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Basics of US Patents and the Patent System

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Abstract

The patent system plays an important role in stimulating the economy and advancing the quality of life in the United States. It serves as an incentive for innovation by giving inventors an exclusive right to their inventions for a limited period of time. It also increases and hastens the publication of useful knowledge by requiring inventors to disclose their invention to the public. Patents are particularly important in the pharmaceutical and biotechnology industries because they provide a mechanism by which the extremely high product development costs may be recouped. The United States Patent and Trademark Office acts as a gatekeeper in the patent system to prevent patents that do not meet the legal requirements from being thrust on the public. The legal requirements for obtaining a patent are discussed, particularly as they relate to pharmaceutical and biotechnological inventions. The process of examining an application for a patent is briefly described, along with some of the burdens faced by examiners when deciding the patentability of therapy-related inventions.

Keywords: Patent, pharmaceutical, biotechnology, utility, description, obviousness, examiner

Introduction

From its beginning in 1790, the patent system in the United States was intended to promote advances in science and technology that translated into useful products and processes, which in turn enhanced the quality of life and standard of living of its citizens. Patents unarguably contribute to the continued innovation that makes possible the economic well-being and quality of life we currently enjoy. Although the importance of that contribution varies from industry to industry, it has enormous impact on the pharmaceutical and fledgling biotechnology industries. A single patent on a therapeutically active drug can generate tens of billions of dollars during its lifetime. Commercial biotechnology products, although gaining in prevalence, have yet to achieve the strength in the marketplace as compared with their drug product counterparts. In these 2 industries, patents provide both an incentive to continue developing new treatments and a means for recouping the very large development and regulatory costs.

The goal of this article is to give its readers a basic understanding of the patent system as it operates in the United States, with an emphasis on the role of the US Patent and Trademark Office (USPTO). It briefly discusses what constitutes the patent system in terms of who the players are, what the requirements are for obtaining a patent, the patent examination process, and some of the difficulties facing the examination process, particularly with respect to pharmaceutical and biotechnology applications.

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Origin and Players

The US patent system has its beginnings in the US Constitution, which states in Article I, Section 8, clause 8: "The Congress shall have Power…To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries…." During the course of the past 216 years, this brief phrase has been deconstructed in a manner that provides the basis for both patent and copyright law. "To promote the progress" provides the basis for the concepts that an invention or writing must be new and that an invention must be described in such a manner as to allow the public to make and use it. "Science and useful Arts," at the time the Constitution was written, referred to the philosophical endeavors of authors and the practical inventions of inventors. The word "useful" gives rise to the legal requirement that an invention has some usefulness to the public. "[S]ecuring for limited Times…the exclusive Right to their respective Writings and Discoveries" underpins the concept of the exclusionary nature of copyright and patent rights, and perhaps, most importantly, the idea that these rights are not natural birthrights that are granted in perpetuity—they are of limited duration. With respect to patents, the fundamental principle provided for in the Constitution, and still embodied in the patent statutes of today, is the trade of a government-granted limited time exclusive right to an

inventor or discoverer in exchange for a detailed description of the technological advance that distinguishes the invention as something new and useful.

The current patent system is very complex. It involves scientists, engineers, and artisans who invent new and useful products and processes, or make significant improvements on existing products and processes. By obligation or desire, inventors often assign or sell all or part of their patent rights to others. The owners of the patent rights may produce or use the invention as part of their own commercial endeavors, using the patent rights to prevent others from entering into direct competition against them during the life of the patent. The owners may decide instead to license one or more others to make or use the invention, generally in return for a financial consideration. In some industries, patent rights may be traded for other patent rights, often as part of cross-licensing agreements by which both parties are able to produce products that neither might be able to produce without such an agreement.

