RECENT DEVELOPMENTS AFFECTING THE ENFORCEMENT, PROCUREMENT, AND LICENSING OF RESEARCH TOOL PATENTS

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I. INTRODUCTION

This Article summarizes recent developments under U.S. patent laws and provides insights into the practices of various academic sciences, industries, and government agencies regarding the treatment of so-called "research tool" inventions. For many years a vigorous discussion has existed about the need to provide exclusive patent rights as incentives to invent and to disclose research tools, whether such exclusive rights should apply to all uses and users of patented research tools, and whether exclusive rights to prohibit all uses of research tools would unduly discourage sequential invention. Concerns over the proper scope of patent rights in regard to subsequent research uses of inventions have a long history, but have received increased scrutiny in light of judicial decisions since the

turn of the century. New studies of uses of research tools and efforts to assert research tool patents have been performed in light of the decision of the U.S. Court of Appeals for the Federal Circuit (Federal Circuit) in 2002 to provide a restrictive interpretation of the experimental-use exception to patent infringement in *Madey v. Duke University,*[2] and the decision of the U.S. Supreme Court in 2005 to provide an expansive interpretation of the codified regulatory-approval exception[3] in *Merck KGaA v. Integra LifeSciences I Ltd.*[4] This Article seeks to describe the broad parameters of these developments.

In general terms, the law regarding patents and research tool inventions has become clearer since 2000. The Federal Circuit's 2002 *Madey* decision has increasingly been recognized as expressing the state of the law regarding the experimental-use exception, particularly as neither the U.S. Supreme Court nor the U.S. Congress have chosen to intervene to revise the Federal Circuit's approach. Thus, uses of patented research tools in almost all contexts, even for university-based basic research, must for now be considered an actionable infringement of exclusive patent rights. Only in the context of the regulatory-approval exception does significant uncertainty remain regarding whether uses of patented research tools constitute actionable infringements. In that context, the broad language of the Supreme Court's interpretation in *Merck*, the subsequent decision of the Federal Circuit on remand,[5] and other recent cases suggest that the exception may apply to at least some research tool uses of inventions closely related to the target of the regulatory-approval decision.

At the same time, social practices have become more complex. Recent studies demonstrate that both academic and commercial researchers ignore the actual state of the law and routinely use patented inventions without the authorization of patent holders. This approach appears justified in light of other studies that demonstrate that many research tool patent holders will not assert their patents to restrict research. However, fears of potential liability may nevertheless unduly restrict research, and routine disregard of legal rights (even if unlikely to be asserted) may not be a stable position. In some contexts, such as diagnostic and stem-cell inventions, aggressive assertion of research tool patents has led to public criticism, and new academic and government guidelines have developed to assure broad licensing of research tools on reasonable terms.

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2. *See* 307 F.3d 1351 (Fed. Cir. 2002).
3. 35 U.S.C. § 271(e)(1) (2000).
4. 545 U.S. 193 (2005).
5. Integra Lifesciences I, Ltd. v. Merck KGaA, 496 F.3d 1334 (Fed. Cir. 2007).

This Article provides basic definitions, briefly describes the history of the experimental-use and regulatory-approval exceptions and their application to research tools, and then summarizes recent developments in the case law, studies of recent practices of researchers and patent holders, and recent changes to licensing policies in regard to research tools. It also provides a brief discussion of alternatives to a broad experimental-use exception and throughout contains references to relevant academic articles.

II. DEFINITION OF RESEARCH TOOLS

This Part provides a basic definition of research tools addressed in this Article. A broad definition is adopted because the focus of this Article is on the effects of potential patent liability on scientific research. Narrower definitions are more applicable in the discussions about incentivizing the development of technologies intended for research.

"Research tools" may have many definitions and may include a very wide range of technologies. For example, patented inventions covering the following are all sometimes referred to as research tools: cell lines, genetic sequences, assay methods, software, and instruments such as microscopes and lasers. Research tools are often defined as inventions whose patent application discloses that their intended use is solely or principally for scientific research.[6] However, this definition is problematic because technologies are commonly used for research that the patent holder did not contemplate, and the right to exclude others from using patented inventions is not limited in the United States to the disclosed and claimed uses.[7] Another approach defines research tools as patented technologies that are only used to produce products that do not incorporate the technology.[8] This approach focuses only on liability for the research market because there is no infringement by the products produced with the research tool. For purposes of discussing the full scope of potential liability, one must consider a broader definition of research tools than inventions that are pa-

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6. *See, e.g.*, Philippe Ducor, *Research Tool Patents and the Experimental Use Exemption—a No-Win Situation?*, 17 NATURE BIOTECHNOLOGY 1027, 1027-28 (1999); Thomas D. Mays, *Sharing Biomedical Research Resources: Principles and Guidelines for Recipients of NIH Research Grants and Contracts: Race Horse or Trojan Horse?*, 3 BIO-SCI. L. REV. 56, 61 (1999-2000).

7. *See* 35 U.S.C. § 271(a) (2000).

8. *See, e.g.*, Janice M. Mueller, *No "Dilettante Affair": Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools*, 76 WASH. L. REV. 1, 14-15 (2001); Esther Pfaff, *"*Bolar*" Exemptions—A Threat to the Research Tool Industry in the U.S. and the EU?*, 38 INT'L REV. OF INTELL. PROP. & COMPETITION L. 258, 262-63 (2007).

tented with a disclosed research purpose or inventions that are used to produce, but are not incorporated into, a commercialized product. Nevertheless, such patents are often the subject of greatest concern regarding the need for patent protection, given that the anticipated market for any commercial value for the patent is for research.

More expansive definitions of "research tools" focus on the possible uses of patented inventions. A recent Federal Circuit case defined research tools as "tools that scientists use in the laboratory, including cell lines, monoclonal antibodies, reagents, animal models, growth factors, combinatorial chemistry and DNA libraries, clones and cloning tools (such as PCR), methods, laboratory equipment and machines."[9] Similarly, analysts and academics have defined research tools broadly as "any . . . input into the process of discovering" products[10] and as "the technological developments that enable particular lines of research to be pursued."[11] We rely on these more expansive definitions below, so for purposes of this Article "research tools" are patented technologies used in conducting research that are not themselves the object of the research inquiry at that time. It bears repeating, however, that this expansive definition applies to many types of patented technologies having different intended markets than the research at issue.

III. BRIEF HISTORY OF THE EXPERIMENTAL-USE AND REGULATORY-APPROVAL EXCEPTIONS

The following Part summarizes the origins and history of judicial interpretations of the experimental-use and regulatory-approval exceptions in the United States.[12] The summary identifies significant changes over

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9. Integra LifeSciences I Ltd. v. Merck KGaA, 331 F.3d 860, 872 n.4 (Fed. Cir. 2003) (Newman, J., dissenting) (quoting Sharing Biomedical Research Resources: Principles and Guidelines for Recipients of NIH Research Grants and Contracts, 64 Fed. Reg. 72,090, 72,092 n.1 (Dec. 23, 1999)).

10. John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 287 (Wesley M. Cohen & Stephen A. Merrill eds. 2003).

11. Dianne Nicol, *Cooperative Intellectual Property in Biotechnology*, 4 SCRIPTED 136, 137 (2007), *available at* http://www.law.ed.ac.uk/ahrc/script-ed/vol4-1/nicol.asp.

