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Technology Transfer at the National Institutes of Health

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3.1
Introduction

The National Institutes of Health (NIH) as an agency within the Department of Health and Human Services leads the US Government's support for biomedical research and training. The NIH is composed of 27 Institutes and Centers with more than 18 000 employees, and a fiscal year (FY) 2006 budget of US$ 28.6 billion.[1)] Its mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems, and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. Just under 10% of the budget funds the research conducted at the NIH (the intramural program) and just over 80% of the budget funds researchers outside the NIH, mostly at universities and hospitals in the United States but worldwide (the extramural program). It is estimated that NIH provides nearly 60% of US biomedical funding to US universities.[2)] As the largest funding institution for biomedical research, the policies developed by the NIH to guide the conduct and management of NIH-funded research have a leading role in steering the activities of the biomedical research community.

Researchers funded by NIH, in both the clinical and basic research sciences, produce important new research findings, research materials and databases, advances in clinical care, and inventive technologies. The process of disseminating these results for the further advancement of science and, as necessary, the commercialization of technologies to meet public health needs may be considered under the broad umbrella of technology transfer. In this sense, technology transfer is not at all a new phenomenon. However, the manner in which such technologies are transferred, the role of the patenting and licensing of inventions, and the degree of commercial collaboration with academic and Government laboratories in this process has changed enormously in the last 25 years.

1) www.nih.gov.
2) http://www.nsf.gov/statistics/infbrief/nsf08320/.

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This chapter will review the laws, regulations and policies that apply to the transfer of technologies from NIH-funded research, particularly the dissemination of research results, unique materials, and inventions. The authors will share perspectives on technology transfer policies and procedures that emanate from the experience of the NIH in its own technology transfer efforts. In addition, the discussion will include policy issues that have garnered the most attention and debate in recent years in the context of global public health challenges.

3.2 Technology Transfer Legislation

The transfer of technology from universities and Government laboratories is by no means a new phenomenon. However, decades ago, such activities were far more common in the physical sciences and engineering, which had more direct applications to industrial needs.[3] To the extent it occurred in the biomedical sciences, it usually involved diffusion of technologies through public disclosure rather than an active engagement or direct collaboration with the private sector of the research institutions with the commercial sector. However, some technologies, such as the polio vaccine, warfarin and cisplatin, invented before the 1980s were effectively transferred to industry. Prior to 1980, some agencies entered into Institutional Patent Agreements (IPAs) with individual universities to allow them to hold title to and license their inventions. While IPAs encouraged technology transfer, they created a system of unequal treatment of funding recipients sometimes with different, even conflicting, terms between different agencies and the same university.

All of this changed with the passage of the Patent and Trademark Amendments of 1980 (the Bayh–Dole Act)[4] and the Stevenson–Wydler Technology Innovation Act of 1980,[5] which established the modern era of technology transfer for extramural recipients of Government funding and intramural Government laboratories, respectively.[6] The intent of Congress was to promote US global economic competitiveness by addressing the lack of commercial uptake of Government-funded technology. The statutes provide incentives to research institutions to transfer inventive technology to the private sector for commercial R&D. In particular, the Bayh–Dole Act established a uniform patent policy for recipients of Government funding in granting them the right to elect title to inventions made under Federal grants and contracts.[7] This statute also strengthened the US

3) Rosenberg, N. and Nelson, R.R. (1994) American universities and technical advance in industry. *Research Policy*, **23**, 323–348.
4) Public Law 96-517. Although this statute only applies to non-profit and small business recipients of Government funding, President Regan extended it to large businesses under Executive Order 12591.
5) Public Law 96-480.
6) However, Federal laboratories were not given the right to enter into certain cooperative agreements with companies (see Footnote 14), retain royalties within their agency and provide the inventors with a share of the royalties until the enactment of the Federal Technology Transfer Act of 1986. Public Law 99-502.

patent system by consolidating eleven different appellate courts with jurisdiction to hear patent cases into one court – the Court of Appeals for the Federal Circuit. The expectation was that ultimately the US consumer would benefit with new products, new jobs and a more robust economy.

In exchange for the right to manage their intellectual property (IP) rights and keeping any royalties they earn, the funding recipients must favor small US businesses in their licensing efforts,[8] grant the Government a right to use the intellectual property 'for and on behalf of the US Government' worldwide on a royalty-free, non-exclusive basis,[9] i.e. a Government use license, require that licensees who manufacture a product for the US market manufacture the product substantially in the United States[10] and share some of the royalties with the inventors.[11] The Government also has the right to initiate 'march-in' proceedings under certain circumstances such as when the owner or the licensee of the patent is not bringing or does not have adequate plans to bring the technology to commercial application.[12] In addition, non-profit institutions cannot assign Bayh–Dole inventions to third parties without permission of the funding agency, except for an assignment to an organization that manages inventions as one of its primary functions.[13]

Congress has amended these statutes over time without substantial alternations in their structure, but has granted additional authorities to Government laboratories to conduct collaborative research under Cooperative Research and Development Agreements (CRADAs). Under this mechanism, the collaborating party and the Government laboratory can exchange personnel and materials, the collaborator can provide funds to but not receive funds from the Government[14] and the collaborator is offered an exclusive option to license inventions made by Government investigators in performance of the CRADA.[15]

7) The statute defines a subject invention as one which was conceived or actually reduced to practice in performance of the funding agreement. Note that the statute using the term 'contract' to refer to any research funding agreement, including grants, cooperative agreements and Government contracts under the Code of Federal Acquisitions, but excludes from these provisions other types of funding such as training grants. See 35 USC §201.
8) 35 USC §202(c)(7)(D), where 'small business' is defined as not having more than 500 employees. Small businesses, constituting the bulk of the workforce, were seen as engines of economic development.
9) 35 USC §202(c)(4).
10) 25 USC §204, with provision for a waiver process by the agency that funded the invention.
11) 35 USC §202(c)(7)(B). Note that Bayh–Dole does not set any particular amount to be shared with the inventors, whereas Federal agencies must share the first US$ 2000 and at least 15% of royalty income thereafter under a particular license with a cap per year of US$ 150 000 per person in total. 15 USC §3710c(a). Under NIH policy, its inventors share the first US$ 2000, 25% of the amount received above US$ 2000 up to US$ 50 000 and then 25% of amounts received thereafter in a given year.
12) 35 USC §203.
13) 35 USC §202(c)(7)(A).
14) Note that this is one of only four ways most agencies can receive funds, the others being Congressional appropriations, royalties from licenses and gifts funds, which can be restricted by the donor to a particular purpose, but not solicited by the Government agency nor accepted with any *quid pro quo* to the donor.
15) 15 USC §3710a.