To obtain a patent in the first place, the inventor(s) must submit an application to the USPTO, which will examine the application to determine whether all the statutory requirements for a patent have been met. The system includes specialist patent attorneys and agents who draft patent applications and represent the applicant's interests during the examination process. The USPTO is responsible for properly administering the patent laws, and patent examiners are responsible for ensuring that patents are issued only for inventions that meet the statutory requirements. The examination process, with its interplay between an examiner and a patent attorney, is important because it is during this process that the potential benefits of a patent can be maximized and the potential negative impacts can be minimized. Licensing and technology transfer officials play a significant role in helping to ensure that patented technology is developed into products and processes that contribute to the overall economy, quality of life, and, in the case of pharmaceuticals and therapeutics, to the health and welfare of the public. Finally, litigators and the court system serve to protect the patent owners and licensees, and their competitors, from either infringement or the assertion of patents in an inappropriate manner.

The Examination Process in Brief

Patent examiners are required to have a degree in a recognized technology, engineering, or scientific field. Since the first biotechnology specialist examiners were hired, most have had PhD degrees and most of those who did not had master's degrees in a field related to biology or biological chemistry. In the past few years, an increasing number of individuals with PhD degrees in organic chemistry have been hired to examine organic compounds and compositions. While examiners may not maintain the level of expertise exhibited by their counterparts who are actively engaged in research, they are generally very capable of understanding the nuances of the science they encounter during the course of their work.

Patent applications are assigned to examiners according to the technology of the invention and the technological background of the examiner. Ideally, examiners are able to focus on a narrow band of technology, because by doing so, they become familiar with the state of the art, thereby enhancing their examining efficiency and quality. This is important because time constraints placed on the examination of each application mandate an ability to quickly and efficiently understand the claimed invention, its supporting specification, any prior art references that are found or submitted during the course of the examination, and any other evidence that may be submitted in an effort to demonstrate patentability of the claimed invention. An experienced examiner of applications claiming organic compounds and therapeutic methods must complete the examination in an average of 14 hours from first sight to final disposition (that is, allowance, abandonment, or appeal to the Board of Patent Appeals and Interferences) to maintain a performance rating of fully successful.

The basic process of examining an application includes the following activities: (1) The examiner must read and understand the claims that define what the applicant views as the invention and the supporting disclosure; (2) the examiner must search the prior art—prior patents, foreign patents and documents, and scientific or technical literature (referred to as nonpatent literature [NPL])—and analyze the references that are most relevant to the claimed invention; (3) based on what the examiner finds, he or she decides whether or not each claim meets the requirements for a patent as codified in the patent statutes (which will be discussed below). In over 80% of the cases, the examiner finds prima facie evidence that one or more claims are unpatentable and rejects those claims with a detailed explanation of how the evidence shows lack of patentability. The communication rejecting the claims is sent to the applicant's legal representative (inventors who work in pharmaceuticals or biotechnology rarely represent themselves) who will then respond to the examiner by amending the claims, producing evidence that contradicts the rejection, and/or arguing that the rejection is improper. Occasionally, the applicant will abandon the application entirely if the examiner has demonstrated that there is nothing of value that can be patented, or if the scope of patent protection that would be granted would not adequately protect the inventor's invention, or if the product for which patent protection is sought fails to show adequate commercial applicability. Once the examiner receives the response from the applicant's representative, he or she reevaluates the claims in view of the totality of old and new evidence and arguments. If the claims are still deemed unpatentable, one or more of the rejections against them

are maintained and made Final, which closes prosecution on those claims. The applicant is entitled to request reconsideration of a Final rejection based only on evidence of record or evidence that could not have been submitted earlier. The applicant is also entitled to appeal the Final rejection to the Board of Patent Appeals and Interferences. If the applicant appeals, the examiner will respond to the applicant's Brief on Appeal by writing an Examiner's Answer, which explains to the Board why the examiner thinks the rejections are proper and should stand in the face of any arguments or evidence submitted by the applicant. Because of time periods allocated to allow the examiner and applicant's attorney to prepare actions and responses, the examination process generally occurs over the space of a year or more from the time the examiner first picks up the application.

Requirements For a Patent

The primary statutes defining the requirements for obtaining a patent are found in Title 35 of the US Code; sections 101, 102, 103, and 112, which respectively deal with patent-eligible subject matter and usefulness (utility), the novelty and unobviousness of an invention, and the proper disclosure of the invention and how it is made and/or used.