12. The summary is largely based on an article co-authored by one of the authors of this Article (Sarnoff), which provides additional details and a comparison to European law. *See* Henrik Holzapfel & Joshua D. Sarnoff, *A Cross-Atlantic Dialog on Experimental Use and Research Tools*, 48 IDEA 123 (2008). For another comparative perspective, see Sean O'Connor, *Enabling Research or Unfair Competition? De Jure and De Facto Research Use Exceptions in Major Technological Countries*, *in* COMPARATIVE PATENT

time to the scope of the experimental-use exception, as well as unresolved questions regarding its basic nature and regarding the nature, scope, and application of the regulatory-approval exception.

A. Origins and Early Interpretations of the Experimental-Use Exception

Supreme Court Justice Joseph Story first articulated the experimental-use exception in the United States in the early Nineteenth Century. As Justice Story stated in 1813 in *Whittemore v. Cutter,*[13] "it could never have been the intention of the legislature to punish a man, who constructed such a machine merely for philosophical experiments, or for the purpose of ascertaining the sufficiency of the machine to produce its described effects."[14] The patent statute at the time provided liability for any person who shall "make, devise, use, or sell" the patented invention, and the statutory language had been amended earlier to make clear that making without use constituted an infringement of the exclusive right.[15] Thus, the language of the *Whittemore* decision may be understood in one of two ways—either as a statutory interpretation of the limits of the specific rights granted by a patent, or as a judicially imposed exception to the rights granted, consistent with the more extensive judicial common law-making powers of the time. The distinction is significant, both substantively and procedurally, as the first approach would define the limits of property initially granted and the second approach would impose restrictions (in the nature of an affirmative defense to liability) on the use of that property.[16] The dispute over which approach is correct has not yet been settled, but the experimental-use exception is most frequently referred to as a "common law" exemption from liability.[17]

The *Whittemore* decision articulated two different grounds for an experimental-use exception to patent infringement. The first was for "philosophical experiments,"[18] and the second was to "ascertain . . . sufficien-

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LAW: A HANDBOOK OF CONTEMPORARY RESEARCH (Toshiko Takenaka & Rainer Moufang, eds., forthcoming 2008).

13. 29 F. Cas. 1120 (C.C.D. Mass. 1813) (No. 17,600).

14. *Id.* at 1121.

15. Act of Apr. 17, 1800, ch. 25, § 3, 2 Stat. 37, 38 (1800) (current version at 35 U.S.C. § 271(a) (2000)); *see* Act of Feb. 21, 1793, ch. 11, § 5, 1 Stat. 318, 321 (1793).

16. *See* O'Conner, *supra* note 12*,* at 3, 7 (discussing alternative treatment of the doctrine as an exception or as an exemption).

17. *See, e.g.*, Integra LifeSciences I, Ltd. v. Merck KGaA, 331 F.3d 860, 863 n.2 (Fed. Cir. 2003).

18. At the time, "philosophical experiments" was understood to mean scientific research, particularly in physics. *See, e.g.*, THE COMPACT EDITION OF THE OXFORD ENG-

cy"[19] of the patented invention for the disclosed uses. The scope of these two prongs of the exception has been the subject of extensive dispute and numerous cases over the course of the next two centuries.

In *Sawin v. Guild,*[20] Justice Story sought to clarify further the scope of the exception as follows:

> [T]he making of a patented machine to be an offence within the purview of it, must be the making with an intent to use for profit, and not for the mere purpose of philosophical experiment, or to ascertain the verity and exactness of the specification. In other words, that the making must be with an intent to infringe the patent-right, and deprive the owner of the lawful rewards of his discovery.[21]

Unfortunately, the decision did not clearly define what constituted "lawful rewards," although it seemed to suggest that a patentee's monopoly does not extend to cover noncommercial experiments and validity-testing experiments. In 1852, Justice Curtis explained the basis for this distinction in *Byam v. Bullard,*[22] where he noted that scientific research and competitive evaluation do not cause injury to the exclusive patent right and are not performed "with [an] intent to deprive the patentees of some lawful profit."[23]

Numerous cases were decided between 1852 and 1950 that explored the limits of the "intent to deprive . . . of some lawful profit" standard. Commentators differ regarding the nature of the standard that the courts actually applied, but generally agree that a finding of infringement required the user of the patented technology either to have a commercial intent to make a profit through the use of the patented invention or to derive some actual commercial benefit from the use of the invention (such as sales or reduced costs of production).[24] During this period, only one case,

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LISH DICTIONARY 180 (Oxford Univ. Press 1971) (defining philosophical experiments as "[p]ertaining to, or used in the study of, natural philosophy, or some branch of physical science").

19. *Whittemore*, 29 F. Cas. At 1121.

20. 21 F. Cas. 554 (C.C.D. Mass. 1813) (No. 12,391).

21. *Id.* at 555 (citation omitted).

22. 4 F. Cas. 934 (C.C.D. Mass. 1852) (No. 2,262).

23. *Id.* at 935.

24. *See, e.g.*, Ronald D. Hantman, Letter to the Editor, *Re: The Experimental Use Defense*, 87 J. PAT. & TRADEMARK OFF. SOC'Y 348, 348-49 (2005) (noting that the historic case law for the exception required both experimentation and the absence of an intent to use for profit, i.e., where "the infringer makes or attempts to make a monetary profit while infringing the patent"); Ronald D. Hantman, *Experimental Use as an Exception to Patent Infringement*, 67 J. PAT. & TRADEMARK OFF. SOC'Y 617, 625 (1985) [he-

Ruth v. Stearns-Roger Manufacturing Co.,[25] addressed scientific research in a university setting.[26] In *Ruth*, the court found that the defendant was not liable for contributing to infringement by supplying replacement parts used at a mining school, given that the patented machines were used only experimentally in a laboratory and subsequently were cut up and changed.[27]

In 1950, Congress proposed legislation that would have explicitly codified the experimental-use exception, excluding from infringement "making or using of a patented invention solely for the purpose of research or experiment" and not for sale.[28] But in 1952, Congress enacted a revised patent law that did not provide an express exception for experimental use. Instead it merely codified in section 271(a) the exclusive rights to make, use, and sell and the existing judicial standards for infringement.[29]

B. The 1984 *Bolar* Decision and Legislative Adoption of the Regulatory-Approval Exception

Between 1952 and 1984, relatively few experimental-use cases were decided, and none involved scientific research.[30] In 1984, however, the Federal Circuit decided *Roche Products Inc. v. Bolar Pharmaceuticals*

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reinafter Hantman, *Experimental Use as an Exception*] (distinguishing "use for profit" from cases in which "the experimenter neither made money nor tried to make money while infringing the patented invention"); N. Scott Pierce, *A New Day Yesterday: Benefit as the Foundation and Limit of Exclusive Rights in Patent Law*, 6 J. MARSHALL REV. INTELL. PROP. L. 373, 384-412 (2007) (discussing cases finding infringement that focused on the benefit of the invention gained by use, rather than profits obtained, and later cases focusing on commercial intent); Andrew S. Baluch, Note, *Relating the Two Experimental Uses in Patent Law: Inventor's Negation and Infringer's Defense*, 87 B.U. L. REV. 213, 250-53 (2007) (discussing factors to distinguish experimental from commercial use derived from experimental-use cases relating to the public use bar of 35 U.S.C. § 102(b)); *cf.* Richard E. Bee, *Experimental Use as an Act of Patent Infringement*, 39 J. PAT. OFF. SOC'Y 357, 367-68 (1957) (noting the failure of courts to impose reasonably royalty damages for noncommercial uses and arguing that courts used to treat the experimental-use exception very narrowly and found it to apply only when the experiment was performed to gratify a philosophical taste, curiosity, or for amusement).