Federal agencies exercise similar licensing authorities for inventions made by their scientists except that Federal agencies must limit exclusive licensing of inventions to those where such an incentive is needed for the licensee to invest the necessary capital to bring it to market. In addition, the scope of exclusivity is to be narrowly tailored to provide no more than the incentive necessary for the licensee to bring the invention to practical application.[16] Before a Federal agency can grant an exclusive or partially exclusive license, except for CRADA subject inventions, the agency must give public notice of the intention to grant the license and consider comments that are submitted in response to the notice.[17] All licensees must submit a development and marketing plan for the invention.[18] NIH uses this plan in part to develop the due diligence and performance milestones under a license, particularly for exclusive commercial licenses.

3.3
Impact of Bayh–Dole and Stevenson–Wydler Acts

Universities, Government agencies, and the business community by and large consider the Bayh–Dole and Stevenson–Wydler Acts to have been a great success in meeting the stated goals to enhance the transfer of technology to the private sector for commercialization. In 2002, *The Economist* concluded that Bayh–Dole was 'perhaps the most inspired piece of legislation to be enacted in America over the past half-century'.[19] Prior to Bayh–Dole, 28 000 patents resulting from Government-funded research were issued with very few licensed for commercialization. In 1980, US universities received less than 250 patents, but in 2004 they received 3800. More than 3100 products have reached the market since 1998 that result at least in part from university-licensed technologies. Since 1980, US universities have spun out more than 4500 companies, with two-thirds of these operating in 2004.[20]

At the NIH, technology transfer activities have grown significantly in the last 15 years. Royalty income has risen from several million dollars annually to US$ 97 million in FY 2008. The number of licenses executed annually has risen from 160 in FY 1995 to 259 in FY 2008. The portfolio includes about 3500 issued and pending patents, and over 1300 active licenses. Since 1987, over 400 NIH licenced products have reached market. While most of these are research reagents, 25 are FDA approved products, 17 are veterinary vaccines and one is a veterinary drug. These licensees have reported US$45 billion in sales from these products, with US$6 billion in 2007.

16) 35 USC §209.
17) 35 USC §209(e).
18) 35 USC §209(f).
19) *The Economist*, 14 December 2002 (US edn). There have been those who disagree or point out some of what they perceive as flaws. See 'Bayhing for blood or Doling out cash?, *The Economist*, 21 December 2005. Some of these articles are not completely accurate or neglect to include key facts. See www.autm.net. To the extent some of the problems are manifest, they represent the actions of a few institutions and not the technology transfer community as a whole.
20) AUTM Annual Survey 2004. www.autm.net.

3.4
Growth of Technology Transfer in Government and Academic Laboratories

A number of factors led to the expansive growth of the biotechnology sector in the 1980s. The legislative history and committee hearings prior to the passage of the Bayh–Dole and Stevenson–Wydler Acts suggest that Congress was most concerned with enhancing the economic competitiveness of United States in industries where it saw the technological lead slipping to countries like Japan and West Germany, namely those relying upon the physical sciences and engineering.[21] However, at the same time, the biotechnology revolution was giving birth to an entirely new industry. This entrepreneurial sector arose out of academia as distinct from traditional pharmaceutical companies, which produced small-molecule drugs and biologics processed from natural sources, including vaccines and proteins such as insulin and clotting factor. Ironically, prior to the passage of the Bayh–Dole Act, Drs Cohen and Boyer invented their recombinant DNA technology with funding from the NIH. The patent issued on 2 December 1980, shortly after the passage of Bayh–Dole.[22] Also supporting the development of the biotechnology industry was a decision of the US Supreme Court in 1980 that a genetically engineered bacterium was patentable subject matter.[23]

With the arrival of gene-splicing technology, researchers in the biomedical sciences found the more immediate results of their bench-top experiments of far greater commercial interest than ever before. Rather than being limited to their traditional role of laying the foundation for industrial drug design by elucidating the mechanisms of a biological function, biologist were now able to create genetically engineered microorganisms that could, e.g., produce commercially valuable proteins. Bayh–Dole and Stevenson–Wydler enhanced the importance of academic and Government research by providing institutions with new incentives and clear mechanisms to hold title to inventions, obtain patent protection, and the ability to use tools such as royalty-bearing licenses to exploit the commercial potential of new technologies (in this case, for public health benefit). It took several years before many public research organizations (PROs) would establish distinct technology transfer functions to capture technologies arising out of Government-funded research. The NIH itself initially managed patenting of inventions through the Office of General Council, moving this function over to the newly created Office of Technology Transfer in 1989.[24]

21) 1980 *US Code Congressional and Administrative News* (94 Stat. 2311), 4893; 1980 *US Code Congressional and Administrative News* (94 Stat. 3015), 6460.
22) US Patent 4237224.
23) *Diamond v. Chakrabarty*, 447 US §303 (1980).
24) The House Committee on Energy and Commerce, concerned with 'how to blend accelerated transfer with informed transfer', requested the Office of Technical Assessment to study technology transfer and assessment activities at the NIH. The report published in March 1982 focuses on the broader scope of technology transfer, primarily clinical trials and training to 'transfer research findings to the health care delivery system'. Only cursory mention is made to patents and licensing to industry in the comment that 'NIH is quite active in this regard, with approximately 370 patents licensed to industry'. OTA (1982) *Technology Transfer at the National Institutes of Health, A Technology Memorandum*, Congress of the United States, Office of Technology Assessment, Washington, DC, March, p. 52.

By the late 1980s, Bayh–Dole was hailed as a success with Government agencies and many research intensive universities having established offices dedicated to these technology transfer functions. However, it was not until the 1990s that many PROs began to see biotechnology technologies reaching the market yielding the first significant royalty streams.[25] Those who were not in the ballgame now wanted to play.

Organizations such as the Association of University Technology Managers (AUTM) grew significantly in membership and established models, training and facilitated the sharing of successful practices between members.

Long before the Bayh–Dole Act, scientists have had pressures, and sometimes acted upon them, to keep research results and important reagents from getting into the hands of their 'competitors'. By the 1990s, some of the first restrictions on the free flow of results of biomedical research appeared in the management of patent rights in a manner that had the effect hindering the progress of research, particularly with the use of research tools such as animal models, cell lines and antibodies. In 1995, AUTM and the NIH developed the Universal Biological Materials Transfer Agreement to facilitate sharing of materials between non-profit institutions.[26] The NIH developed internal policies favoring the licensing of research materials on a non-exclusive basis without obtaining patent protection.[27] After soliciting public and stakeholder input on hindrances to the exchanges of research materials, the NIH developed *Guidelines and Principles for the Sharing of Biomedical Research Resources*, known as the 'Research Tools Guidelines'.[28]

The Research Tools Guidelines require recipients of NIH funds to distribute materials that constitute research tools to researchers in all sectors – academic, governmental and for-profit. The terms of transfer agreement should not reach-through to capture rights in new materials made using the research tool, without charging for more than reimbursement for costs to researchers at PROs. In all of these policies, the focus is on using the patent system, and licensing in a manner that sustains and facilitates research while providing the appropriate incentives, including exclusive licensing as necessary, to the commercial sector for product development.

