

PATENT OR PERISH*

Devon Fanfair
Salil Desai
Christopher Kelty

This work is produced by OpenStax-CNX and licensed under the
Creative Commons Attribution License 2.0[†]

Abstract

A brief overview of patent law and its controversies and uses in nanotechnology

NOTE: "This module was developed as part of a Rice University Class called "Nanotechnology: Content and Context"¹ " initially funded by the National Science Foundation under Grant No. EEC-0407237. It was conceived, researched, written and edited by students in the Fall 2005 version of the class, and reviewed by participating professors."

1 Introduction

Nanotechnology is one of the newest and fastest growing scientific fields in today's world. As many new ideas and applications come along, there is an overwhelming need for numerous patents. Since nanotechnology poses such great potential for technological advancement and therefore tremendous financial gains, patents in this field become especially important. A patent is defined as a public document that demonstrates the use of a new product or process and that consequently gives the patentee exclusive rights to the development and profit of his or her invention.[1]

The three basic types of patents are:

- Utility Patents: A patent for the function of an invention. For example, a patent on a mousetrap.
- Design Patents: A patent for the non-functional characteristics of an invention. For example, a patent on a specific design of jewelry.
- Plant Patents: A patent for an asexually reproducible plant.[2]

Additionally, there are four basic requirements for patent law. First, it must be a novel idea. Next, it must be a non-obvious idea. Thirdly, the patent must have a practical purpose or a marketable application. And last, the patent must be described in such a way that it can be interpreted and used by a person skilled in the particular field (i.e. nanotechnology).[3]

To protect the inventor, the patent systems in the United States and other countries allow the patentee to take action against infringers through civil lawsuits. The definition of infringement in the United States is defined in the case of *Wolverine World Wide, Inc. v. Nike, Inc.*:

"[F]or a court to find infringement, the plaintiff must show the presence of every element or its substantial equivalent in the accused device." [4]

*Version 1.1: May 7, 2007 2:01 pm +0000

[†]<http://creativecommons.org/licenses/by/2.0/>

¹<http://frazer.rice.edu/nanotech>

2 Why are Patents Important?

The United States has a patenting system to allow inventors, ranging from corporations to universities, to get a guarantee of a return on their investment for their research. Without this, capitalism, the driving force of our entire country, could not flourish because inventors would not be able to secure their ability to profit from their invention. For example, in the case of a pharmaceutical company, investors will put in billions of dollars into research for new drugs over a long period of time (often a decade or more). They are willing to do this on the assumption that they can obtain a patent which will allow them to obtain revenues as the sole distributor of that product. In addition, patents are also important tools for university researchers and their institution to receive prestige and recognition. For example, Dr. Richard Smalley, a professor at Rice University in the chemistry department, obtained patent number 5227038 for his discovery of the fullerene- more commonly known as the Buckyball- a third form of carbon.[5] First, with this patent, Dr. Smalley and Rice University became known world wide. This recognition included a Nobel Prize for Smalley as well as large government contracts and grants for the school. Second, with this patent, future possibilities of earnings-via royalties-were opened up for the school and thus leads to further research.

3 Criticism of the Patent System

The major criticism of the patent system lies in the apparent creation of a monopoly. When an inventor is granted exclusive economic control of his invention, competition is hindered. As a result, this stifles capitalism and also provides an expensive but lower quality product.[6]

Secondly, a concept known as the "tragedy of the anticommons" presents a deeper problem in patenting. This theory was established by Michael Heller and Rebecca Eisenberg in a 1998 publication of "Science." [7] In essence, their paper stated that innovations to patented inventions would be hindered due to the additional costs of respecting royalties from the original patent. As a result, the societal benefits due to innovations of current products would be inhibited.[8]



The United States

To all to whom these Presents shall come. Greeting.