25. 13 F. Supp. 697 (D. Colo. 1935), *rev'd on other grounds*, 87 F.2d 35 (10th Cir. 1936).

26. *Id*.

27. *Id.* at 703, 713.

28. STAFF OF H. COMM. ON THE JUDICIARY, 81ST CONG., PROPOSED REVISION AND AMENDMENT OF THE PATENT LAWS 59 (Comm. Print 1950) (proposed Section 73).

29. *See* 35 U.S.C. § 271(a) (2000); S. REP. NO. 82-1979 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2402 (noting that proposed section 271(a) was merely declaratory of what constitutes infringement).

30. *See* Hantman, *Experimental Use as an Exception*, *supra* note 24, at 630-39 (discussing the cases).

Co.[31] In *Bolar,* the court held that the experimental-use exception did not apply to scientific tests using a patented pharmaceutical compound for the purpose of obtaining generic product marketing approval from the Food and Drug Administration (FDA).[32] Specifically, the court construed the experimental-use exception to be narrow (limited to "amusement, to satisfy idle curiosity, or for strictly philosophical inquiry") and held that the defendant's tests were "solely for business reasons."[33]

Congress responded to *Bolar* by codifying a separate regulatory-approval exception to patent infringement as part of broader legislation balancing the rights of pioneering and generic pharmaceutical manufacturers.[34] The principal concerns expressed by Congress when adopting this exception were that *Bolar* had been wrongly decided and that patent holders should not be able to dominate research and development during the patent term in a manner that would result in the improper effective extension of the right to exclude beyond the patent term (due to the need to obtain regulatory approval).[35] Specifically, Congress created new section 271(e)(1), which excepted from infringement any making, using, or selling of a patented invention "solely for uses reasonably related to the development and submission of information under a Federal law which regulates . . . drugs."[36]

In section 271(e)(1), Congress codified broad categorical language that implicitly rejected the narrow *Bolar* construction of the experimental-use exception in the particular context of human drug development.[37] Section 271(e)(1) protects experimenters and their suppliers by excepting from infringement sales for the specified experimental uses. Further, and relevant to the research tool question, the language of section 271(e)(1) encompasses experiments performed by commercial entities with the intent

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31. 733 F.2d 858 (Fed. Cir. 1984).

32. *Id.* at 862-63.

33. *Id.* at 863.

34. *See* 35 U.S.C. §§ 155, 155A, 156, 271(e) (2000 & Supp. II 2002).

35. *See, e.g.*, H.R. REP. NO. 98-857, pt. 2, at 60-61 (1984); H.R. REP. NO. 98-857, pt. 1, at 46 (1984).

36. Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, § 202, 98 Stat. 1585, 1603 (1984) (codified as amended at 35 U.S.C. § 271(e)(1)). Congress later extended the exception to offers to sell and imports and to approval of veterinary biological products. *See* Generic Animal Drug and Patent Term Restoration Act, Pub. L. No. 100-670, § 201, 102 Stat. 3971, 3988 (1988) (codified as amended at 35 U.S.C. §§ 156, 271 (2000 & Supp. III 2003); Uruguay Round Agreements Act, Pub. L. No. 103-465, § 533, 108 Stat. 4809, 4988 (1994) (codified as amended in scattered sections of 35 U.S.C.).

37. *See* Eli Lilly & Co. v. Medtronic, Inc., 872 F.2d 402, 406 (Fed. Cir. 1989) (citing 35 U.S.C. § 271(a), (e)(1)).

subsequently to market products. Moreover, section 271(e)(1) does not on its face distinguish among types of patented inventions or among their roles in regard to experiments designed to obtain regulatory approval. Thus, not only does the exception cover pharmaceuticals being tested for regulatory approval, but it might also arguably be interpreted to cover the use of a patented syringe to draw blood in order to perform that testing. In *Eli Lilly & Co. v. Medtronic, Inc.*,[38] the Supreme Court subsequently interpreted section 271(e)(1) to apply not only to patented inventions used in human drug development, but also to inventions used in developing information for all products requiring pre-market approval by the FDA and subject to the patent term extension provisions of the U.S. patent law.[39]

C. Subsequent Federal Circuit Interpretations Narrowly Construing the Experimental-Use Exception

Since Congress revised section 271 in 1984, the Federal Circuit has narrowly construed the experimental-use exception. In 2000, in *Embrex, Inc. v. Service Engineering Corp.*,[40] the Federal Circuit reiterated language from *Bolar* that the experimental-use exception does not apply when the experiments have "definite, cognizable, and not insubstantial commercial purposes."[41] The court upheld a jury verdict of infringement of a patent for a method of injecting eggs based on injection tests performed by scientists, who were employed by a company that unsuccessfully sought to demonstrate a commercial vaccination machine for use as an alternative to the patented method. Specifically, the court held that the tests did not qualify as *de minimis* infringement or as experimental use, given that the tests were performed "expressly for commercial purposes."[42]

In 2002, in *Madey v. Duke University*,[43] the Federal Circuit held for the first time that the experimental-use exception may not apply to university-based scientific research. The District Court had granted summary judgment of noninfringement to Duke for constructing and using (in ways that allegedly were not authorized under a federal government contract, as Duke would have no liability if the use was so authorized)[44] certain free electron lasers and microwave guns that embodied the claims of two pa-

38. 496 U.S. 661 (1990).

39. *See id.* at 669-78; 35 U.S.C. § 156 (2000 & Supp. II 2002).

40. 216 F.3d 1343 (Fed. Cir. 2000).

41. *Id.* at 1349 (quoting Roche Prods. Inc. v. Bolar Pharms. Co., 733 F.2d 858, 863 (Fed. Cir. 1984)).

42. *Id.*

43. 307 F.3d 1351 (Fed. Cir. 2002).

44. *See* 28 U.S.C. § 1498 (2000).

tents.[45] The Federal Circuit reversed, holding that its precedents obligated it to recognize a "judicially created experimental use defense, however, in a very limited form."[46] That exception "does not immunize use that is in any way commercial in nature . . . [or] that is in keeping with the alleged infringer's legitimate business, regardless of commercial implications."[47]

With regard to universities, the court in *Madey* noted that scientific research "projects unmistakably further the institution's legitimate business objectives, including educating and enlightening students and faculty participating in these projects. These projects also serve, for example, to increase the status of the institution and lure lucrative research grants, students, and faculty."[48] The court thus remanded for further evaluation of "the legitimate business Duke is involved in and whether or not the use was solely for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry."[49] On remand, the District Court found that Duke had presented no evidence to suggest that its experiments were not "in keeping with its legitimate business as an educational institution" and thus denied Duke's motion for summary judgment but left the issue open for proof at trial.[50]

Few reported district court cases have addressed the experimental-use exception since the *Madey* decision. Those cases that do so either have reiterated the narrow scope of the exception or have simply referred to *Madey* as binding precedent.[51] In *Integra Lifesciences I Ltd. v. Merck KGaA*,[52] the Federal Circuit suggested in dicta that the experimental-use exception is not only narrow but also based on the concept of *de minimis* damages rather than the lack of infringement.[53] In contrast, a dissenting opinion suggested that the exception is significantly broader—i.e., that the

45. *Madey*, 307 F.3d at 1352.