One of the specific challenges that arose at that time involved the distribution of Cre–lox mice, transgenic mice utilizing technology licensed to DuPont where the *cre* and *lox* DNA elements from bacteria are utilized in mice to facilitate re-

25) For example, the first FDA-approved product that included NIH patented and licensed technology was Fludara sold by Berlex after regulatory approval in April 1991. Between 1991 and 1995, the FDA approved six products that utilized technology licensed from the NIH. http://www.ott.nih.gov/about_nih/fda_approved_products.html.

26) www.autm.net.

27) See NIH Principles and Guidelines for Sharing Biomedical Research Resources. December 1999 http://www.ott.nih.gov/policy/research_tool.html, and Ferguson, S.M. (2001) Licensing and distribution of research tools: National Institutes of Health perspective. *Journal of Clinical Pharmacology*, **41**, 1075–125 and Rohrbaugh, M.L. (2005) Distribution of data and unique material resources made with NIH funding. *Journal of Commercial Biotechnology*, **11**, 249–62.

28) http://www.ott.nih.gov/policy/research_tool.html.

combination of foreign DNA elements into the genome.[29] The NIH and DuPont entered into a Memorandum of Understanding (MOU) in 1998 to facilitate the distribution of mice for research purposes among non-profit researchers on a non-exclusive, royalty-free basis.[30] The MOU governed the transfer of Cre–lox mice to and from the intramural research program and served as a basis for the exchange of mice among non-profit research institutions because DuPont agreed to enter into agreements with these institutions 'in accordance with the terms' of the NIH/DuPont MOU. NIH entered into similar agreements with DuPont for 'oncomice'[31] and with the providers of human embryonic stem cells that were approved for use with Government funding.[32]

With the success and maturation of technology transfer operations, the public and Congress turned the question of the appropriate return to the taxpayers for their investment in NIH-funded research. The undercurrent of concern by the American public related to the cost and means for reimbursement for pharmaceuticals, primarily drugs. In 2001, the NIH responded with *A Plan to Ensure Taxpayers' Interest are Protected*.[33] The report notes that the greatest return to the public from NIH research is in extended life expectancy and reduction of disability such that, according to the US Congressional Joint Economic Committee, 'if only 10% of this increase in value is the result of NIH-funded research, it indicates a payoff of about 15 times the taxpayers' annual NIH investment'.[34] The report looked more closely at the 47 drugs with sales of more than US$ 500 million in 1999. Of these only four, Taxol, Epogen, Procrit and Neupogen, utilize technologies invented with NIH funding.[35] An additional study done by the Government Accountability Office confirmed that few widely-prescribed drugs on the market utilize patented technology made with Government funding. The study found that of the top 100 brand name drugs, on a dollar value basis, procured by the Veterans Administration or dispensed by the Department of Defense in 2001, only six and four drugs, respectively, utilized Government-funded inventions.[36]

These studies confirm that the primary role of NIH-funded research is to provide basic scientific knowledge and unique reagents to the greater research community. Companies often develop drugs and therapeutics based on this

29) US patent 4959317.
30) http://www.ott.nih.gov/policy/policies_and_guidelines.html.
31) Mice transgenic for an oncogene for use in cancer research, covered by DuPont patents US 4736866, US 5087571 and US 5925803. See MOU at www.ott.nih.gov/policy/policies_and_guidelines.html.
32) http://www.nih.gov.
33) http://www.ott.nih.gov/policy/policy_protect_text.html.
34) The Joint Economic Committee, US Senate, May 2000. The benefits of medical research and the role of the NIH, quoted in *A Plan to Ensure Taxpayers' Interests are Protected*. jec.senate.gov.
35) Epogen and Procrit are based on different uses of the same patented technology developed at Columbia University. Taxol was manufactured by Bristol-Myers-Squibb (BMS) utilizing a method of semisynthetic synthesis invented at Florida State University and is administered by a method invented at the NIH under a CRADA with BMS.
36) US Government Accountability Office (2003) *Technology Transfer: Agencies' Rights to Federally Sponsored Biomedical Inventions (GAO-03-536)*, US Government Accountability Office, Washington, DC, July. http://www.gao.gov/htext/d03536.html.

knowledge of biological systems. Even when a Government-funded technology is licensed for use in a commercial product, the licensee company most often receives an early-stage technology, and takes on the high risk and massive development costs to bring it to market. The technology licensed from a PRO is usually only one of several patented technologies that are used to manufacture or comprise part of the final product. Thus, the relative contributions of the PRO and the company must be taken into account in any discussion the contribution of publicly funded research to a marketed product.

Several times NIH has formally considered the issue of the role of NIH in the ensuring that drugs are 'reasonably' priced when those drugs arise in any way from NIH-funded research. As a reaction to Congressional concern about returns to taxpayers, the NIH adopted a policy in 1989 that there should be a 'reasonable relationship between the pricing of a licensed product, the public investment in that product, and the health and safety needs of the public'.[37] This 'reasonable pricing clause' was included in CRADAs and applied to exclusive licenses for NIH CRADA inventions. Industry reacted negatively to this clause and many companies withdrew from interactions with NIH. The NIH convened panels involving academic and Government scientists and administrators, patient advocacy groups, and industry to review the policy. The panels' recommended that the policy be rescinded because it created a barrier to relations with industry that did not serve the best interests of technology development. They viewed the benefits of rapid development of technologies for public health as so significant that they overrode monetary return considerations.[38]

In 2004, the NIH considered two requests to use its march-in authority based on what was viewed as excessively high prices for the drugs in the United States compared to their prices in Europe and Canada. One request related to Xalatan (latanoprost) manufactured by Pfizer for the treatment of glaucoma and based on technology invented at Columbia University with NIH funding. The other related to Norvir (ritonivir) manufactured by Abbott based on technology it invented with direct NIH funding. Two separate conditions that could warrant march-in were considered: (i) the patent assignee or licensee 'has not taken or is not expected to take within a reasonable time, effective steps, to achieve practical application of the subject invention' or (ii) 'action is necessary to alleviate health or safety needs which are not reasonably satisfied' by the patent assignee or licensee.[39] The march-in authority allows an agency such as the NIH to conduct an administrative proceeding similar to a trial to determine whether one of the statutory criteria for march-in is met. If the agency makes such a determination, then it can grant a license to the Government-funded patents to a new party or require

37) *A Plan to Ensure Taxpayers' Interest are Protected*. http://www.nih.gov/news/070101wyden.htm#references.

38) See Footnote 37.

39) www.ott.nih.gov/policy/policies_and_guidelines.html quoting 37 USC §203(a)(1), (2). The other prongs that would justify march in were not relevant here: (3) 'action is necessary to meet requirement for public use specified by Federal regulations. . . .' and (4) action is necessary because of lack of compliance with the requirement in §204 for 'products embodying the subject invention or produced through the use of the subject invention will be manufactured substantially in the US'.

the owner/licensee to sublicense the technology for commercial development. With respect to Xalatan and Norvir, the NIH found that the statutory conditions that would support a proceeding for march-in were not met in that both products were on the market and widely prescribed by physicians such that the manufacturer had achieved practical application and met health and safety needs.[40]

Of particular note is the NIH interpretation of term 'practical application', which is defined in the statute as having been achieved when 'the invention is being utilized and that its benefits are ... available to the public on reasonable terms'.[41] The NIH concluded that 'available to the public on reasonable terms' was not a requirement for 'reasonable pricing'.[42] Moreover, the issue of drug pricing and the global implications was properly left to Congress to address, not the NIH, and that the 'extraordinary remedy' of march-in is not an appropriate means of controlling or regulating prices.

