highly likely to be an obstacle to downstream product development using the relevant inventions, beyond the inventor's awareness.

Problem ③ [Certified experiment results]

Under the current law, if the fulfillment of the enabling requirement is denied on the ground that parts other than modes for carrying out the claimed invention are not workable, the relevant applicant may be able to obtain a patent by submitting certified experiment results after filing a patent application. This will create the possibility of obtaining rights beyond inventors' awareness, so certified experiment results should not be easily relied upon.

Problem ④ [Definiteness]

Under the current law, definiteness tends to be judged on the basis of the interpretation of terms described in the claims. Therefore, even if the essence of an invention of which the inventor is aware is the same, the technical scope of the invention may be judged as being largely different due to slight divergences in the terms described in the claims. Moreover, the excessive application of such practice will have an adverse effect on the obtainment of rights for inventions that use new terms and concepts, thereby causing the possibility that the inventors of pioneer inventions can obtain only extremely limited rights contrary to their awareness. Therefore, definiteness must be judged not by excessively emphasizing the interpretation of terms but by understanding the essence of inventions described in the claims.

Problem ⑤ [Usefulness]

Under the current law, the concept of "usefulness" is used for either "industrial applicability" or "enabling requirement" or both. For many new technology-related inventions in the life science field, the usefulness requirement that requires proof of specific effects becomes a problem, and thus inventions may not be sufficiently protected contrary to the inventors' awareness. Consequently, this report proposes to separate the requirement of "usefulness" from the enabling requirement provided in Section 36(4) of the Patent Law, unify the requirement of "usefulness" into "industrial applicability" stated in the main paragraph of Section 29, and leave the requirements of "how to use" and "how to make" in Section 36(4). Through this, the examiners come to have the burden of proof of the "industrial applicability" stated in the main paragraph of Section 29, while applicants come to have the burden of proof of Section 36(4). This enables a similar handling to that in the United States and Europe, and is expected to achieve an effective protection of inventions.

Problem ⑥ [Protection of invention of process]

Under the current law, in judging the novelty of inventions of process, inventions will not be deemed to be novel in principle if their constitutions (parts of mode for carrying out the invention) are the same, even if their purposes differ. On the other hand, even when findings and modes of use are the same for use inventions, if the purposes (usages) differ, the inventions are considered to be findings for limited use and thus deemed to be novel as inventions of product. For harmonization between rights for inventions of product and rights for inventions of process, it is necessary to clarify conditions for inventions of process and consider their purposes (usages) as the constitution of the inventions.

Problem ⑦ [Support requirement]

Under the current law, Section36(6)(i) of the Patent Law provides that the invention described in the claims shall be that described in the detailed explanation of the invention in the specifications, but this point is only formally judged in the actual situation. When applying the support requirement, all possible modes for carrying out the claimed invention must be reasonably understandable from the detailed description of the invention for the purpose of not losing sight of the essence of the invention. Such application is considered necessary to prevent claims of a broad scope of right that are contrary to inventors' awareness.

2 Limits of the Current Legal Standards

This section investigates the limits of protection under the Patent Law under the current legal standards by considering the patentability of bioinformatics-related technologies (virtual screening processes) and inventions, which are representative examples of newly emerging technologies, and proposes problems as well as their solutions.

(1) Protection of Data on Tertiary Structure of Proteins, etc.

Under the current law, for example, in the case of "preparing output data by processing input data with a specific algorithm of the bioinformatics system," if data on the tertiary structure of proteins or pharmacopoeia data, which becomes "input data" or "output data," is claimed by itself or is made to be a media claim, it will not be considered to be an "invention" and thus will not be protected.

However, considerable time and costs are required to obtain data on the tertiary structure of proteins or pharmacopoeia data, and it is also true that these data themselves have significant economic value. Therefore, some sort of protection of such data is required.

Thus, given that such data are recognized as "inventions" and protected under the Patent Law under certain requirements, the following problems are considered to arise.