Subject Matter Eligible To Be Patented and Utility

Section 101 sets forth the subject matter that may be considered eligible for patenting. Specifically section 101 reads: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." Processes, machines, articles of manufacture, and compositions of matter, as well as improvements of any of these, may be patented, provided they are new and useful. The manner in which section 101 has been interpreted and applied has undergone significant change in the recent past. In 1980, the US Supreme Court took up the question of whether a living organism could be the subject of a patent. The decision in *Diamond v Chakrabarty,* 447 United States 303, 206 USPQ 193 (1980), not only proclaimed the patentability of living organisms, but also cited a phrase from the committee reports accompanying the Patent Act of 1952, that "anything under the sun that is made by man" is subject to patenting. This expansive interpretation of the statute has created significant difficulties in some industries in determining just what may and may not be eligible for patent protection. In the pharmaceutical and biotechnology areas, the determination of patent-eligible subject matter is relatively straightforward. Living organisms, biological molecules, and naturally occurring chemicals are appropriate subject matter for patenting if the hand of man is involved in making or isolating them so they can be distinguished from their naturally occurring state.

A more problematic aspect of section 101 for pharmaceuticals and biotechnology is the requirement that an invention have a practical utility at the time the application for a patent is filed. This is because applications for biological and pharmaceutical products are frequently filed before sufficient research has been done to indicate a particular therapeutic use for the product (as opposed to a wide range of possible uses). Guidelines for applying the utility requirement of section 101 were published in January of 2001[1] in the *Federal Register*. To be deemed useful under section 101, an invention must have a specific, substantial, and credible utility. The utility may be asserted by the inventor(s) in the application, or it may be readily apparent to one who is knowledgeable in the field of the invention (one skilled in the art) based on the nature of the invention and the knowledge in the art. The utility must be specific to the invention itself as opposed to being generally applicable to the class of the invention. For example, a newly discovered organic compound is not patentably useful if the only known utility is as a carbon source in animal feed.

What constitutes a substantial utility is still the subject of much debate. The US Supreme Court, in *Brenner v Manson*[2] upheld a Patent Office determination that a chemical process that produced a known product lacked utility because the product had no known use except, perhaps, as a subject of scientific research. In its decision, the Court stated the following test for utility:

"The basic *quid pro quo* contemplated by the Constitution and the Congress for granting a patent monopoly is the benefit derived by the public from an invention with substantial utility. Unless and until a process is refined and developed to this point—where specific benefit exists in currently available form—there is insufficient justification for permitting an applicant to engross what may prove to be a broad field."

The Court further wrote: "This is not to say…that we are blind to the prospect that what now seems without 'use' may tomorrow command the grateful attention of the public. But a patent is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion."

The USPTO utility guidelines adopted the Supreme Court's test requiring that a utility be substantial—have a real world use in currently available form—and specific. Recently, the Court of Appeals for the Federal Circuit (CAFC), a specialty federal court hearing patent appeals, used a similar standard when they upheld a USPTO decision that DNA fragments (specifically, expressed sequence tags or ESTs) representing fragments of genes with uncharacterized functions lacked specific and substantial utility.[3] With respect to substantial utility, the CAFC wrote: "to

satisfy the 'substantial' utility requirement, an asserted use must show that that claimed invention has a significant and presently available benefit to the public." Thus, an invention that is only useful as an object of further research, or in testing to determine what it is useful for, is not considered to have a substantial, currently available utility.

The final prong of the utility test as applied under the 2001 utility guidelines is that the utility be credible to one skilled in the technology that pertains to the invention. The assertion of at least one specific and substantial utility must be credible to one of ordinary skill in the art in view of the disclosure of the invention and any other evidence of record. Only one specific, substantial, and credible utility is required for a compound, composition, or article of manufacture to be patented, if all other statutory requirements are met. Once granted, the patent protects the compound, composition, or article of manufacture for any and all uses for the life of the patent.