There are a number of challenges in considering how one would fully implement the march-in authority.[43] It is useful as a deterrent and action of last resort rather than a facile tool for forcing the owner or licensee of a technology to move toward commercialization. Moreover, licensing practice of PROs has matured in the last two decades. It is now common practice for a licensor to include specific diligence terms such that the license can be revoked if the licensee does not meet performance milestones in taking reasonable steps to commercialize the technology.[44] This is a far more effective tool to achieve the same end. In times of emergency when the public needs rapid access to a technology and a licensee is not able or willing to take necessary action, the Government has at its disposal the authority to use patented inventions, whether Government funded or not,[45] which gives a patent owner, as the sole remedy for infringement, the right to sue the Government in the DC Court of Claims for a reasonable royalty. The patent owner cannot obtain an injunction, receive compensation for lost profits or obtain punitive damages. The Government can also assert as a defense a license to the invention under Bayh–Dole if it was made with under a Government funding mechanism.[46] This remedy applies only to direct infringement by the Government or

40) http://www.ott.nih.gov/policy/march-in-xalatan.pdf and www.ott.nih.gov/march-in-norvir.pdf. Also, see Raubitschek, J. and Latker, N.J. (2005) Reasonable Pricing—a new twist for March-in rights under the Bayh-Dole Act. *Santa Clara Computer & High Technology Law Journal*, **150**, 149–167.

41) 35 USC §201(f).

42) A public meeting was held for the march-in request for Norvir. Their comments include those who supported this interpretation, including former Senator Birch Bayh, and those who spoke against this interpretation. See www.ott.nih.gov/policy/meeting/May25.htm.

43) See McGarey, B. and Levey, A. (1999) Berkley Technology Law Journal, 14, 1095–1116.

44) This would not be an option in the rare instance when an invention is made and commercialized by a company with direct funding from the Government, such as in the case of Norvir.

45) 28 USC §1498.

46) The Government's license under Bayh–Dole in which the patent owner grants the Government a royalty-free, worldwide license to use the patented technology 'for or on behalf of the Government' has been consistently interpreted by the Government as applying to the Government itself and its contractors, who are acting on behalf of the Government, but not to grantees, who merely receive funds under an assistance mechanism. However, there are no judicial opinions interpreting the scope of this license. See *Duke v. Madey*, 307 F.3d 1351 (Fed. Cir. 2002).

its contractors, with the authorization and consent of the Government,[47] rather than contributory infringement, for which the Government cannot be held liable.

As any program matures, it requires refinement of its policies to manage new challenges that come to bear upon the programmatic mission. By the mid 1990s, the NIH recognized that it needed a formal policy to guide the management of its patenting and licensing responsibilities for inventions arising out of the intramural research program. The policies are based on the general principle that the primary goal of technology transfer at NIH is ultimately the improvement of public health. Other factors such as obtaining a reasonable return in royalties under the license and the economic benefits to society from the creation of new technologies are important but always secondary to the goal of improved public health. Thus, the patent policy envisions the use patents as tools primarily when they are needed to protect the technology and provide an incentive for commercialization under licenses.

As a result, the NIH generally does not patent technologies that are only useful as a research tool, such as animal models, cell lines and drug screening protocols. When a technology has dual use as a research tool and a commercial product or service, the NIH will consider obtaining a patent for the technology. In licensing technologies, the NIH always reserves the right to grant research licenses to both for-profit and non-profit research. It can charge for costs associated with preparing and shipping materials but will not charge a license fee or assert its patents against non-profit researchers even if they are collaborating with a company in which the company has certain rights to the output of that research. The company requires a license from the NIH only if it is using patented technology in an internal research project or for a commercial product or service.

The NIH objects to the use of license structures that could unduly encumber future research findings and the use of new intellectual property. This includes the use of 'reach-through' terms to attach rights to the novel outcomes arising from the use of the licensed technology that is not covered by the licensor's patent claims. Such terms, for example, would include fees based on sales of a new drug discovered using a patented and licensed screening technology. Exclusive licenses are reserved for technologies where the commercial sector requires that incentive due to the high risk and large investment in bringing a technology to market. Even then, the license will be limited to a scope of the commercial interest of the company. In addition, the NIH always reserves the right to grant internal research use licenses even under exclusive commercialization licenses. These last two principles, or avoiding 'reach-through' terms and permitting further research, are important to providing an open research base free from significant encumbrances such a stacking royalties that would result from reach-through terms possibly hindering or making the commercial development of a technology financial undesirable.

Policies developed for both the NIH intramural and extramural recipients of funding, are based on these same principles of using the patent system to provide

47) 28 USC §1498(a).

constructive incentives for new products and services to improve public health and not for unnecessary encumbrances on the system. While general NIH policies may recommend against patenting certain types of technologies, such as animal models, which do not require greater incentives for commercialization, the policies are most importantly directed towards licensing activity. Patents *per se* do not create hindrances for research and commercial development unless they are enforced in a manner that has that effect. Of increasing concern as well is the use of contractual obligations for materials governed by patents so that undue restrictions that cannot be or are difficult to enforce under patent law are enforced under contractual agreements such as Material Transfer Agreements to transfer unique materials that fall within the scope of one or more patents.

3.5 NIH Efforts to Transfer Technology Globally

The focus of the NIH licensing and its policies is necessarily on promoting public health benefits for the United States. However, the public mission of NIH is global. In part, the United States has had humanitarian goals in mind in supporting research on diseases that burden primarily the developing world. In the last 20 years, US policy makers have affirmed that such research serves the US public indirectly in that infectious diseases that arise or are endemic in one part of the world can spread to the rest of the world. In addition, countries that are severely burdened with poor public health are less likely to become strong trading partners and stable democracies.

Similarly, the NIH has increasingly had global public health in mind in licensing technologies of importance to developing countries.[48] For technologies with a potential impact on public health needs worldwide, the NIH has required licensees to provide plans for brining the product to market in at least some developing countries either concurrent with or subsequent to market approval in Western countries. In addition, technologies have been licensed directly to institutions in developing and emerging-market countries that the capacity to manufacture drugs or vaccines. Technologies for dideoxyinosine, and vaccine technologies for rotavirus, dengue fever, meningococcus, typhoid fever and vericella.[49] Another effort involves the collection of technologies related to neglected diseases invented by non-profit institutions and offered as available for licensing. The NIH currently hosts a website that lists technologies by disease and vaccine or drug categories with web links to the institution that owns the technology and would negotiate the license.[50]

48) Salicrup, L.A. and Fedorková, L. (2006) Challenges and opportunities for enhancing biotechnology and technology transfer in developing countries. *Biotechnology Advances*, **24**, 69–79.