Whereas Samuel Hopkins of the City of Philadelphia and State of Pennsylvania hath discovered an Improvement, not known or used before, such Discovery, in the making of Pot ash and Pearl ash by new Apparatus and Process, that is to say, in the making of Pearl ash 1st by burning the raw Ashes in a Furnace, 2^d by digesting and boiling them when so burnt in Water, 3^d by drawing off and setting the ley, and 4th by boiling the ley into Salts which then are the true Pearl ash, and also in the making of Pot ash by fusing the Pearl ash so made as aforesaid, which Operation of burning the raw Ashes in a Furnace, preparatory to their Digestion and boiling in Water, is new, because Little Oxidum; and produces a much greater Quantity of Salt: There be therefore in pursuance of the Act, entitled "An Act to promote the Progress of useful Arts", to grant to the said Samuel Hopkins, his Heirs, Administrators and Assigns, for the Term of fourteen Years, the sole and exclusive Right and Liberty of using and vending to others the said Discovery, of burning the raw Ashes previous to their being digested and boiled in Water, according to the true Intent and meaning of the Act aforesaid. In Testimony whereof I have caused these Letters to be made patent, and the Seal of the United States to be hereunto affixed Given under my Hand at the City of New York this thirty first Day of July in the Year of our Lord one thousand seven hundred & Ninety.

G. Washington

City of New York July 31st 1790.

I do hereby certify that the foregoing Letters patent were delivered to me in pursuance of the Act, entitled "An Act to promote the Progress of useful Arts"; that I have examined the same and find them conformable to the said Act.

Edm: Randolph Attorney General for the United States.

Figure 1: Figure 1: First patent issued by United States [10]

4 History of Patents: From Ancient Greece to Nanotechnology

"Before [the adoption of the United States Constitution], any man might instantly use what another had invented; so that the inventor had no special advantage from his own invention. The patent system changed this; secured to the inventor, for a limited time, the exclusive use of his invention; and thereby added the fuel of interest to the fire of genius, in the discovery and production of new and useful things."-Abraham Lincoln, Second lecture on discoveries and inventions, February 11, 1859

Patenting has a very lengthy history; this tradition began in a rudimentary form in ancient Greek cities. However, it was not until 15th century Venice that patents in today's sense were issued. This Venetian law was defined as the Venetian Statute of 1474 and called for an invention's "legal protection against potential infringers." [9] Over time, patenting evolved throughout Europe. In the United Kingdom, for example, the King or Queen was given the executive power to issue "letters patent" that awarded certain people monopolies over specific goods or services. Then, in 1790, a revolutionary breakthrough in the patenting process occurred when the United States established the Patent Commission of the U.S. The first patent (Figure 1) was awarded by this commission in this same year. [11] The most important facet of this patent system was that it recognized by law that an inventor had an "intrinsic" right to make money off of his or her discovery. Previously, this right was not intrinsic but rather individually given by a monarchical power. [12] Our founding fathers created this specific system to allow capitalism, the backbone of America, to flourish.

This important distinction in the United States patent system is depicted in Article I, Section 8 of the Constitution:

"Congress shall have the 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."

Over time, after several amendments to the original Patent Commission, the United States Patent Office was officially created in 1802. From this point, hundreds of thousands of patents were given out over the course of the next two centuries.[13]