Novelty and Unobviousness—Sections 102 and 103

Section 102[1] of Title 35 lays out the requirement for novelty and defines conditions that cause the inventor to lose the right to a patent. Specifically, Section 102 states the following:

A person shall be entitled to a patent unless —

1. the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
2. the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than 1 year prior to the date of the application for patent in the United States, or
3. the inventor has abandoned the invention, or
4. the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than 12 months before the filing of the application in the United States, or
5. the invention was described in—(a) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (b) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language; or
6. he did not himself invent the subject matter sought to be patented, or
7. (a) during the course of an interference conducted under section 135 or section 291, another inventor involved therein establishes, to the extent permitted in section 104, that before such person's invention thereof the invention was made by such other inventor and not abandoned, suppressed, or concealed, or (b) before such person's invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or concealed it. In determining priority of invention under this subsection, there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

Examples of conditions that prevent an applicant from being granted a patent are that "the invention" was known or used in this country before being invented by the applicant; that the invention was described in a printed publication in this country or a foreign country more than 1 year before the application was filed; or that the invention was in public use or on sale more than 1 year before the application was filed. When section 102 uses the term "the invention," it is referring to the invention as delineated in a claim, in all its particulars. To negate the patentability of claims under this section, the prior art reference or patent or other condition described in the section must include (anticipate) all of the limitations that define the invention in those claims. The novelty requirement can be used very effectively to limit a claimed invention to something approximating what the inventor actually did that advanced the technology. It is standard practice for inventors to claim their inventions with as few limitations as possible so that the claim will encompass many variations of the actual invention. For example, a new protein or peptide that is useful as an antigen may be claimed as "antigen X, comprising any 5 contiguous amino acids of the polypeptide of sequence number 1." This claim would be anticipated by any known protein or peptide that had any 5 contiguous amino acids in common with antigen X, even if the protein and antigen X shared nothing else in common. Generally speaking, determining whether a claimed invention is anticipated by the prior art under section 102 is relatively uncomplicated if the claim is interpreted correctly

as to its full breadth, and if the prior art is properly searched and is capable of being searched effectively.

Section 103 is most notable for its requirement that even if an invention is not identically disclosed and described in the prior art, and thus meets the criteria of section 102, it does not have a right to a patent if any differences between the claimed subject matter and the prior art are such that the claimed subject matter as a whole would be obvious to a person having ordinary skill in the art. This is the requirement that an invention be unobvious in view of the prior art, as well as new (ie, not identical).

The first clause of section 103 also includes a sentence that is frequently ignored, but is sometimes important. That is: "Patentability shall not be negatived by the manner in which the invention was made." In other words, how an invention is made (for example, by accident, or with the help of a machine or computer) may not affect whether or not an invention is patented, if it meets the statutory requirements for patentability. The current test for determining obviousness was set forth in a 1966 Supreme Court decision, *Graham v Deere*,[4] and involves the following considerations:

> Determine the scope and content of the prior art;
>
> Ascertain the differences between the prior art and the claims at issue;
>
> Resolve the level of ordinary skill in the art, and
>
> Evaluate any evidence of secondary considerations that may have relevancy as indicia of obviousness or nonobviousness.

Once this analysis has been completed, an examiner may find that the invention is *prima facie* obvious if (1) one or more references are available in the prior art disclosing the elements of the invention; (2) there is a suggestion or motivation to modify what is disclosed in a reference to bridge the gap between the reference and the claimed invention; (3) there is a reasonable expectation that making the modification would be successful; and (4) all of the limitations in the claim are taught by the one or more references. The motivation and the expectation of success must be based on the prior art and cannot be derived from the applicant's own specification. The motivation, however, need not be explicit in the prior art—it may be implicit in the teachings of the prior art or in the knowledge generally available to the person of ordinary skill in the art.

The elements required to build a *prima facie* case that an invention is obvious are designed to prevent the use of hindsight in determining obviousness. Many inventions appear to be extremely obvious once they are known, but without the insight of the person who actually made the invention, the connection that led to it may never have been achieved.