49) Salicrup, L.A. and Rohrbaugh, M.L. (2007) Partnerships for Innovation and Public Health: NIH International Technology Transfer Activities in *IP Management in Health and Agricultural Innovation*. http://www.iphandbook.org/handbook/ch17/p12/.

50) http://www.ott.nih.gov/licensing_royalties/NegDis_ovrvw.html.

In addition to transferring technologies arising from the intramural program, the NIH believes that research institutions in developing and emerging-market countries need to be equipped to manage the technology transfer of their own inventions. To this end, the NIH has established a program for short-term training of individuals from such institutions.[51] To date, participants have included those from institutions in China, South Africa, India, Brazil and Mexico.

3.6 International Technology Transfer by Publicly Funded Research Organizations

Many countries look to the United States as a source for polices and procedures that can be adapted to address concerns in their localities. For example, the Organization for Economic and Cooperative Development (OECD)[52] leads initiatives that focus on harmonizing understanding and practices for trade-related issues. One of their initiatives is their guidelines for *Best Practices for the Licensing of the Genetic Inventions*[53] (the 'Guidelines'). This document represents the views of the OECD's 30 member countries regarding the licensing of nucleic acids, proteins, and methods of using these molecules in R&D. The Guidelines, largely emulating the NIH's Research Tools Guidelines,[54] globalize recognition of the importance of balancing the need for access to basic scientific information with the patent system's economic innovation incentive. The OECD Guidelines note that:

> ... over the last decade, as the number of such [gene-related] innovations has increased, their impact on health care has grown substantially. Recently, some governments, patient groups and healthcare providers have become concerned about how certain genetic inventions have, in certain circumstances, been licensed and exploited, particularly for diagnostic genetic services in the human health care field.

The Guidelines also note that:

> ... global issues remain regarding whether the intellectual property [IP] systems function effectively by encouraging the diffusion of information and technologies or [is] ... impeding access to genetic inventions ... [The Guidelines] conclude that the IP system ... functions largely as intended –

51) http://www.ott.nih.gov/about_nih/intl_tt.html.

52) www.oecd.org. 'The OECD groups 30 member countries sharing a commitment to democratic government and the market economy. With active relationships with some 70 other countries, NGOs [non-governmental organizations] and civil society, it has a global reach. Best known for its publications and its statistics, its work covers economic and social issues from macroeconomics, to trade, education, development and science and innovation.'

53) http://www.oecd.org/document/26/0,2340,en_2649_201185_34317658_1_1_1_1,00.html.

54) http://www.ott.nih.gov/policy/rt_guide.html.

> stimulating innovation and the disclosure of information, and that there is no evidence to suggest a systemic breakdown in the licensing of such inventions. Nevertheless, some specific concerns were identified, and in particular with respect to access to diagnostic genetic tests.

The Guidelines establish broad principles focusing on fundamental issues in the licensing of biotechnology including the importance of healthcare, research freedom, commercial development and avoiding anticompetitive practices. The guidance provided in the Guidelines took over 4 years to develop and is general in nature illustrating the time intensive nature of establishing even general global policy guidance. However, issues in technology transfer are highly fact specific and must account for the environment (legal, geographic and organizational) within which the technology is to be employed. Different actors presenting the public, private and non-profit sectors have distinct priorities, needs and constraints that must be considered when enabling technology transfer activities. These actors' conditions are further confounded by ethical, moral and social issues in the biotechnology industry because included among its many applications are pharmacology, diagnostics, and medical treatments. Each of these technologies is highly regulated and these regulations vary significantly across nations. Navigating the policy webs linking national, corporate and nonprofit communities is a difficult exercise, but linking these interests at one level or another are PROs.

International aspects of the interaction and collaboration among PROs remain of great interest. The success of Bayh–Dole within the United States is based on a variety of predicate assumptions including the particularities of the US patent system, more liberal market regulations in the United States, and the means by which the United States has implemented its obligations under international treaties including the World Trade Organization's (WTO) Trade-Related Aspects of Intellectual Property (TRIPS) Agreement and other treaties.

The WTO[55] is the successor to the forum associated with the General Agreement on Tariffs and Trade (GATT) that was established in 1947.[56] At the same time the WTO was formed, the TRIPS Agreement[57] was also negotiated and ratified. The TRIPS Agreement, ratified in 1994, was crafted in the shadow of the successful Bayh–Dole system and includes provisions that encourage a technology transfer environment similar to that of the United States. It is important to note, however, that the Bayh–Dole system, which arose as part of an evolutionary process, attempts to strike a coherent balance between 'pure' academic research

55) See the gateway to the World Trade Organization (WTO) that can be found at http://www.wto.org/english/thewto_e/whatis_e/whatis_e.htm.

56) GATT was first signed in 1947. The agreement was designed to provide an international forum that encouraged free trade between member states by regulating and reducing tariffs on traded goods and by providing a common mechanism for resolving trade disputes. GATT membership now includes more than 110 countries.

57) See the gateway to the TRIPS material on the WTO website at http://www.wto.org/english/tratop_e/trips_e/trips_e.htm.

that focuses upon 'philosophical speculation' and the practical adaptation of that research that leads to tangible public benefit.

The success or failure of any regulatory or legislative can be measured in many ways, but given the plethora of products and services based upon PRO technology[58] and the worldwide fascination with adaptation of the US Bayh–Dole/Federal Technology Transfer Act acts to other national intellectual property legal landscapes, it is clear that these acts provide validated models for translating PRO research to the public. For example, one study indicates that, at least in regard to pharmaceutical development among US institutions, there is strong reciprocal relationship between the public and private sectors. This study examined the:

> ... interaction between the public and private sectors in pharmaceutical research using qualitative data on the drug discovery process and quantitative data on the incidence of co-authorship between public and private institutions. [It found] ... evidence of significant reciprocal interaction[s and rejected] ... a simple 'linear' dichotomous model in which the public sector performs basic research and the private sector exploits it. Linkages to the public sector differ across firms, reflecting variation in internal incentives and policy choices, and the nature of these linkages correlates with their research performance.[59]
>
> Many current policy proposals and initiatives display the classic signs of international emulation-selective borrowing from another nation's policies for implementation in an institutional context that differs significantly from that of the nation being emulated.[60]

Regardless of the adaptive mechanism, the international Bayh–Dole-type 'initiatives are based on the belief that university patenting was an essential vehicle for effective transfer of technology from universities to industry and that Bayh–Dole was essential to the growth of university-industry interaction in science-based industries in the United States during and after the 1980s'.[61]

In Europe, while the majority of basic research is conducted by PROs, the route through which the results of their innovative efforts are translated into practical application has changed. As a general rule, European research has 'evolved from

58) *AUTM Licensing Survey: FY 2006 Survey Summary*, p. 10. A survey of 189 US institutions indicated that 697 new products were introduced into the marketplace and 553 new startup companies launched as a result of their technology transfer efforts. Association of University Technology Managers. http://www.autm.net/AM/Template.cfm?Section=Licencing_Surveys_AUTM&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=2292.