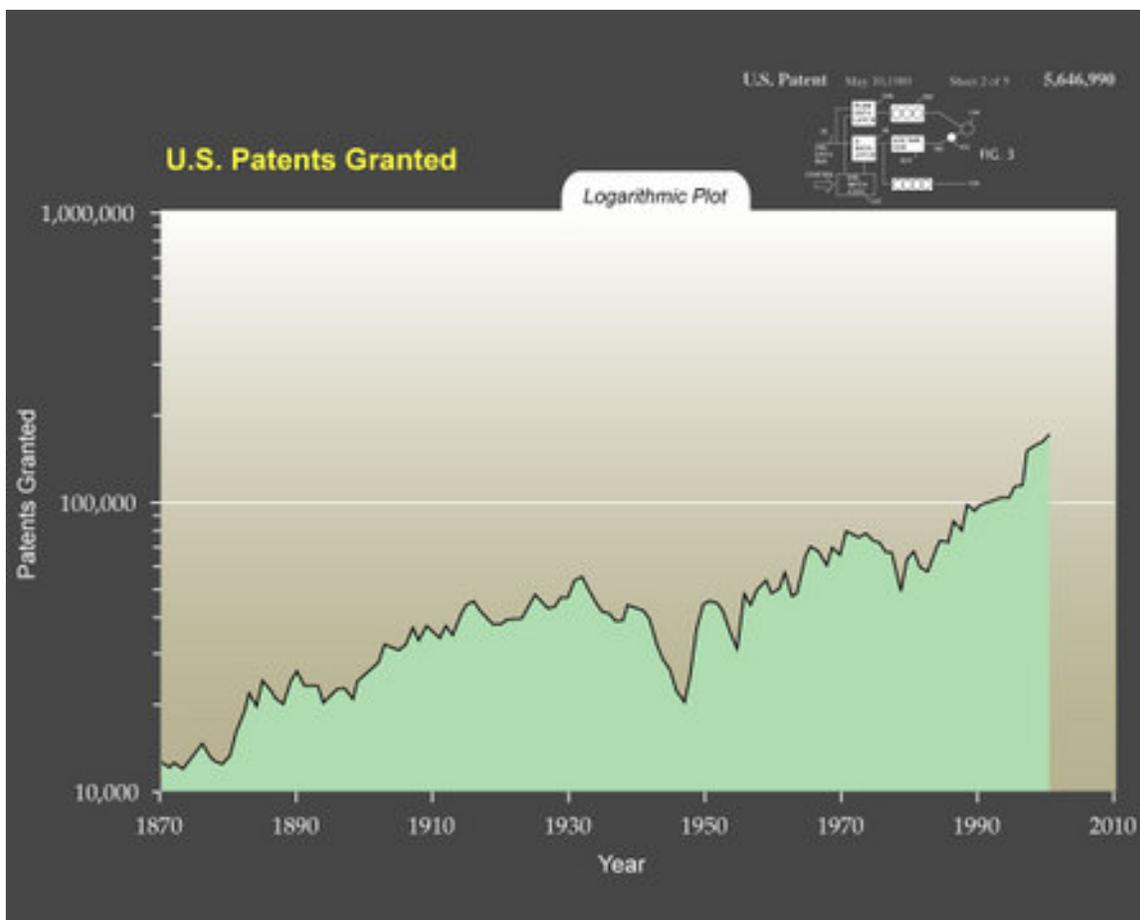


Figure 2: Graph of the number of patents granted from 1870 to 2005 [14]

Additionally, a second patenting breakthrough occurred in the United States after World War II. Vannevar Bush, a leading government researcher, realized the importance of government funded research for national defense. Expanding on this idea, Bush recognized that university research could also be used in non-war time to enhance the economy, through the transfer of knowledge from basic science to industrial production. Consequently, he believed that the government should fund these university projects. This belief was put into practice by the foundation of the National Science Foundation and other similar organizations. Nevertheless, up until the 1960's, there was limited success in the transfer of basic research discoveries into economic results due to patenting problems. Because of the inconsistencies in the policies and practices of government

agencies, very little of the discoveries made in basic scientific research were transferred to the private sector. Statistically, in 1980, out of the 28,000 patents titled by the federal government, less than 5% were directed towards commercial products that would benefit the public directly. [15]

In 1980, the United States government, in order to solve this problem, decided that a policy was needed which allowed universities to obtain ownership over certain inventions (direct involvement in commercialization). As a result, this policy would theoretically stimulate the United State's economy due to an influx in the licensing and commercialization of new inventions. This policy was officially implemented as the Bayh-Dole Act, which allowed and, to an extent, encouraged colleges and universities to begin developing and strengthening the research needed to proceed in the patenting of useful inventions.[16]