Problem ① [Easiness of copying]

If a part of the data is protected as an invention, the data itself will be described in the specifications, so third parties can very easily copy the data by incorporating it into their own computers.

Problem ② [Difficulty in proving infringement]

In the information processing system, information processing is usually conducted by sequentially transmitting data to an algorithm executed at a CPU, so it is extremely difficult to prove what data infringers used (information processing) through the information processing system in the past.

Problem ③ [Absolute exclusive right]

Unlike copyright, patent right is an absolutely exclusive right, so if the same data exists, the relevant right can be executed without consideration of the process of the data creation.

The grant of an absolute exclusive right to such information that can be considered to be "knowledge" may severely hinder the research and development of technologies using the "knowledge." For example, bioinformatics companies and the patentees of data on protein structure themselves have to conduct investigations on their infringement against other's data patents, whenever they refer to well-known data on protein structure in a computer or create new data on protein structure.

Problem ④ [Difficulty in examination]

In terms of examining the inventive step of data, since the value of data differs depending on the type and property of the data, it is probably extremely difficult to carefully examine the value of each datum at the examination stage to grant appropriate protection.

In this way, it is considered difficult to protect data that are newly emerging technologies in the life science field themselves under the Patent Law. However, it is also true that such data themselves have significant economic value, so some sort of protection is necessary. Solutions are presented below.

Solution ① [Distribution through copy mart]

It is possible, on the assumption of the current agreement-based protection, to distribute data on the tertiary structure of proteins and pharmacopoeia data by registering them with the lump-sum publication/agreement-based electronic copyright management system for digital content like "copy mart."(*1)

The specific method is to register the creator, type and content of data, etc. and to keep the content of data unpublished for a certain period after registration. This system enables users to access the content of data by concluding an agreement for the obtainment of desired data and paying a prescribed counter value after inspecting published information.

Solution ② [Unique legislation]

A solution by unique legislation with a publication system as follows is also worth considering on the assumption of registration with a unified "structure data right management system" like "copy mart" (principle of registration): the system to conduct the prescribed formality check of the registered content, grant an exclusive right (relative exclusive right) to registered structure data, etc., provide a remedy for illegal copies, and publish the content of the data after a certain period from registration.

(2) Protection of Virtual Screening Processes

The following describes the results of the investigation on the patentability of inventions of the virtual screening process under the current legal standards from the standpoint that the inventions of the virtual screening process should be protected by patent.

Problem ① [Completion of invention]

If a virtual screening model reflects the real world at a certain level, and consequently, compound information that has been obtained from screening corresponds to a compound that is combined with actual proteins with "constant certainty and reproducibility," the "utilization of a law of nature" should be recognized in the idea of the virtual screening itself. In other words, the utilization of a law of nature can be found not only in a system working in cooperation with hardware resource but also in the idea of using the model itself. Moreover, the idea may sometimes prove to be a "technical idea" through identification of a "publicly-known algorithm" that has shown conformity to information on the new tertiary structure of proteins.

Problem ② [Novelty of invention]

Under the current law, the inventions of the virtual screening process that are different from the conventional technologies only in data itself are not considered to involve novelty, and such position of the Japan Patent Office is also indicated in the Report on Comparative Study by the Trilateral Patent Offices. However, the mere Examination Guidelines for Computer Software Related Invention, which do not rely on the viewpoint of the advance of the drug development industry, are applied to the inventions of the virtual screening process of which characteristics exist in information on the new tertiary structure of proteins, and the patentability of the patent of technology that is essentially the subject of protection is denied in a uniform way. This result is considered unfavorable from the purposes and principle of the Patent Law.