46. *Id*. at 1360; *see also id.* at 1361 (recognizing the exception exists "in the very narrow form articulated by this court" in *Embrex* and *Bolar*).

47. *Id.* at 1362.

48. *Id.*

49. *Id.* at 1363.

50. Madey v. Duke Univ., 336 F. Supp. 2d 583, 591-92 (M.D.N.C. 2004).

51. *See, e.g.*, Eli Lilly & Co. v. Emisphere Techs., Inc., 408 F. Supp. 2d 668, 678 n.2 (S.D. Ind. 2006) (noting pleading of experimental-use defense to infringement counterclaim, and citing to *Madey* for a discussion of the doctrine, but refusing to address the issue as premature); Third Wave Techs., Inc. v. Stratagene Corp., 381 F. Supp. 2d 891, 911-12 (W.D. Wis. 2005) (rejecting arguments that testing of products for cleaving nucleic acids that might infringe patented cleaving methods allegedly to obtain FDA approval for the products would not qualify as experimental use, given the narrow scope of the exception in *Madey* and the commercial motivation to market the products).

52. 331 F.3d 860 (Fed. Cir. 2003).

53. *Id.* at 863-64 n.2.

"subject matter of patents may be studied in order to understand it, or to improve upon it, or to find a new use for it, or to modify or 'design around' it."[54]

D. Proposals for Legislation to Codify a Broader Experimental-Use Exception

Since *Bolar*, Congress has, on a few occasions, proposed legislation to codify a broader experimental-use exception. But these efforts have not resulted in adoption of a change to the law. For example, in 1990, Congress introduced a bill that would have excepted from infringement any making and use for "research or experimentation purposes," unless the primary purpose of the patented invention was for research (i.e., intended for use as a research tool), in which case it would not be an act of infringement to study the invention or use it to develop new inventions outside the scope of the patent.[55] Similarly, in 2002, Congress introduced a bill that would have excepted from infringement any patented genetic sequences "for purposes of research," which would not apply to commercial manufactures and sales.[56] In contrast, in 2007, Congress introduced a bill that would prospectively ban the patenting of any "nucleotide sequence, or its functions or correlations, or the naturally occurring products it specifies."[57] The bill thus would preclude a particular category of patents (not only gene patents but all patents on polynucleotides), which may be used as research tools. However, the biotechnology industry and others have expressed significant opposition to the bill,[58] and it currently appears unlikely to be enacted into law.

In 2002, the Federal Trade Commission (FTC) heard testimony on the effects of research tool patents on third-party research and innovation.[59]

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54. *Id.* at 875 (Newman, J., concurring in part and dissenting in part).

55. Patent Competitiveness and Technological Innovation Act of 1990, H.R. 5598, 101st Cong. § 402 (1990) (proposed 35 U.S.C. § 271(j)).

56. Genomic Research and Diagnostic Accessibility Act of 2002, H.R. 3967, 107th Cong. § 2 (2002) (proposed 35 U.S.C. § 271(j)(1)).

57. Genomic Research and Accessibility Act, H.R. 977, 110th Cong. § 2 (2007) (proposed 35 U.S.C. § 106).

58. *See, e.g.*, *Stifling or Stimulating—The Role of Gene Patents in Research and Genetic Testing: Hearing Before the Comm. on The Judiciary Subcomm. on Courts, the Internet and Intellectual Property*, 110th Cong., at 73-77 (2007) [hereinafter *Hearings*] (statements of Jeffrey Kushan on behalf of the Biotechnology Industry Organization and E. Jonathan Soderstrom, Managing Director, Office of Cooperative Research, Yale University).

59. FTC, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY, executive summary, at 3-4, ch. 3, at 18-20, ch. 4, at 34-36

The hearing, which addressed many issues, "involved more than 300 panelists, including business representatives from large and small firms, and the independent inventor community; leading patent and antitrust organizations; leading antitrust and patent practitioners; and leading scholars in economics and antitrust and patent law."[60] Various panelists voiced general approval for codifying a broader experimental-use exemption that would apply to research directed at understanding if and how a patented invention works (recall the statement in *Whittemore* regarding sufficiency of the machine to produce its desired effects).[61] They were more divided on the question of whether an exception should apply to research directed at improvement or follow-on innovation resulting from use of patented research tools. They generally rejected the idea of providing an exemption for use of a research tool to develop another product.[62] A report based on the hearings concluded that developers of research tools "need an income stream from those who use their inventions" and that the "hearing record provides no basis for exempting such tools from patent protection."[63]

Proposals to explicitly codify an experimental-use exception have also come from the private sector. A 2004 report sponsored by the National Academy of Sciences (NAS) recommended codification of an experimental-use exception in light of *Madey*, given that "there should be some level of protection for noncommercial uses of patented inventions."[64] The report also recommended taking various administrative actions to ensure access, given that legislative enactment might not occur.[65] Some members of the committee consulted in the preparation of the report expressed the opinion that any codified experimental-use exception should be conditioned upon the researcher agreeing to refrain from patenting the results of the protected research, "the results of the research not undermining a patentee's commercial markets, a covenant not to use the research results for commercial purposes, and provision for terminating the exemption if the protected research yields patents that are asserted against another party lacking the exemption."[66]

(2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf [hereinafter FTC, TO PROMOTE INNOVATION].

60. *Id.*

61. *Id.* ch. 4, at 34-36.

62. *Id.* ch. 4, at 36.

63. *Id.*

64. *See* NAT'L RESEARCH COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY 82, 109 (Stephen A. Merrill et al. eds., 2004) [hereinafter PATENT SYSTEM].

65. *See id.* at 108-17.

66. *See id.* at 115.

Later in 2004, the American Intellectual Property Lawyer's Association (AIPLA) endorsed the NAS recommendation and proposed language for a broader codified experimental-use exception.[67] Specifically, the AIPLA proposal would have excepted from infringement the acts of:

> (1) evaluating the validity of the patent and the scope of protection afforded under the patent; (2) understanding features, properties, inherent characteristics or advantages of the patented subject matter; (3) finding other methods of making or using the patented subject matter; and (4) finding alternatives to the patented subject matter, improvements thereto or substitutes therefor.[68]

In 2006 the NAS published a report focused more specifically on the impact of patents on genomic and proteomic research.[69] This report recommended:

> Congress should consider exempting research "on" inventions from patent infringement liability. The exemption should state that making or using a patented invention should not be considered infringement if done to discern or to discover:
>
> a. the validity of the patent and scope of afforded protection;
>
> b. the features, properties, or inherent characteristics or advantages of the invention;
>
> c. novel methods of making or using the patented invention; or
>
> d. novel alternatives, improvements, or substitutes.
>
> Further making or using the invention in activities incidental to preparation for commercialization of noninfringing alternatives also should be considered noninfringing. Nevertheless, a statutory research exemption should be limited to these circumstances and not be unbounded. In particular, it should not extend to unauthorized use of research tools for their intended purpose, in other words, to research "with" patented inventions. According-

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67. *See* AM. INTELLECTUAL PROP. LAW ASS'N, AIPLA RESPONSE TO THE NATIONAL ACADEMIES REPORT ENTITLED "A Patent System for the 21st Century" 23-27 (2004), *available at* http://www.aipla.org/Content/ContentGroups/Issues_and_Advocacy/Comments2/Patent_and_Trademark_Office/2004/NAS092304.pdf [hereinafter AIPLA RESPONSE].