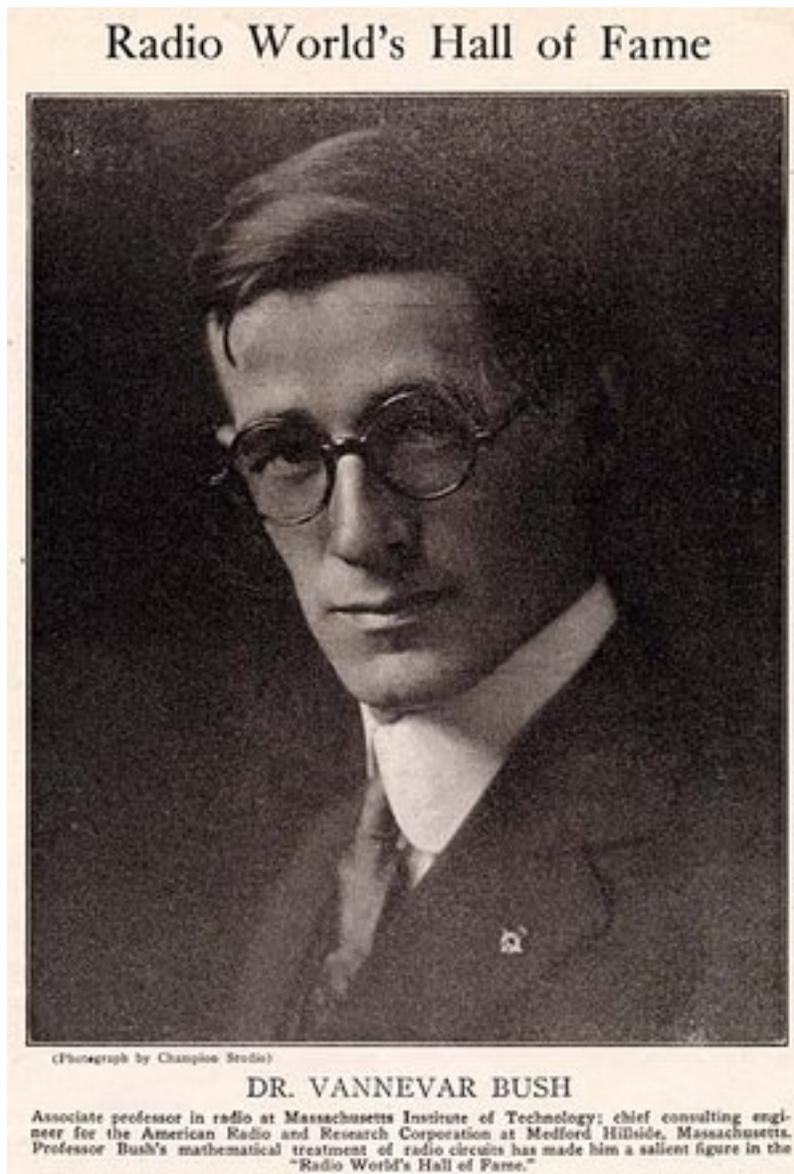


Figure 3: Vannevar Bush [19]

Prior to the decision of passing this act, there was considerable debate about this issue. Many feared that such a policy of exclusive licenses would lead to monopolies and higher prices. Furthermore, people saw problems in areas ranging from foreign industries getting too much benefit from the act to whether the act fostered anti-competitiveness. However, this drastic concern for the act led to increased debate and modifications that strengthened the future benefit of the measure.[17]

Ultimately, it can be concluded that the Bayh-Dole act drastically increased the transfer of technology from research into industry. Today, the positive effect of the Bayh-Dole act is evident in the miraculous

advances in the medical, engineering, chemical, and computing fields. Hence, the Bayh-Dole act is an integral part of nationally funded scientific research. Today, there exist more than 5 million patents given by the United States Patent and Trademark Office. [18]

5 Patents and the World

In an increasingly globalized and economically interconnected world, the importance of patents across borders has become an important issue in recent years. Patents and patent law often come into dispute on the international level for two main reasons. Most countries have some form of patent laws and agencies but all differ, some drastically, in how they define a patent, what it can be filed for, and the degree that other countries' patents are accepted. Hence, the first main issue of this dispute comes from whether a patent made in one country is viable in another. The second issue arises when one country's laws and dealings come into conflict with another; a problem that requires international mediation.