59) Cockburn, I. and Henderson, R. (1996) Public–private interaction in pharmaceutical research. *Proceedings of the National Academy of Sciences of the USA*, **93**, 12725–30 and see Footnote 60.

60) Mowery, D.C. and Sampat, B.N. (2005) The Bayh–Dole Act of 1980 and university–industry technology transfer: a model for other OECD governments? *Journal of Technology Transfer*, **30**, 115–27.

61) See Footnote 60.

an open source model in which PROs did not retain any IP rights, to a 'Licensing Model' in which the PROs started to retain, protect and commercialize inventions based on their discoveries, essentially through licensing the IP rights to industry or to start-up companies'.[62] In the last 10 years, the European licensing model has been expanded to include an innovation model consistent with that in the United States. Whereas, in the United States, the lines between PROs and private industry have blurred as PROs spin-off private sector companies. In addition, personnel and their associated know-how pollinate private sector companies and industrial innovators often move to, collaborate with or provide resources to PROs.

Consistent with US findings, the European commission has found that a 'best practice is to vest initial ownership of results and inventions funded by public funds to the PROs where the research was conducted'.[63] They also noted that while spin-off company generation is more prevalent in the United States than in the EC, this is changing slowly and is considered to be a 'best practice'.

Translating the success of the US innovation model to the non-US communities remains a challenge as evidenced by statistics relating to, for example, European adaptation of PRO research to commercial technologies. Given the volume of ongoing research in European PROs relative to that in the United States, one could expect a 'far greater number of technologies being developed in an industrial context'.[64] However, this expectation may be unrealistic. The translation of US PRO innovation to practical application has been facilitated by technology transfer efforts that coming 24 years after the advent of the Bayh–Dole Act. These laws have only recently been introduced into the European communities, and it will take time for technology transfer systems to adapt and evolve from these changes to legislative and regulatory environments. It is clear that no single implementation model will suffice for all nations and the iterative adaptations necessary for the development of successful PRO technology transfer will take time.

Governments worldwide have sought to increase the rate of transfer of academic research advances to industry and to facilitate the application of these research advances by domestic firms since the 1970s as part of broader efforts to improve national economic performance in an era of higher unemployment and slower growth in productivity and incomes. In the 'knowledge-based economy,' according to this view, national systems of higher education can be a strategic asset, if links with industry are strengthened and the transfer of technology

62) European Commission (2004) *Working Paper on Community Research: Management of Intellectual Property in Publicly-funded Research Organizations: Towards European Guidelines*, European Commission, Brussels, p. vii. http://ec.europa.eu/research/era/pdf/iprmanagementguidelines-report.pdf. Note that the NIH does not work activity to establish new companies around its intramural technologies (i.e. spin-out companies) because it believes that this would not be consistent with its role as a Governmental agency that funds research primarily through grants and contracts to outside entities on a scientifically competitive basis. The NIH, however, does work to license technologies to start-up companies.

63) See Footnote 52.

64) See Footnote 52.

enhanced and accelerated. Many if not most of these 'technology transfer' initiatives focus on the codification of property rights to individual inventions, rather than the broader matrix of industry–university relationships that span a broad range of activities and outputs.[65)]

For example, 'several countries ... have recently enacted laws, regulations or policies assigning ownership or the first right to ownership to PROs', including Austria, Belgium, Denmark, France, Spain and Russia. In the United Kingdom, patent rights have been vested in the university since the patent act of 1977. In other countries patent ownership has relied upon the so-called 'professor's privilege' system in which invention assignment vests in the professor or other public funding recipient. The latter systems were only recently rescinded in Finland and Norway and only remain in Sweden and Italy among European Union Countries.[66)] The criticality of the difference between these two modalities should not be underestimated. For example, one analyst notes that:

> ... until recently, German universities were not interested in dealing with intellectual property issues because, by law, professors retained ownership of their discoveries. As a result, universities saw little return from licensing patents to companies. This all changed in February 2002 when a new law came into force that shifted intellectual property ownership to the universities and ruled that academics are to receive 30% of the licensing revenues.[67)]

Since the introduction of the changes to section 42 of the German Employed Inventor's Act, the Max Planck Institute reported licensing revenues in 2003 of DM 32 million and Bernhard Hertel, managing director of the Max Planck Society's (MPS) technology transfer division, says that, '... there is an increasing demand from young scientists who want to start their own companies, not only at MPS but elsewhere in Germany'. Germany also maintains a program called 'EXIST' that promotes 'networks between universities, capital providers, and service companies to facilitate university spinouts'.[68)] In still other countries, such as Denmark, patent rights are split between the university and the faculty member.

Regarding yet another example, Goldfarb and Henrekson[69)] opine that the:

> ... different incentive structures that academic researchers face in the United States and Sweden ... demonstrates that in Sweden academics face strong disincentives to take the time away from their academic pursuits to facilitate knowledge transfer to the commercial sector ... we believe

65) See Footnote 60.
66) http://www.eutechnologytransfer.eu/downloads.php.
67) Habeck, M. (2003) Humboldt University beefs up technology transfer. *Bioentrepreneur*, published online: www.nature.com/bioent/bioenews/112003/pf/bioent781_pf.html.
68) See Footnote 67.
69) Goldfarb, B. and Henrekson, M. (2003) Bottom-up versus top-down policies towards the commercialization of university intellectual property. *Research Policy*, **32**, 639–58.

> that it is unlikely that Sweden is harvesting the full commercial potential of its research output as successfully as the US.[70)]

Other countries have still more varied intellectual property ownership schemes. For instance, while Italy has shifted ownership from universities to individual researchers, in Japanese universities ownership of IP rights resulting from publicly funded research is determined by a committee. In the UK and Canadian university systems, no single national policy governs IP rights ownership, although this is moving towards a system similar to that found in the United States.

Regardless of the mechanism by which ownership of PRO intellectual property is managed, there is a worldwide movement to vest interests in publicly funded research with the institution or person that has received that funding. The goal is to facilitate the university/industry collaboration that, for example, '... senior Japanese Government officials have declared ... [is] essential for Japan's economic revival'.[71)]

In Europe, one report notes that:[72)]

> ... the combination of weak intellectual property laws and expensive patent prosecution can be fatal to a country's intellectual property regime, as is the case in Spain. The EU [European Union] condenses all these problems into the following list of concerns. Poor EU performance could be explained by the culture of many EU research institutions. Problems cited included:
>
> - a continued over-reliance on a 'linear' approach to innovation, which assumed that investment in the supply side would automatically result in marketable innovations downstream;
> - measuring academic success on the basis of research papers or academic citations, with intellectual property creation, for example, often not given parity of esteem as a research publication;
> - peer review (and lack of external examination), which may tend to prevent academic networks opening up to external scrutiny; and
> - academics being given insufficient time, or promotion incentives to engage in commercial activities.