68. *Id.* at 25.

69. COMM. ON INTELLECTUAL PROPERTY RIGHTS IN GENOMIC & PROTEIN RESEARCH & INNOVATION, NAT'L RESEARCH COUNCIL, REAPING THE BENEFITS OF GENOMIC AND PROTEOMIC RESEARCH: INTELLECTUAL PROPERTY RIGHTS, INNOVATION, AND PUBLIC HEALTH (2006) [hereinafter REAPING THE BENEFITS].

> ly, our recommendation would not address the circumstances of the *Madey* case, which clearly entailed research "with" the patented laser; but it would shield some types of biomedical research involving patented subject matter.[70]

Scholars also have debated for many years the need for the U.S. to implement an expanded experimental-use exception.[71] Some have advocated the creation of broad exemptions for use of patented technologies by university and nonprofit researchers,[72] while others have pointed out a host of practical difficulties that might arise if such plans were implemented.[73] Some worry that a broad experimental-use exception would remove incentives for the development of new research tools.[74] Others question whether patent protection is needed to develop research tools, although often recognizing that patents can play a useful role when investment is needed to make the technology practically available.[75] Some commentators have proposed application of the doctrine of fair use to promote access to re-

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70. *Id.* at 145.

71. *See, e.g.*, HAROLD C. WEGNER, PATENT LAW IN BIOTECHNOLOGY, CHEMICALS & PHARMACEUTICALS 460 *passim* (2d ed. 1994); Lauren C. Bruzzone, *The Research Exception: A Proposal*, 21 AIPLA Q.J. 52 *passim* (1993); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017 *passim* (1989); Irving N. Feit, *Biotechnology Research and the Experimental Use Exception to Patent Infringement*, 71 J. PAT. & TRADEMARK OFF. SOC'Y 819, 832 (1989); Steven J. Grossman, *Experimental Use or Fair Use as a Defense to Patent Infringement*, 30 IDEA 243, 247 (1990); Ned A. Israelsen, *Making, Using, and Selling Without Infringing: An Examination of 35 U.S.C. Section 271(e) and the Experimental Use Exception to Patent Infringement*, 16 AIPLA Q.J. 457, 458, 472, 474 (1988-1989); Suzanne T. Michel, Comment, *The Experimental Use Exception to Infringement Applied to Federally Funded Inventions*, 7 HIGH TECH. L.J. 369, 376, 389 (1992); Patricia M. Thayer & Richard A. De Liberty, *The Research Exception to Patent Infringement: The Time Has Come for Legislation*, 4 J. BIOLAW & BUS. 15 *passim* (2000); Jordan P. Karp, Note, *Experimental Use as Patent Infringement: The Impropriety of a Broad Exception*, 100 YALE L.J. 2169, 2170 (1991).

72. *See, e.g.*, Eyal H. Barash, Comment, *Experimental Uses, Patents, and Scientific Progress*, 91 NW. U. L. REV. 667, 699-700 (1997); Kevin Sandstrom, Note, *How Much Do We Value Research and Development?: Broadening the Experimental Use Exemption to Patent Infringement in Light of* Integra Lifesciences I, Ltd. v. Merck KGaA, 331 F.3d 860 (Fed. Cir. 2003), 30 WM. MITCHELL L. REV. 1059, 1111 (2004).

73. *See, e.g.*, Elizabeth A. Rowe, *The Experimental Use Exception to Patent Infringement: Do Universities Deserve Special Treatment?*, 59 ME. L. REV. 283, 308-10 (2007).

74. *See, e.*g., Mueller, supra note 8, at 39-40.

75. *See, e.g.*, Michael S. Mireles, *States as Innovation System Laboratories: California, Patents, and Stem Cell Technology*, 28 CARDOZO L. REV. 1133, 1152 (2006).

search tools,[76] but others have criticized this approach.[77] A number of scholars have proposed hybrid systems combining limited experimental-use exceptions with compulsory licensing or other alternative approaches, some of which are discussed in more detail below in Part VII.[78]

E. *Merck v. Integra*: Initial Federal Circuit and Subsequent Supreme Court Interpretations of the Regulatory-Approval Exception

In *Integra Lifesciences I Ltd. v. Merck KGaA,*[79] the Federal Circuit assessed the boundary between the experimental-use exception and the regulatory-approval exception of section 271(e)(1) in the context of the drug development and regulatory-approval process. The district court held that the use of patented materials in early-stage experiments assessing the materials' potential applicability to cancer treatment[80] qualified for the experimental-use exception.[81] In contrast, the district court held that later experiments conducted before performing human clinical trials (some of which, as discussed below, may have been research tool uses) did not qualify for the regulatory-approval exception.[82] Integra did not appeal the experimental-use exception holding for the early stage experiments, even though they likely had been performed with ultimate commercial pharmaceutical applications in mind. Merck appealed the holding that section 271(e)(1) did not apply to the subsequent preclinical experiments, and the Federal Circuit affirmed.[83] Specifically, the Federal Circuit noted that these experiments were not "solely for uses reasonably related to the development and submission of information," because they did not "reasonably relate to the development and submission of information for FDA's safety and effectiveness approval processes."[84] In contrast, the dissent would have held that the regulatory-approval and experimental-use exceptions should be read co-extensively to avoid any gap in coverage, and thus

76. *See, e.g.*, Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1249-50 (2000).

77. *See, e.g.*, Rowe, *supra* note 73, at 309-10.

78. *See, e.g.*, Katherine J. Strandburg, *What does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 143-144.

79. 331 F.3d 860 (Fed. Cir. 2003).

80. The experiments assessed the patented materials' potential to block certain receptors and thereby inhibit blood vessel proliferation. *Id.* at 863.

81. *See* Merck KGaA v. Integra LifeSciences I, Ltd., 545 U.S. 193, 200 (2005),

82. *See id.* at 201.

83. *See id.*

84. *Integra LifeSciences I, Ltd.,* 331 F.3d at 866 (quoting 35 U.S.C. § 271(e)(1)).

that "the statutory immunity of § 271(e) takes effect wherever the research exemption ends."[85]

In 2005, the Supreme Court in *Merck, KGaA v. Integra LifeSciences I Ltd.*[86] reversed the Federal Circuit's narrow construction of the regulatory-approval exception of section 271(e)(1), but did not resolve whether a gap exists between the two exceptions and expressly refused to address whether section 271(e)(1) applies to patented inventions used as research tools.[87] The Court held that the exception was not limited to tests that generate safety and effectiveness data; rather, it included any tests (including basic research on biological mechanisms) that might generate data submitted to the FDA:

> At least where a drugmaker has a reasonable basis for believing that a patented compound may work, through a particular biological process, to produce a particular physiological effect, and uses the compound in research that, if successful, would be appropriate to include in a submission to the FDA, that use is "reasonably related" to the "development and submission of information under . . . Federal law."[88]

Following the *Merck* Supreme Court decision, commentators have noted that research tools were involved in at least some of the allegedly infringing experiments at issue on appeal, notwithstanding the parties' arguments to the contrary. For example, the patented materials at issue were used as positive controls to measure the effectiveness of other materials.[89] Use as an experimental control is a research tool use because the materials are not the object of the experiment but rather supply the means to conduct it. Commentators also have raised concerns that application of section 271(e)(1) to research tool inventions would eviscerate patent rights and incentives.[90] To avoid this result, they have argued that the term "pa-

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85. *Id.* at 875-76 (Newman, J., concurring in part and dissenting in part).