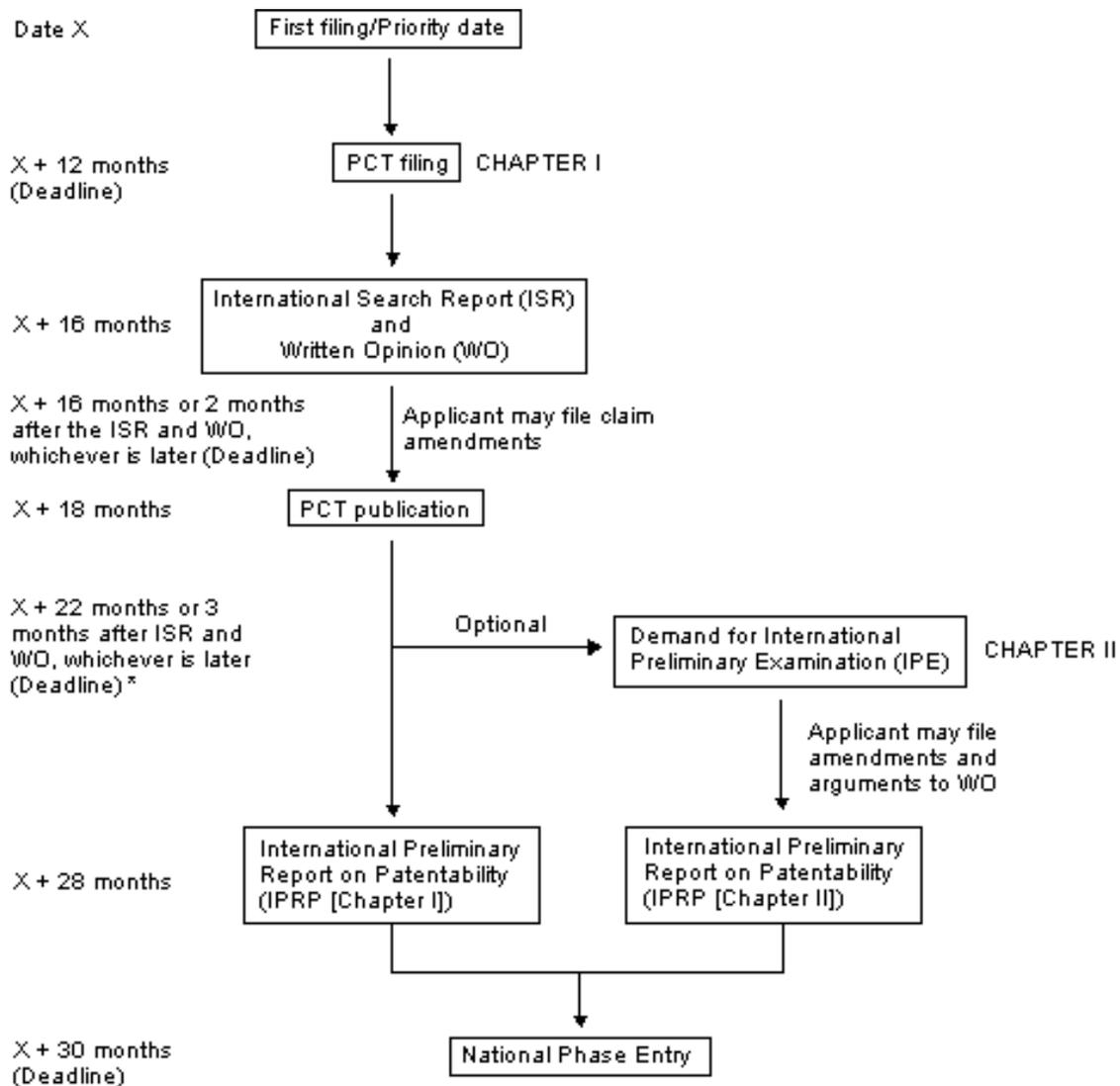


Figure 4: National application process through WIPO [21]

When one gets a patent they would usually have to apply and obey procedures (and pay the fees) required by each of the countries' patent laws. Due to the difficulty of applying for patents in dozens of countries, many treaties have been created to make the process more feasible. The first such recorded treaty came out of the Paris Convention of 1883, which simply established that all the countries that were part of the Paris Convention would accept the filing date of a patent originating in any one country. However, this still

left the problem of going through the procedures of each country. The Patent Cooperation Treaty (PCT) attempted to streamline various national procedures into a single national application process (Figure 4) through the World Intellectual Property Organization (WIPO).[20] This system has eased this first issue substantially, though there is still a great deal of asymmetry in countries' patent law.