70) See Footnote 69.

71) Rutt, J.S. and Maebius, S.B. (2004) Technology transfer under Japan's Bayh–Dole: boom or bust nanotechnology opportunities? *Nanotechnology Law and Business*, **1**(3), article 8. pubs.nanolabweb.com.

72) Siepmann, T.J. (2004) The global exportation of the US Bayh–Dole Act. *University Of Dayton Law Review*, **30**, 209–43. http://law.udayton.edu/lawreview/documents/30-2/The US Bayh-Dole Act.pdf.

> The EU is vocal and specific in calling for reform of the research systems within its member nations and cites a litany of problems from 'poor knowledge transfer mechanisms from the science base to industry,' to 'significant barriers' within the academic culture itself that prevent commercialization. The EU also cites an overall lack of clarity among many member nations as to who actually owns intellectual property stemming from government-funded research.

Whether an invention is assigned to the innovator (person) or the institution (e.g. grantee), the process of obtaining patent rights and developing the partnership relationships through licensing or assigning rights that permit their translation into products and services is complex both legally and technically. The US experience has grown up over almost three decades and has involved exercises fraught with mistakes. Business acumen, patent and licensing experience are all needed for a successful application of PRO innovation for practical public benefit.

Actualization of technology from PROs to the public can, at least in part, be measured by formation of spin-out companies. A 'spin-out company' generally refers to an independent corporate entity that is created to exploit intellectual property. These companies provide means to gather funding, further educational and research efforts, and transfer knowledge between the public and private sectors. It also provides a means to reap financial rewards that motivate academics to pursue practical applications of basic research activities. However, the latter carries with it the danger that the lure of financial gain may shift the balance from the basic research enterprise to developmental activities carrying greater profit potential.

In the United States, a greater amount of public funds are used per spinout that in, for example, Canada and the United Kingdom. For example, 2001 data from AUTM and UNICO–NUBS[73)] indicated that the United States spends approximately US$ 171 million for each spinout formed in contrast to only US$ 48 million in Canada and US$ 17 million in the United Kingdom.[74)] The survey also:

> ... shows that during 2001 universities created 175 new spinout companies, accounting for 31% of all 554 spinouts formed in the [preceding] ... five years. However, much of the spinout activity is concentrated in relatively few universities. About a quarter of universities (26.7%) created more than 10 spinouts each but a quarter (25.3%) did not create any spinouts in this period.

73) University/Company Association (http://www.unico.org.uk) and Nottingham University Business School (http://www.nottingham.ac.uk/enterprise/unieihome_archive.htm).

74) See, e.g. 'Spinouts pick up speed'. http://www.hero.ac.uk/uk/business/archives/2002/spinouts_pick_up_speed2872.cfm.

Regardless of the system employed or the mechanism by which technology is developed, the ownership provided by Bayh–Dole type rights does not directly translate into IP rights and technological innovation. It is still necessary to have the requisite skill, policies and knowledge to obtain useful patent protection, and then the ability to utilize those IP rights to facilitate development of products and services. There are many factors that, in the United States, act as catalysts for translation of research results into product and services that directly benefit the public.

One cornerstone of the US economy is entrepreneurship and a permissive environment for, among other, translating early stage science into practical application. Derek Leebaert, a professor at Georgetown University, notes that:[75)]

> Small businesses contribute much more to the US economy and society as a whole than can be calculated just from the spending and profit that they generate. These businesses tend to be more economically innovative than larger companies, more able to respond to changing consumer demand, and more receptive to creating opportunities for women and minorities, and activities in distressed areas. 'Building, running, and growing small business is a part of a virtuous cycle of creativity and increasing prosperity that can be applied by dedicated and thoughtful people anywhere,' the author says. 'There are no secrets, and frequently money is less important than a considered combination of imagination and effort.

Other factors that contribute to the ability of innovators in the United Nations to bring products and services to the consumer include access to a broad array of financial resources (including, for example, venture capitalists and Angel investors) and an open economic environment. In addition, the relatively unique aspects of the US patent system provide an environment that balances open information exchange against the exclusionary rights provided by the patent system.

In contrast to the rest of the world, the US patent system currently has a first-to-invent system rather than a first-to-file one. In the latter system, if there is a conflict between inventors claiming the same invention, the Government will grant a patent to the first party to file a patent application, presuming, of course, that all other conditions for patentability are met. In contrast, in a first-to-invent system the patent office will award the patent to the party that is able to demonstrate that they were the first ones to 'invent' that which is sought for patenting. Resolution of conflicts between parties seeking patents on the same invention is done through an expensive and complex process known as 'interference'. While discussion of interference practice is beyond the scope of this chapter, the reader should note that the complexity of determining who invented something first

75) Leebaert, D. (2006) How small businesses contribute to US economic expansion. *eJournal USA: Economic Perspective*, **11**(1). http://usinfo.state.gov/journals/ites/0106/ijee/leebaert.htm.

has driven a global transition to first-to-file systems. Whether this is helping or hindering innovation is unclear.

In the academic community, information exchange is largely done through the established system of publication in peer-reviewed journals. In the United States, this is usually where an invention is first disclosed and provides a means for broad disclosure of scientifically validated research results. In the first-to-file system, inventors need to make their first submission to the patent office which will not publish that information until 18 months after filing. It is only after filing the invention that an inventor becomes free to publish their research findings. Thus, the pattern of information disclosure is different in the United States than in other countries.

Another factor that contributes to the preservation of academic freedom and open dissemination of knowledge while preserving the potential incentives provided by the patent system is the 'grace period' provided by US patent law. In the United States, an inventor may disclose their invention to the public up to 1 year before filing a patent application without jeopardizing their potential patent rights. Similar types of grace periods are present in some countries while others (including members of the European Commission) have an absolute novelty standard that requires that patent application filing be the first disclosure of an invention.

Different countries address the so-called 'grace period' in different ways.[76] The absolute novelty standard best serves innovators that do not rely upon open publication for information dissemination (e.g. large industrial actors) and capital investment. In contrast, PROs rely upon peer-reviewed publications for information sharing and dissemination and keeping research results. Secrecy is anathema to the public research enterprise.

The potential importance and impact of the grace period on the ability to bring inventions to market should not be underestimated.

> [The] official view of the French and German Government as regards the introduction of a grace period in the European patent law, contains 10 points … [including that the] introduction of a grace period in Europe would favor innovations, in particular a more rapid transfer of results of research and development into commercial application [and that] (r)esearch and scientific institutions would benefit at

76) The spectrum of 'grace periods' among countries can be divided into three basic categories: relative, local and absolute novelty. For example, Brazil, the European Patent Office, France, Germany, Mexico, South Africa, Taiwan, the United Kingdom and Venezuela have an absolute novelty standard for patentability. Any disclosure of the claimed invention to the public anytime before the filing of the patent application is sufficient to preclude patenting. In contrast, in some countries including the United States, Australia, China, Canada and Japan, there is a relative novelty standard that permits the inventor to disclose there invention to the public up to 1 year before filing a patent application without negating their ability to obtain patent protection. The third situation, local novelty, provides inventions may not be disclosed within the country of patenting prior to filing of the patent application.