The requirements for showing that an invention is obvious have come under considerable scrutiny in recent years, with many individuals, organizations, and agencies opining that too many US patents are being granted on inventions that are obvious variations or improvements on prior art products or processes. Some of the controversy over this issue has been addressed (while this manuscript was in preparation) in the US Supreme Court decision, *KSR International Co v Teleflex Inc et al*,[5] which dealt with the obviousness analysis. It is too early to have fully analyzed the Supreme Court's decision, but it is clear that it makes the obviousness hurdle more difficult to overcome. Instead of needing a "motivation" or "suggestion" or "teaching" to bring elements in the prior art together to show obviousness, it is only necessary that an artisan of ordinary skill would have found a reason to bring the elements together. The reason could be that the artisan recognizes several possible solutions to a problem, any one of which would probably solve the problem or accomplish what the invention was intended to do. KSR also makes it clear that the problem to be solved by bringing 2 elements together does not have to be the one the inventor was trying to solve, so long as the result is the claimed invention. This decision will almost certainly make it somewhat more difficult to obtain a patent on an invention, although the degree to which it will affect patentability is not readily discernible at the moment.

Biotechnology has seen another controversy over what renders an invention obvious, particularly related to nucleic acids. Because much of the work involved in identifying and sequencing genes is routine, or even automated, many believe that a gene for a known protein should not be patented; it is an obvious extension of the prior art. The Court of Appeals for the Federal Circuit decided that structural obviousness was required to deny a patent on a biological macromolecule.[6,7] In other words, the actual structure of the molecule must be obvious from the prior art, and the patent cannot be denied because the prior art technology was used as a methodology for obtaining the molecule.

The concept that a molecule whose chemical structure is unknown before the inventor/applicant describes it may be an obvious invention because a general method of identifying such molecules is known would seem to contravene the section 103 proscription against the patentability of an invention being negatively affected by the manner of making it. In this aspect of patent law the United States has clearly separated itself from Europe in terms of the way it handles obviousness, or "inventive step" as it is referred to in the European Patent Office. Europeans view the use of well-known methodology to obtain a new product such as a gene, or cDNA that encodes a protein, as not providing an inventive step unless the isolation and sequencing of the new product could only be accomplished by overcoming a significant technical difficulty. Thus, from the European

perspective, a known rat gene encoding rat protein A may render the human gene for protein A obvious if the isolation and identification of the human gene were accomplished using known methods incorporating probes or primers from the rat sequence.

How obviousness is determined can have a significant influence on the overall effectiveness of the patent system. If patents are too easy to obtain for inventions that do not add to the progress of the "useful arts," the incentive for making significant advances is greatly reduced. On the other hand, if it becomes too difficult to obtain a patent except for inventions that are truly groundbreaking, then many useful and worthwhile advances may not be made or disclosed to the public in a way that permits them to add to the public store of knowledge.

Enablement and Written Description—Section 112

Section 112 details what the inventor is required to disclose so that the public is informed sufficiently with respect to what the invention is and how it is made and used. This is what inventors must give to justify the limited exclusive rights that will be granted them if their invention meets all the requirements for a patent. The first paragraph of section 112 states that the patent specification "shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention." The specification must describe the invention in sufficient detail to indicate that the inventor possessed the invention at the time the application for a patent was filed. It is not a requirement that the invention itself was made or performed, but the written description must clearly indicate that the inventor knew what the invented article or product is, or if the invention is a process, what steps are necessary and sufficient to carry out the process successfully. Separate from the written description requirement is the requirement for enabling a person skilled in the art to make and use the invention. This is referred to as the enablement requirement.

The second paragraph of section 112 requires that the specification conclude with at least one claim "particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." The claim defines the legal borders, or "metes and bounds," of the invention so that those working in the technology can know with reasonable certainty whether they are infringing upon the patented invention. When reading a patent, it is important to keep in mind that the patent permits its owners to exclude others from doing what fits within the invention as defined by the claim(s). Exclusivity does not cover everything that is described in the body of the specification. A good specification will explain the context of the invention, set forth what the inventor has done that is new, and paint a broad picture of all that the inventor conceives the invention may possibly encompass or apply to. For a peer-reviewed publication, a scientist is generally quite circumspect in describing the potential importance of what is being reported or extrapolating the findings to possible future applications. For a patent specification, the inventor is encouraged to do the opposite—that is to speculate freely about how the kernel of the invention may be expanded to cover any potential future use or application. The specification will then conclude with several claims, beginning usually with one that broadly protects everything the inventor conceived of, and followed by claims of decreasing scope that match closely with what the inventor may have actually done, or that evidence and knowledge in the art supports as capable of being done.