The second problem creates even more contention. How does the international community enforce patent rights and laws? What 'body' should deal with mediating disputes? Should one country be able to affect another country's patent laws? How? Major international disputes have put these questions into sharp focus. For example, a recent patent bill proposed in India would prevent the production of generic (cheaper copies of brand name products) alternatives to larger company drugs. This would pose a large problem for many African countries because the bill would prevent Indian firms from selling anti-viral drugs. These integral drugs would be used to fight the AIDS virus, which continues to be a rampant problem in this area of the world. The new patent would drastically increase prices and therefore affect the treatment of millions of people infected with HIV in Africa.[22] Should African countries have a say in Indian patent law? What kind of judicial body should deal with the dispute? The Hague Conference on Private International suggested judicial solutions, but none have yet to be satisfactorily initiated.

Ultimately, international relations and patents now rest in any uneasy partnership of treaties that deal with increasing numbers of international patenting.

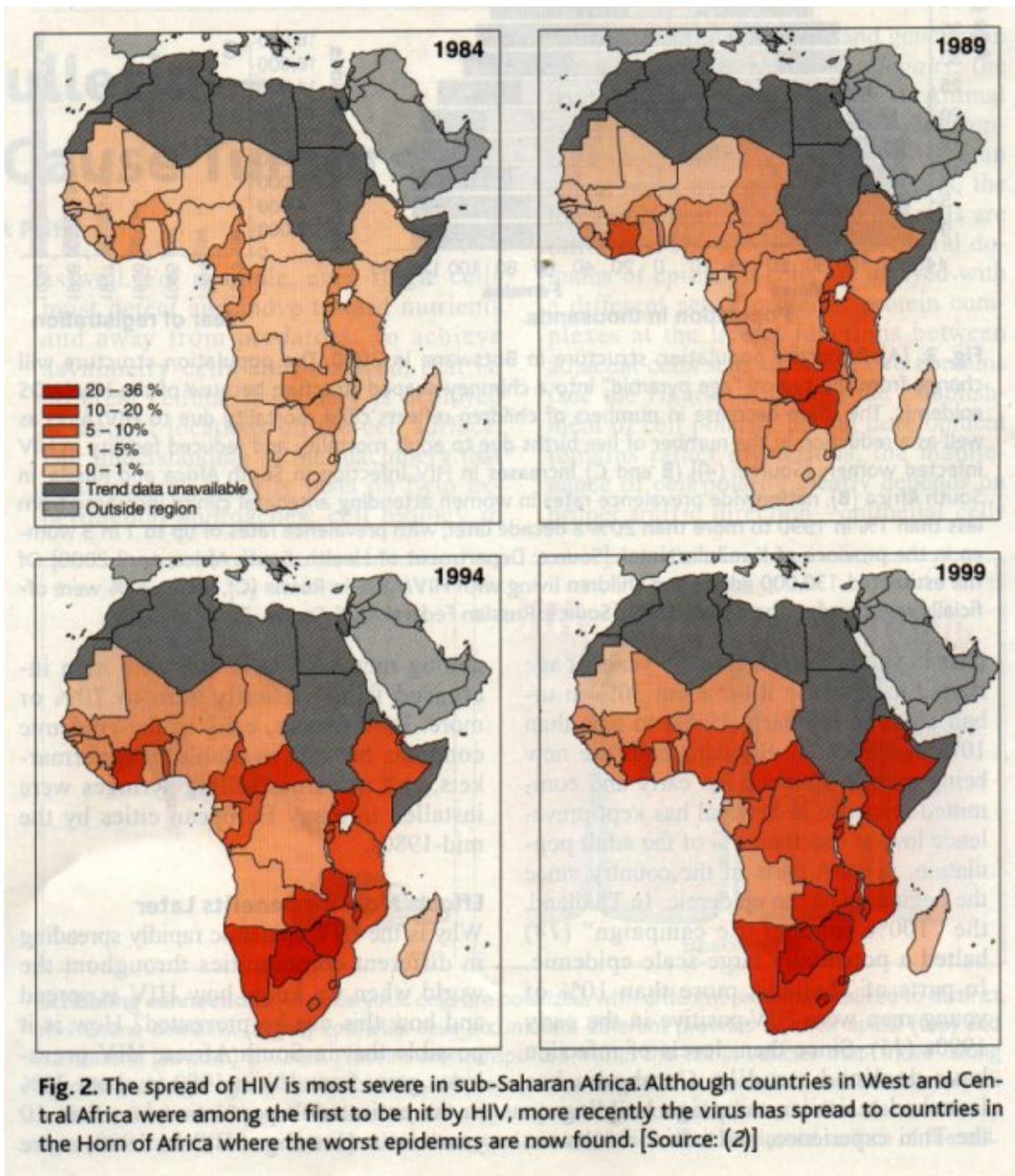


Figure 5: AIDS population distribution, 2000. [23]

6 Are Ideas Patentable?



Figure 6: "We got our patent for 'alternating diaphragm contraction and relaxation effecting pulmonary uptake and exhaust'. Now whenever anybody breathes, we collect a royalty."