Therefore, it is proposed to assess the novelty of inventions based on the content of information. Information that brings about a technical effect and is obtained in a purely scientific process that is inseparably from a method using a law of nature, such as information on the new tertiary structure of proteins, should be recognized as a numeric limit with technical significance and thus be considered a positive element for the requirements of the novelty and inventive step of inventions. On the other hand, it is appropriate to deny the novelty of pure

(*1) Based on the copy mart plan proposed by Zentaro Kitagawa (professor emeritus of Kyoto University). (For example, see "*Gouishisutemu Toshite No Chosakuken Shijo—Kopi Maato Ron—* (Copyright Market as a System for Agreement—Copy Mart Theory—)," *Chitekizaisan Housei* (Intellectual Property Legislation), Tokyo Nunoi Shuppan, 1996, and Zentaro Kitagawa "*Kopi Maato Kousou* (Copy Mart Plan), *Chiteki Souzou Jidai No Chiteki Zaisan* (Intellectual Property at the Age of Intellectual Creation), Keio University Press, 2000, p.98-103, etc.) The copy mart outline is shown below. For details, see the Kyoto Comparative Law Center's Web site (http://www.copymart.gr.jp), etc.

information of which value can be found only in artificial arrangements and which does not bring any technical effect, such as an address list.

Problem ③ [Inventive step of invention]

The inventions of the virtual screening process of which characteristics exist in information on the new tertiary structure of proteins depend on the difficulty of creating them. So, they can be evaluated from the aspect of the process of obtaining specific three-dimensional information and the aspect of effects brought by utilizing specific three-dimensional information.

Moreover, in order to appropriately protect the inventions of the virtual screening process, examination from the aspect of the effects of patent rights is also important. Problems from these effects are described below.

Problem ① [Experiment and research]

Regarding the interpretation of "experiment or research" as provided in Section 69(1) of the Patent Law, there is a prevailing theory that experiment and research should be divided into research related to the theme of the relevant invention and mere means for mere research. In this case, the use of a screening process for drug development is use as means for research, and it thus constitutes an infringement. However, according to this interpretation, it is hard to distinguish exploitation by companies and universities, etc., so pure experiment and research activities by universities, etc. may constitute infringements of patent rights. Moreover, the above-mentioned division is usually difficult. On the other hand, if Section 69(1) of the Patent Law is applicable not only to the improvement of patented inventions but also to acts that are expected to contribute to the obtainment of broad technical knowledge or the general progress of science and technology, all kinds of uses of screening processes will fall under "experiment or research." However, in this case, it is extremely difficult to achieve the effective protection of patents for screening process. In this way, it is hard to determine which interpretation is appropriate, or whether another interpretation should be adopted, but there is a desire for an early solution to the problem by the court in order to eliminate the uncertain condition of the drug development industry.

Problem ② [Whether simple process or manufacturing process]

Although it has been contested as to whether the screening process is a simple process or a process of manufacturing the product, it is considered to be a simple process when considering the purport of the Supreme Court decision on the Kallikrein Case. Therefore, the effect of its patent right is not considered to be extendable to the results obtained through the process.

Problem ③ [Limit of effect based on the principle of territoriality]

The effect of patent rights extends only to the acts of exploitation conducted in Japan on the basis of the principle of territoriality. If the screening process is considered to be a simple process and the effect of its patent right does not extend to the results obtained through the process, even if the relevant screening were conducted in a foreign country where any patent for the process has not been obtained and the results are imported and sold in Japan, the patentee could not countervail such acts in any way.

Problem ④ [Patent of virtual screening process and patent of wet screening process]

Virtual screening process is technology that recreates the utilization of a law of nature in the wet screening process on a computer, so the technical ideas of both processes are common. The developer of a wet screening method may try to obtain a patent that is considered to include a corresponding virtual screening process, but it is extremely difficult to give descriptions that fulfill the requirements for patentability, such as definiteness of invention. In addition, regarding whether it is possible to prevent the exploitation of a corresponding virtual screening process through application of the doctrine of equivalent to a patent of the wet screening process, it may be extremely difficult to fulfill the requirement of "easily replaceable." Therefore, there does not seem to be any conflict of effect between the patents for both processes.