With pharmaceutical and biotechnology applications, it can be uniquely difficult to determine whether or not a specification teaches the public (that portion of the public skilled in the technology related to the invention) how to make and use the invention; that is, whether the specification adequately "enables" the invention. The difficulty stems from the unpredictability of biological systems, the fact that many of the applications disclose and claim therapeutics with huge earning potential, the desire to file applications early in the development process, and the practice of expanding limited findings to any and all potential future uses. Applicants need not include every detail about how their invention is made or how it should be used—the reader of the patent specification may be assumed to know information that is already well established in the art. Working examples or exact recipes detailing how to make and use the invention are not required, and, in fact, the invention does not have to have been made or done before filing the application for a patent. A general description of how the invention could be accomplished, so long as it is particular enough to guide the person skilled in the technology to create the invention without "undue" experimentation, is sufficient for the purposes of adequately enabling the invention. Although not well defined, "undue experimentation" can be understood as requiring imaginative or creative input such as applying techniques (new or borrowed) to a problem where the expectation of successfully achieving what the inventor achieved is low. Undue experimentation is not based on quantity of experimentation as much as it is on unpredictability of outcome.

As a result of these freedoms, patent specifications are filed with as little detail and evidence of what the inventor has actually accomplished as possible. Attorneys tend to view every detail that is disclosed about how to make and use the invention, and every clear description of a working

example, as an opportunity for the examiner, or the courts after a patent issues, to unduly narrow the claims so that the applicant receives narrower protection than that to which he or she is entitled. The only information that is included in applications directed to therapeutics in considerable quantity is background information aimed at linking the actual discovery made by the inventor to as many biological processes and therapeutic targets as can be found in the literature that might possibly relate to the inventor's finding.

The classic instance of what was not considered "undue" by the courts was *in re* Wands, 858 F2d 731, 8 USPQ2d 1400 (Fed Cir 1988), where the court held that making a monoclonal antibody to a particular antigen was a long and tedious process, but it was done by well-established techniques. The fact that any one colony of antibody-producing hybrid cells could not be predicted to make the appropriate antibody was offset by the fact that hundreds or thousands of different colonies could be prepared and screened to find the few that did make the desired antibody.

Pressure to file for a patent on the broadest possible range of subject matter and as early in the discovery process as can reasonably be accomplished is resulting in applications with little scientific evidence of specific functions. Instead, applicants provide speculations based on extensive extrapolation of the results that have been obtained. For example, a pharmaceutical scientist finds a new organic compound, X, that interacts with a polypeptide Y. The scientist has evidence that Y is part of a family of proteins that phosphorylate several other polypeptides thought to be involved in a variety of intracellular signaling mechanisms that ultimately lead to changes in gene expression. The actual function of Y within this family is unknown, but phosphorylation mediated by proteins of this family has been shown to occur in numerous tissue types and could potentially be involved in various abnormalities of the liver, kidneys, and brain, as well as diabetes, diabetes-related pathologies, lipid metabolism, and lipoprotein profiles. A specification is written describing the compound with positional substitutions that, if all were synthesized or even drawn out, would include a virtually incalculable number of additional compounds. Directions for synthesizing some of the compounds are also disclosed. Numerous scientific articles are cited and discussed that describe research implicating members of the Y family to various signaling pathways. This extensive background discussion is accompanied by statements that compound X and related compounds with the described substitutions may be used to treat, prevent, or ease the symptoms of liver disease, kidney disease, diabetes, diabetic retinopathy, atherosclerosis, stroke, heart attacks, depression, sexual dysfunction, and eating disorders. The specification also discloses that compound X or the related compounds may be given orally, parenterally, by inhalant, or by transdermal patch, in doses from 0.5 µg to 5000 mg, but preferably in a dose of 5 µg to 100 mg, and more preferably, in a dose of 500 µg to 50 mg. The application includes claims that vary in breadth from using any of the billions and billions of disclosed compounds to treat or prevent any or all of the conditions asserted to be affected by the compounds, to using one specific compound (or a small number of very structurally similar compounds) to treat (have at least a minimally therapeutic effect) one specific condition out of the wide variety that were said to be treatable. Once an application such as this is filed, the examiner must try to define what the inventor actually did, or conceived the invention to be, and then determine what portion of this list of claims may be sufficiently enabled to warrant a patent. To deny a patent on any part of the scope of the claimed invention, the examiner must find evidence or set forth convincing and clear scientific reasoning to support a *prima facie* case that that part of the claimed invention is not enabled.