The constitution states that "inventions" can be patented to protect the inventor's right to make a profit over his or her discovery. Mere ideas that do not have any concrete commercial function cannot be patented. However, in modern science, including the field of nanotechnology, the line between an invention and an idea has become blurred. For example, in the field of genetic research, certain genes have been patented by researchers. In some cases, researchers have identified both the sequence and the specific function of a gene, which they are trying to patent. However, if a researcher merely discovers a novel gene without knowing the possible commercial uses of it, will the gene still be patentable? It is relatively easy to discover a multitude of novel genes; however it is quite difficult to establish a commercial use for it. Hence, this issue is highly controversial and parallels the problems in the "patentability of ideas." An idea, like a gene, is very easy to create. While some researchers can supplant an idea with a concrete commercial purpose in today's world, others simply "discover" the idea. To come up with an idea, just like identifying a gene, is relatively easy, whereas to define a tangible function for the idea/gene is considerably difficult. For example, any average Joe can create an idea for a futuristic hover car but it would take a large research team and a couple "Albert Einsteins" to make one. Thus, where can we draw the line when it comes to this issue? Are all genes patentable even if a researcher can not demonstrate its use? Similarly, are all ideas patentable even if an inventor can not physically demonstrate its use? Will the patenting of ideas and genes monetarily hinder research that will help establish their specific commercial function?[24] All of these questions demonstrate the inherent problems between modern scientific research and patents.[25] This crisis must be sorted out for research to truly continue. As a result, the United States government and the USPTO are still trying to work with scientists and researchers to resolve this problem in the case of genetic research. Currently, this problem, however, has yet to be solved and there is still great deliberation about this in both the scientific community and the government.[26]

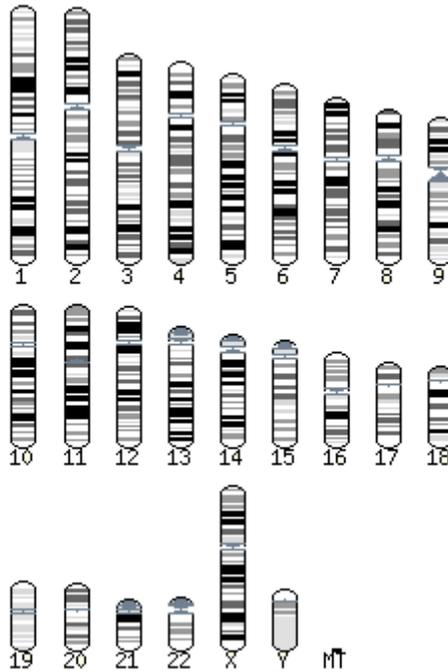


Figure 7: Figure 6: Human Genome Karyotype.[27]

Furthermore, if the government allows a researcher to scan the human genome (easy process) and hypothetically patent hundreds of vital genes, then, similarly, one can argue that hundreds of feasible ideas can be patented even if their commercial function is not physically defined. If this is possible, then what does patenting an idea entail? Will the patentee get royalties every time someone researches a way to convert their idea into a usable product? Or will it go so far as a patentee will collect royalties every time someone merely thinks about their idea? Obviously, a fine line must be drawn by the USPTO in order to prevent this scenario from getting out of hand. Hence, due to the hypothetical nature of modern scientific research in genetics and nanotechnology, this "fine line" is necessary for an orderly and efficient transfer of technology from research to commercial products. Ultimately, as soon as this feat is accomplished, society will benefit as a whole.