86. 545 U.S. 193 (2005).

87. *Id.* at 205 n.7.

88. *Id.* at 207 (quoting 35 U.S.C. § 271(e)(1)).

89. *See, e.g.*, Paul Wiegel, *Was the FDA Exemption to Patent Infringement, 35 U.S.C. § 271(e)(1), Intended to Exempt a Pharmaceutical Manufacturer's Activities in the Development of New Drugs?*, 2007 B.C. INTELL. PROP. & TECH. F. 112901 (2007); Benjamin G. Jackson, Note, *Merck v. Integra: Bailing Water Without Plugging the Hole*, 20 BYU J. PUB. L. 579, 596 (2006) (noting the court's statement that "Scripps used the RGD peptide in . . . tests as 'positive controls' against which to measure the efficacy of the mimetics").

90. *See, e.g.*, Daniel J. Ford, Merck v. Integra*: Implications for the Common Law and Statutory Exemptions*, 7 LOY. L. & TECH. ANN. 123 (2007); Vihar R. Patel, *Are Patented Research Tools Still Valuable? Use, Intent, and a Rebuttable Presumption: A Pro-*

tented inventions" within section 271(e)(1) should be interpreted to be limited to patented drug and medical device inventions that are subject to regulatory approval and term extension under section 156, which was the focus of the broader legislation enacting section 271(e)(1).[91]

In contrast, other commentators have suggested that the effects of the *Merck* decision on research tool inventions will be minimal, because "the sanctioned research is *into*, not *using*, patented technology and patents have a smaller impact on research tools and instruments than on drug development."[92] Other commentators have suggested expanding the exception further to minimize incentives for drug companies to "outsourc[e] their early stage research from the United States,"[93] to jurisdictions where broader experimental-use exceptions exist or where patent rights in research tool inventions do not exist.

F. Cases Interpreting the Regulatory-Approval Exception Since the 2005 Supreme Court Decision in *Merck*

Cases since *Merck* have for the most part followed the trend of construing the regulatory-approval exception of section 271(e)(1) broadly, with some notable exceptions discussed later in this section. For example, on remand from the Supreme Court the Federal Circuit held in *Integra Lifesciences I Ltd. v. Merck KGaA*[94] that section 271(e)(1) applied to experiments with patented compounds that at the time were candidates for, but were not ultimately the subject of, the regulatory-approval application.[95] The experiments developed information "after the biological mechanism and physiological effect of a candidate drug have been recognized, such that if the research is successful it would appropriately be included in a

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posed Modification for Analyzing the Exemption from Patent Infringement Under 35 U.S.C. 271(e)(i), 47 IDEA 407 (2007); Tara Stuart, Comment, *Has the Supreme Court Incorrectly Expanded § 271(e)(1) to Risk a Regulatory Taking?*, 5 J. MARSHALL REV. INTELL. PROP. L. 216 (2006); Anna McMinn, Note, *Judicial Interpretation of 35 USC § 271(e)(1): An Improper Expansion Beyond the Legislative Intent*, 16 ALB. L.J. SCI. & TECH. 195 (2006).

91. *See* 35 U.S.C. § 156 (2000 & Supp. II 2002); Pierce, *supra* note 24. A patent holder has also made this argument in litigation. *See, e.g.*, Oral Arguments in Proveris Sci. Corp. v. Innovasystems, Inc., 536 F.3d 1256 (Fed. Cir 2008) (No. 2007-1428), *available at* http://oralarguments.cafc.uscourts.gov/mp3/2007-1428.mp3.

92. Daniel A. Lev, *A Realist Approach to* Merck KGaA v. Integra, 5 NW. J. TECH. & INTELL. PROP. 135, 150 (2006) (emphasis added).

93. Katherine A. Helm, Note, *Outsourcing the Fire of Genius: The Effects of Patent Infringement Jurisprudence on Pharmaceutical Drug Development*, 17 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 153 (2006).

94. 496 F.3d 1334 (Fed. Cir. 2007).

95. *Id.* at 1347.

submission to the FDA."[96] Significantly, the court held that whether the experiments were "reasonably related" to submission "does not depend on the success or failure of the experimentation or actual submission of the experimental results."[97]

The Federal Circuit also held in 2008, in *Amgen, Inc. v. Roche Holding Ltd.*,[98] that section 271(e)(1) applies to patent infringement actions brought under section 337 of the Tariff Act of 1930.[99] Section 337 prohibits importation and sale after importation of articles that infringe a valid U.S. patent or that are produced by a process covered by a valid U.S. patent.[100] Amgen had argued that the regulatory-approval exception of section 271(e)(1) did not apply to section 337 actions for products of patented processes, given that the language of section 271(e)(1) excepts only a "patented invention" and that Congress had stated an intent to preserve section 337 remedies when it separately provided infringement liability for importing products of patented processes.[101] The Federal Circuit upheld the Commission's interpretation that section 271(e)(1) applies to section 337 actions, based on a "broadly stated Congressional policy" in the legislative history of section 271 that importing products made by patented processes for regulatory approval should not constitute patent infringement and on Supreme Court statements that in enacting section 271(e)(1) Congress "intended that the immunity of regulatory activity not be inhibited."[102] However, the Federal Circuit remanded the case to the Commission to determine whether to provide a remedy against potential infringement that might occur after a regulatory-approval decision, when section 271(e) would no longer be applicable.[103]

Several district court decisions have also interpreted 271(e)(1) broadly. For example, in *Classen Immunotherapies, Inc. v. Biogen IDEC*[104] a district court held that 271(e)(1) applies to activities aimed at generating data for post-approval submissions to FDA.[105] The alleged infringing activities involved examining risks associated with the administration of vaccines

96. *Id.* at 1339; *see id.* at 1340.
97. *Id.* at 1341.
98. 519 F.3d 1343 (Fed. Cir. 2008).
99. *Id.* at 1345.
100. 19 U.S.C. § 1337(a)(1)(B)(i)-(ii) (2000).
101. 35 U.S.C. § 271(e)(1) (2000); *see* 35 U.S.C. § 271(g) (2000); 19 U.S.C. § 2901(b)(10) (2000); *Amgen,* 519 F.3d at 1346-47.
102. *Amgen,* 519 F.3d at 1348 (citing S. Rep. No. 100-83, 48 (1987) and Merck KGaA v. Integra LifeSciences I, Ltd., 545 U.S. 193, 202 (2005)).
103. *Id.* at 1350-53.
104. 381 F. Supp. 2d 452 (D. Md. 2005).
105. *Id.* at 456.