Problem ⑤ [Combination of a patent of the virtual screening process and a patent of the wet screening process]

For a claim of a screening process that is created by combining a patent of the virtual screening process and a patent of the wet screening process, when the relevant dry screening process company and the relevant wet screening process company are separate, it is difficult to allege that the claim constitutes a direct infringement because of the principle of unity of right. However, as decided in the *Suchiropi-zu* (expandable polystyrol) Case, if the claim were considered to institute a joint unlawful act, it might be possible to question responsibility by considering the claim to be direct infringements of both processes.

3 Protection of Findings that Cannot be Protected by Patent

As mentioned above, according to the theory of interpretation of the current law, it is hard to consider data on the tertiary structure of proteins to be the subject of protection under the Patent Law.

However, since certain usefulness and economic value are to be found through the accumulation of data of this kind, some legal protection as a kind of information source will be required.

The following describes the results of examining the protection of findings that cannot be protected under the Patent Law.

① [Protection by trade secret]

In order to protect data on the tertiary structure of proteins as trade secrets provided in Article 2 (4) of the Unfair Competition Prevention Law, the data must fulfill the three requirements: being preserved as secret, being publicly unknown and being useful. If the data fulfills all requirements, the relevant patentee is approved to have a right to require an injunction of the act of unfair competition against one who conducts the act and a right to demand compensation for damage caused by the act.

Regarding data of which functions have not been ascertained, there is room for discussion over whether the data fulfills the above-mentioned usefulness requirement, but in terms of the usefulness requirement for trade secrets, a high level of usefulness should not be required according to the purport of the system.

② [Protection by law of contract]

For findings that are not protected under the Patent Law, to deal the authority to use them through voluntary conclusion of a contract between parties concerned cannot be in principle prohibited (principle of liberty of contract). However, if the content of the contract is considered to be contrary to public policy or good morals (Article 90 of the Civil Code), the effect of the contract may be denied. The example of such is that a contract for offering the use of a database includes a contract clause stating that all rights to obtain patents for inventions created by using the relevant database or all patents for such inventions are transferred to the offerer of the relevant database.

③ [Protection by general tort law]

In recent times, there has been a theory behind judicial precedents that an unlawful act is constituted even for information property that is not recognized to be explicitly protected under the Copyright Law, under certain theory of requirements.(*2) According to the theory, if the following four requirements are fulfilled, the relevant act may constitute an unlawful act: when (i) one person has created a database through the collection and establishment of information by using costs and labor and (ii) has been carrying out business operations by manufacturing and selling the relevant database, another person (iv) replicates the data of the relevant database and sells the created database (iii) in the area that overlaps with the sales territory of the first person.

Taking into consideration the value of database as information property and the protection of invested capital, it seems necessary to establish the theory of requirements that expands the area where an unlawful act is constituted. However, since protection by tort law may substantially grant semi-permanent legal protection, careful judgment is required. Nevertheless, in the case of protection by tort law, legislative remedy only includes a claim for damage, and remedy by a right to require an injection cannot be expected.

④ [Protection by the Copyright Law]

According to the current Copyright Law, the selection of information or the creativity in systematic construction is to be evaluated, and for edited works, attention is paid to the selection of materials and creativity in sequences. Therefore, generally, a database created by comprehensively analyzing and accumulating data on the tertiary structure of proteins is not greatly expected to be protected as works, excluding databases that were edited in a specific way.

⑤ [Protection by technical protection means]

For computerized findings such as a database, companies are expected to set a technical protection means to eliminate use and access by those other than authentic users before offering use, and the legal regulations under the Unfair Competition Prevention Law are applicable to the act of transferring a device or program to circumvent such technical protection means.

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(*2) Decision on the Vehicle Database Case (Tokyo District Court, interlocutory judgment on May 25, 2001, *Hanrei Jihou*, No. 1774, p. 132; Tokyo District Court, judgment on the merits of the case on March 28, 2002, Collection of Judgments of Intellectual Property Right Cases on the Supreme Court's Web site: http://www.courts.go.jp).


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