7 Nanotechnology and Patenting

Because of its place on the frontier of modern scientific research, nanotechnology is a field that is and will be constantly affected by the patenting system of both the United States and the world. First, due to the wide variety of applications of nanotechnology, both corporations and universities are becoming more and more involved with this field. As a result, the capitalism of nanotech corporations is protected by the patent system, while patents from government-funded research by universities are protected by the Bayh-Dole Act of 1980. Hence the core of nanotech research is intertwined with the United States patent system. In addition, due to the nature of nanotechnology (and genetic research-see "Are Ideas Patentable?"), considerable research is done on hypothetical applications that, at the present time, have no physical commercial function. As a result, the "patentability of ideas" is an important issue in nanotechnology. Thus the USPTO's ability to

resolve this issue is integral to modern research in this field.

Further complications in patenting nanotech inventions result from the nature of the technology. Some of these problems have been resolved. First, the USPTO has established official guidelines for simply defining the field (See "Useful Links"). Second, three basic areas for nanotech patenting have been defined as well. Ultimately, as in genetic engineering, the USPTO and other international patenting offices must adjust and adapt to the onset of a new type of modern scientific research in the field of nanotechnology.

8 Discussion Questions

1. Explain how a patent system in one country can greatly affect other countries around the world. How do you think this problem should be solved? Can it be?
2. Analyze the relationship between the patentability of genes and the patentability of the ideas. What are the similarities? What are the differences?
3. If you were a senator, how would you vote in a decision on patenting genes? Would you be for or against it? Why?
4. How did the Bayh-Dole Act allow Dr. Smalley to patent his discovery of the Buckyball? What would have happened if he discovered it prior to 1980?

9 References

- [1] Wikipedia, "Patent." <http://en.wikipedia.org/wiki/Patent>
- [2] Dean A. Craine, "Types of Patent Applications., Patents, <<http://www.nwpatents.com/fti04.html>>
- [3] Steven Crespi, "Patenting for the research scientist: an update, Biotechnology, Volume 22, Issue 12 , December 2004, Pages 638-642<<http://www.sciencedirect.com/>>
- [4] Wikipedia, "Patent Infringement," <http://en.wikipedia.org/wiki/Patent_infringement>:
- [5] USPTO. <<http://www.uspto.gov/>>
- [6] Ibid., Wikipedia, "Patent."
- [7] Michael A. Heller and Rebecca S. Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research," Science, Vol 280, Issue 5364, 698-701 , 1 May 1998 <<http://www.sciencemag.org/cgi/content/full/280/5>>
- [8] Ibid., Wikipedia, "Patent."
- [9] Ibid., Wikipedia, "Patent."
- [10] Ibid., USPTO.
- [11] Ibid., Wikipedia, "Patent."
- [12] Ideafinder, "Patent Information." <<http://www.ideafinder.com/resource/features/rpp-tn.htm>>
- [13] Ibid., Ideafinder.
- [14] Ibid., Wikipedia, "Patent."
- [15] Univ. of California Office of the President, "The Bayh-Dole Act." <<http://www.ucop.edu/ott/bayh.html#Results>>
- [16] Ibid., UCOP.
- [17] Ibid., UCOP.
- [18] Ibid., UCOP.
- [19] Wikipedia, "Vannevar Bush," <http://en.wikipedia.org/wiki/Vannevar_Bush>
- [20] Michael Caine, "Why and how the PCT is used—Advantages and Problems," Intellectual Federation of Intellectual Property Attorneys. <www.ficpi.org/library/NICE/caine.doc>
- [21] Canadian Bacterial Disease Network, "Patents: an Overview." <http://www.cbdn.ca/english/ip_primer/Web/Patent>
- [22] Marta Sender, "Availability of cheap HIV-AIDS drugs threatened by Indian Patent Law." <<http://www.news-medical.net/?id+8591>> 21 March 2005
- [23] Schwartlander et al., Science, 2000, 289:6423 Univ. of Maryland School of Pharmacy, "HIV Figures," <http://www.pharmacy.umaryland.edu/courses/PHAR531/lectures_old/fig/hiv_fig_all.html>
- [24] Oak Ridge National Laboratory, "Genetics and Patenting," <http://www.ornl.gov/sci/techresources/Human_Genom>
- [25] See also "Criticism of the Patent System" and the "tragedy of the anticommons."

[26] Ibid., ORNL.

[27] Ensembl, "Human (Homo Sapiens)," <http://www.ensembl.org/Homo_sapiens/index.html>