The standard for written description has in recent years been deemed to be that the claimed invention must be described in such detail as to demonstrate to one of skill in the art that the inventor had possession of the invention at the time that the application was filed. For physical objects, the description must describe the structure of the object, or at least those portions of the structure that are necessary for the object to perform its useful function. In most technologies, determining the adequacy of the written description of an invention is straightforward, and usually aided significantly by drawings filed as part of the specification. Biotechnology and organic compounds introduce difficulties in written description at least in part because it is possible to technically describe with particularity far more variations on a specific structure than can actually be envisioned. For example, a DNA molecule can be described by a sequence of 2000 contiguous nucleotides in a specific order. An extremely large family of DNA molecules can be described by defining a set of DNA molecules with sequences that are at least 50% identical to the sequence of the first DNA molecule. Technically, every molecule that met that definition could be determined and listed, but can they actually be envisioned in any practical sense of the word? Applications have been filed with what are called Markush claims—claims that recite more than one form of an invention. These are prevalent in applications claiming organic compounds, and the total number of compounds that may be included in a single claim is effectively incalculable. A Markush claim is drafted with a basic structure, which may require several pages to depict, with substitutions at many or all positions as well as constituents at many or all of the core positions. Each substitution can be a variety of different moieties or atoms; each constituent can be a variety of different moieties, and each of those moieties can have substitutions and additional constituents, which can also be variable. The total number of possible molecules described by such a

claim becomes so large that it becomes clear that no one person or machine could envision all of the possible individual variants. Markush claims generally are taken to be adequately described, because in theory, every individual species could be written out. It is rare, however, that such a claim is granted. Often, the claims are rejected on the grounds that an individual of any level of skill in the art would readily recognize that the vast majority of claimed molecules could not perform the function intended by the inventor. The claims may then be amended to recite a much more defined set of compounds. When a claim is amended in such a way after the application is filed, the amended claim may not meet the written description requirement unless the specification as filed indicated that the inventor had envisioned the single species or the newly claimed small subset of molecules as being the molecules capable of performing the function of the invention.

Concluding Remarks

The USPTO is the gatekeeper for the patent system in this country. It is responsible for issuing patents that have been examined sufficiently with respect to the statutory requirements for patentability to carry a presumption that they are valid. When operating properly, the system should allow the parties that put effort and dollars into making technological advances to recoup their expenses and to profit from their efforts, without burdening the economy and population with unfairly asserted intellectual property rights. However, in recent years, applications and claims sets have expanded in size and complexity to a degree that strains the resources of the examination process. The USPTO now recognizes that it cannot unilaterally solve the problems created by more and larger applications, and it has begun to try to find ways to ask the applicants to share some of the burden by providing more focused applications that clearly tell the examiner what the inventor has done that advances the technology. Applicants are being asked to recognize that as long as they continue to ask examiners to undertake the job of identifying the heart of the invention from among the vast amount of information filed with the application, they will see degradation in the quality of examination and an increase in patents that should not be granted. When bad patents are issued, the fundamental ability of the patent system to promote the progress of the useful arts declines. It is time for all parties in the system to cooperate to make it work as well as it can and should.

References

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