that had already secured FDA marketing approval and submitting the data under FDA regulations.[106] The court dismissed infringement claims against defendants for participating in the studies, given the broad construction of section 271(e)(1) in *Merck*.[107] Specifically, the district court rejected the argument that section 271(e)(1) applied only to data for regulatory decisions made before initial regulatory approval to market products.[108]

Similarly, in *Genentech, Inc. v. Insmed Inc.*,[109] a district court held that section 271(e)(1) applies to experiments conducted in part for commercial reasons unrelated to an FDA submission, so long as "the experiments would produce information that would be given to the FDA in order to get FDA approval."[110] The court granted summary judgment to a defendant that had supplied patented insulin-like growth factor for use in the arguably commercial experiments.[111]

Two decisions have found section 271(e)(1) applicable to activities arguably involving the use of patented technology as a research tool. In *Classen Immunotherapies, Inc. v. King Pharmaceuticals, Inc.*,[112] the patents at issue addressed methods of identifying and commercializing new uses of existing drugs, and infringement was alleged based on the submission of data generated using the patented methods to the FDA.[113] The district court held the experiments were reasonably related to the submission of information to the FDA and found "extension of the safe harbor to cover the use of these tools warranted by the language of *Merck* and a plain reading of the statute."[114]

Integra Lifesciences I Ltd. v. Merck KGaA[115] also arguably applied 271(e)(1) to the use of research tools.[116] Noting that the parties agreed that the patented compounds were not used as research tools, the majority opinion did not address the issue of whether section 271(e)(1) applies to patented inventions used as research tools.[117] However, the dissent argued that the decision did apply to research tools as some of the patents claimed

106. *Id.* at 454.
107. *Id.* at 455-56.
108. *Id.*
109. 436 F. Supp. 2d 1080 (N.D. Cal. 2006).
110. *Id.* at 1095.
111. *Id.* at 1094-95.
112. 466 F. Supp. 2d 621 (D. Md. 2006).
113. *Id.* at 623-24.
114. *Id.* at 625 n.2.
115. 496 F.3d 1334 (Fed. Cir. 2007).
116. *Id.* at 1348.
117. *Id.* at 1347.

methods that could not have been potential regulatory-approval drug candidates.[118] The dissent thus argued that the holding effectively "eliminate[s] protection for research tool inventions."[119] Commentators have also concluded that research tools were involved in at least some of the allegedly infringing experiments at issue on appeal, notwithstanding the parties' arguments to the contrary.[120]

Several court decisions have found substantive or procedural limitations to the application of section 271(e)(1). For example, in *Amgen, Inc. v. F. Hoffman-LaRoche Ltd.,*[121] a district court held that section 271(e)(1) is an affirmative defense, rather than "part of the statutory definition of infringement that [the plaintiff] must establish."[122] Accordingly, the district court rejected a motion to dismiss for failure to state a claim, given that the plaintiff had sufficiently alleged infringement without pleading specific acts of infringement that fell outside the scope of section 271(e)(1).[123] Further, the complaint alleged importation of an allegedly infringing patented drug, which was sufficient given that the district court could not conclude as a matter of law that importation was solely for uses reasonably related to submitting information for regulatory approval.[124]

In *Forest Laboratories, Inc. v. Ivax Pharmaceuticals, Inc.*, the Federal Circuit upheld a prospective but limited injunction against a foreign producer of patented drug products that was supplying production information and would supply products for experiments within the scope of the regulatory-approval exception of section 271(e)(1).[125] The injunction prohibited the domestic experimenter from commercial exploitation following FDA approval and during the life of the patent, and the court held it was appropriate to include the foreign producer as such supply would induce infringement under section 271(b) following such approval.[126]

Finally, in *Proveris Scientific Corp. v. Innovasystems, Inc.*,[127] the Federal Circuit held that the sale of a device intended solely for use in generating data for submission to FDA, and only sold to pharmaceutical com-

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118. *Id.* at 1350-51 (Rader, J., concurring in part and dissenting in part).
119. *Id.* at 1348.
120. *See* Jackson, *supra* note 89, at 595-98; Wiegel, *supra* note 89.
121. 456 F. Supp. 2d 267 (D. Mass. 2006).
122. *Id.* at 273 (quoting Amgen, Inc. v. Hoechst Marion Roussel, Inc., 3 F. Supp. 2d 104, 109 (D. Mass. 1998)).
123. *Id.* at 274.
124. *Id.*
125. Forest Labs., Inc. v. Ivax Pharms., Inc., 501 F.3d 1263 (Fed. Cir. 2007).
126. *Id.* at 1272.
127. 536 F.3d 1256 (Fed. Cir. 2008).

panies or the FDA, does not fall within the section 271(e)(1) safe harbor.[128] In reaching its decision, the court ruled that such a device is not a "patented invention" within the meaning of 271(e)(1) because it "is not subject to FDA premarket approval, and therefore faces no regulatory barriers to market entry upon patent expiration."[129] For this reason, the court did not "think Congress could have intended that the safe harbor of section 271(e)(1) apply to it."[130]

In summary, the Federal Circuit has narrowed and clarified the scope of the experimental-use exception, and under that scope almost no scientific research, including university-based, nonprofit basic research, will qualify for the exception. Such research is likely to be performed with commercial intent or to further the legitimate business of the experimenter's business. In contrast, the Supreme Court has expanded the scope of the regulatory-approval exception of section 271(e)(1), which will apply to a broad range of experiments that may generate data that regulators would be interested in reviewing. However, the limits of the regulatory-approval exception remain unclear. In particular, the courts have yet to draw clear lines for determining: (1) in regard to scientific experimentation not excepted from infringement under the experimental-use exception, when protected regulatory-approval activities begin; (2) whether and under what circumstances patented research tools may be subject to the regulatory-approval exception because they are used in a manner reasonably relating to development and submission of information to the FDA; and (3) when such patented research tools should be considered made, used, or sold solely for regulatory-approval purposes. However, unless the Federal Circuit's approach in the *Proveris* case is later revised or reversed, patented research tools will not be subject to the regulatory-approval exception unless they are themselves potentially subject to FDA premarket approval.

IV. RECENT STUDIES OF SCIENTIFIC RESEARCHER AND PATENT HOLDER PRACTICES

This Part discusses the existing studies of the practices of scientific researchers and patent holders regarding the researchers' acquisition of patented technologies used as research tools, and liability for such research uses. The empirical analysis is important, not only to understand the effects of the legal developments described above, but also to discern potential trends in regard to changing social practices or the need for further

128. *Id.* at 1266.
129. *Id.* at 1265.
130. *Id.*

changes to the legal rules. Unfortunately, the factual results of the surveys are subject to dispute regarding what they suggest for continuation of or changes to existing patent system policies.

A number of studies have been conducted to evaluate the effects of *Madey*, particularly regarding whether patents on inventions intended to function as research tools have impeded or delayed basic scientific research. These concerns reflect earlier theoretical work regarding the potential for development of an "anticommons," or patent thicket requiring licensing of multiple patented inputs, that would result in higher costs, delay, and potentially abandonment of important scientific research (particularly in regard to biomedical and gene-based research).[131] These concerns also reflect the fact that genetic inventions are fundamental, and thus patents on genetic sequences cannot be designed around.[132] The results of these studies demonstrate that relatively few serious problems have resulted from the expanded legal potential for patent liability for use of patented research tools, particularly in regard to use by academic researchers, but suggest that these problems are growing. This may be because patent holders have not aggressively asserted their patents against scientific researchers and because such researchers have continued to act in ways that, in light of the *Madey* decision, infringe those patents. The studies also demonstrate that there has been an increase in warning letters and internal efforts at universities to discourage patent infringement, but neither have yet had significant effects on researcher behavior. Stated differently, there is a significant gap between the law on the books and the practices to which the law applies, and the stability of the current situation remains a subject of significant concern.