> most, since the grace period would ease the conflict between an early disclosure and filing of a patent application. A grace period would be equally beneficial to small and medium size enterprises, in particular as far as their cooperation and public experiments are concerned.[77)]

In addition filing and disclosure requirements, there is also some debate as to how 'new' an invention needs to be before it should be able to be patented. This is a global debate regarding the merit of 'incremental' versus 'evolutionary' technological advances. Incremental innovation provides a continuum of technological adaptation of preceding inventions whereas evolutionary standards provide that in order for an invention to be patentable there must be some 'flash of genius' or other substantive difference between that which is sought for patenting and that which has come before. This is especially contentious in biotechnology and pharmaceuticals where minor advances that provide benefit to the public may be confused with patent 'evergreening',[78)] where otherwise obvious variations of prior inventions are granted patent protection inappropriately. Sometimes the distinction between incremental innovation and evergreening is a matter of opinion rather than fact.

The lines between the incremental innovation that merit patent protection and evergreening efforts that inappropriately exploit the patent systems and keep, for example, generic medicines from the public are often blurred. What can be said is that limiting protection for the incremental innovation that often derives from PROs may be detrimental to global innovation and access to medicines. For example, 'incremental innovations' that provide once-a-day dosing and acid stable antibiotics provide for greater patient compliance and accessibility. Similarly, heat-labile therapeutics support the ability to deliver temperature-sensitive drugs to markets lacking electricity and refrigeration. Thus, while some might call these types of innovations 'evergreening', they help to provide critical medicine technologies to populations that might not otherwise benefit from modern medical advances.

3.7
Patent Harmonization and Access to Medicines

As noted above, since the advent of the Bayh–Dole act in the United States, international attempts to emulate the US success and to harmonize patent standards

77) Straus, J. (2000) *Expert Opinion on the Introduction of a Grace Period in the European Patent Law Submitted upon request of the European Patent Organization*. European Patent Office, Munich. http://epo.org/about-us/press/releases/archive/2000/25072000.html.

78) 'Evergreening' is when patent owners attempt to extend the patent monopoly by seeking a new patent that 'updates' the first one before its expiration. This is usually done by claiming things such as an 'inventive' method for administering the pharmaceutical compound covered by the base patent. For pharmaceutical products, this means an extended monopoly that excludes generic drugs from the market.

has, by some estimations, resulted in greater patent rights, greater scope of exclusivity and decreased access to, for example, vital health technologies. According to Kapczynski *et al.*:[79)]

> ... the United States, the European Union, and Japan have used trade agreements to impose high levels of substantive and procedural protection for IP on countries around the world. The World Trade Organization's Trade-Related Aspects of Intellectual Property Agreement is the foundation of this treaty architecture, but regional and bilateral agreements increasingly impose even higher protections upon countries ... This is particularly true in the area of medicines: at the time the Uruguay Round of trade negotiations was launched, more than fifty countries did not provide patent protection on medicines.

However, the establishment of the TRIPS Agreement provides that least-developed countries had until 1 January 2006 to comply with the terms of the agreement and have the right to defer patents and data exclusivity rights on pharmaceuticals until 2016.

Patent eligibility has played a significant role in the provision of technology, especially pharmaceuticals to the developing world. For example, India did not provide patent protection for pharmaceuticals until January 2005 when they became 'TRIPS compliant'. Before that time, India developed an extensive infrastructure based upon the manufacture of drugs that would have otherwise been patented. Indian companies continue to provide many low-cost drugs to developing countries. However, with the introduction of patent protection for pharmaceuticals, manufacturing of current generation drugs for delivery to developing markets has moved in significant part to other countries that are, in turn, developing manufacturing capacity. Thus, we are currently undergoing a 'TRIPS compliance cascade' that is helping with the establishment of manufacturing capacity throughout the world.

As this is not a treatise on international patent rights, a discussion of possible reasons for this cascade and its effects will not be discussed. However, what is clear is that the availability of patent protection and the scope of that protection has a significant impact on the availability of technology around the globe as well as the ability of countries to participate in this technological revolution. The ability for PROs and there faculty to participate in this revolution through the patent system has played a signification part in both the development and the deployment of technology. Appropriate safeguards that balance public and private interests is clearly the key maintaining the capital investment incentives provided by IP rights. However, there has been recent movement to dilute the strength and

79) Kapczynski, A., Chaifetz, S., Katz, Z. and Benkler, Y. (2005) Addressing global health inequities: an open licensing approach to university inventions. *Berkeley Technology Law Journal*, **20**, 1031.

vitality of the patent system and it is unclear as this point whether this will ultimately harm or help innovation.

Paragraph 5 of the Declaration on the TRIPS Agreement and Public Health adopted on 14 November 2001 by the WTO (the so-called Doha declaration) states in part that in cases of public health emergencies '... each Member has the right to grant compulsory licenses and the freedom to determine the grounds upon which such licences are granted'.[80] However, most nations reserve a royalty-free use license when they issue a patent. The harbinger of a nation being forced to license a technology carries with it a degree of unpredictability that haunts the business community. Such ambiguity may serve to undermine the incentives that patent exclusivities serve to provide.

The degree to which governments will employ the provisions of the Doha declaration remain to be seen. The United States has consistently resisted the use of compulsory licenses and other provisions of intellectual property law such as march-in rights[81] that would dilute the patent strength. Nonetheless, several countries, including Brazil, France and Ghana, have threatened to invoke the Doha declaration provisions for compulsory licenses for technologies that they felt were not being provided to the public at reasonable cost. Last-minute concessions by intellectual property holders have so far obviated the need for such licenses and therefore the impact of the Doha declaration provisions remain unclear.

3.8 Final Notes on the Global Expansion of Bayh–Dole-Type Intellectual Property Regimes

There is no universal panacea to control, regulate, and spur utilization of publicly funded technology. Mowery notes that '... indeed, emulation of Bayh–Dole actually could be counterproductive in other industrial economies, precisely because of the importance of other channels for technology transfer and exploitation by industry'.[82] What is clear though, is that the development of a flexible system that extracts and adapts the best practices of world intellectual property regimes and discards those that are not applicable within a particular country will ensure that an appropriate balance between public and private interests will be maintained. This balance is the key to providing continuing innovative activities that will guarantee that the innovation cycle will endure.

80) http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_trips_e.pdf#search=%22wt%2Fmin(01)%2Fdec%2F2%22.

81) http://ott.od.nih.gov/policy/policies_and_guidelines.html.

82) See Footnote 60.

Keywords: technology transfer, biotechnology, intellectual property, National Institutes of Health