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131. *See, e.g.*, Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 *passim* (1998); Kyle Jensen & Fiona Murray, *Intellectual Property Landscape of the Human Genome*, 310 SCIENCE 239, 239-40 (2005); Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting, in* 1 INNOVATION POLICY AND THE ECONOMY 119, 120 (Adam Jaffe et al. eds., 2001); *cf.* Lori Andrews et al., *When Patents Threaten Science*, 314 SCIENCE 1395, 1395-96 (2006). *But see* TED BUCKLEY, BIOTECHNOLOGY INDUS. ORG. [BIO], THE MYTH OF THE ANTICOMMONS (2007) *available at* http://www.bio.org/ip/domestic/TheMythoftheAnticommons.pdf; Timothy Caulfield et al., *Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies*, 24 NATURE BIOTECHNOLOGY 1091, 1091-94 (2006).

132. *See, e.g.*, John H. Barton, *Emerging Patent Issues in Genomic Diagnostics*, 24 NATURE BIOTECHNOLOGY 939 (2006).

A. The Walsh, Arora, and Cohen Study (2003)

Around the time of *Madey*, various researchers studied the effects of research tool patents on biomedical innovation, as part of broader research, commissioned by the NAS Board on Science, Technology, and Economic Policy (STEP), leading to proposals for reforming the U.S. patent system.[133] In the Walsh, Aurora and Cohen study, the researchers specifically sought to address two questions: (1) "whether an emergent anticommons is in fact impeding the development and commercialization of new drugs, diagnostics, and other therapies"; and (2) "whether restricted access to patents on upstream, foundational discoveries is blocking important follow-on research and innovation."[134]

More specifically, the researchers "conducted 70 interviews with IP attorneys, business managers, and scientists from 10 pharmaceutical firms and 15 biotechnology firms, as well as university researchers and technology transfer officers from 6 universities, patent lawyers, and government and trade association personnel."[135] The interviews probed whether proliferation of patents had resulted in failures to license beneficial patented technologies and whether patents on upstream discoveries had impeded subsequent research. The researchers identified the development of "defensive" patenting strategies in genomics (where patents are obtained principally as a method of discouraging litigation rather than for use in protecting the patented innovation),[136] and that "different parties with different agendas" owned research tool patents.[137] Nevertheless, the researchers found that the number of ongoing R&D projects stopped due to patent problems was "small,"[138] finding little evidence that patent-holding entities were refusing to license needed technologies, that the need to license multiple patents was resulting in excessive royalties, or that the increased costs of licensing individual research tool patents were unreasonable (given beliefs that the "productivity gains conferred by the licensed

133. *See* John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 10, at 285. The recommendations are published in PATENT SYSTEM, *supra* note 64.

134. Wesley M. Cohen & Stephen A. Merrill, *Introduction* to PATENTS IN THE KNOWLEDGE BASED ECONOMY, *supra* note 10, at 13.

135. John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 10, at 292.

136. *See id.* at 295.

137. *Id.* at 296.

138. *Id.* at 303.

research tools were thought to be worth the price").[139] Patent holders also generally tolerated infringing academic uses of research tools (except for diagnostic tests used in clinical research), as such use could increase the value of the technology and as legal fees, risks of having the patent narrowed or found invalid, and bad publicity from suing universities typically outweighed the potential benefits from such lawsuits.[140]

The research did not find that the growth of patents on fundamental upstream discoveries and more aggressive licensing by nonprofit research institutions, small businesses, and research universities had to that time impeded the development of drugs or other therapies in a significant way. Significantly, "firms and other institutions have developed a number of 'working solutions' that limit the effects of the intellectual property complexities that exist," including "fairly pervasive infringement of patents in the course of laboratory research at the pre-product stage."[141] Pervasive infringement was "informally rationalized as causing no commercial harm and, in any event [was believed to be] shielded from infringement liability by the court-interpreted 'research exception.'"[142] However, *Madey* clearly called these common beliefs into question, and "undermine[d] one of the working solutions that has contributed to the progress of biomedical research."[143]

In contrast, "at least for licensing relationships between universities and small firms, access to relatively upstream discoveries . . . is commonly restricted."[144] However, it was not clear that such restrictive (typically exclusive) licensing impeded follow-on discovery, given that it may lead to increased motivation for further development of the upstream technology by the licensee.[145] The study noted the potential for *Madey* to "chill" some

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139. *Id.* at 300-301. *See id.* at 298-302.

140. *See* John P. Walsh, Ashish Arora, and Wesley M. Cohen, *Working Through the Patent Problem,* 299 SCIENCE 1021 (2003) [hereinafter Walsh et al., *Working Through*].

141. Wesley M. Cohen & Stephen A. Merrill, *Introduction* to PATENTS IN THE KNOWLEDGE BASED ECONOMY, *supra* note 10, at 13; *see also* John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 10, at 322-34.

142. Wesley M. Cohen & Stephen A. Merrill, *Introduction* to PATENTS IN THE KNOWLEDGE BASED ECONOMY, *supra* note 10*,* at 13; *see* John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 10, at 324-28.

143. Wesley M. Cohen & Stephen A. Merrill, *Introduction* to PATENTS IN THE KNOWLEDGE BASED ECONOMY, *supra* note 10*,* at 13 n.4.

144. John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 10, at 309.

145. *See id.* at 309-10.

of the infringing biomedical research occurring in university settings[146] and concluded that:

> Through a combination of luck and appropriate institutional response, we appear to have avoided situations where a single firm or organization using its patents has blocked research in one or more broad therapeutic areas. However, the danger remains that progress in a broad research area could be significantly impeded by a patentholder trying to reserve the area exclusively for itself.[147]

Further, the researchers noted significant concerns with increasing secrecy of scientists and with the ability of scientists to share or to obtain access to physical materials needed for research.[148] The process of negotiating material transfer agreements had become significantly longer, resulting in delays of research and in exceptional cases in abandonment of research.[149] Conversely, some university scientists noted that commercial licensing of reagents may result in increasing access given the difficulty of alternative methods of filling demand.[150] The researchers concluded that "to the degree that the patenting of biomedical discoveries may impose additional costs and delays in material transfers, it is partly because the Bayh-Dole Act[151] and related acts have provided universities a vested commercial interest in the disposition of intellectual property."[152]

Finally, the researchers noted several institutional responses that had helped to increase access to research tools. These included the creation of public and quasi-public databases of basic research information (such as GenBank and the SNPs Consortium), and efforts of the National Institutes of Health (NIH) to negotiate greater access to research tools or to require funding recipients not to patent their research.[153] Further, researchers

146. *See id.* at 335.
147. *Id.*
148. *See id.* at 319-21.
149. *See id.* at 321.
150. *See id.* at 322.
151. *See* Act of Dec. 12, 1980, Pub. L. No. 96-517, § 6(a), 94 Stat. 3015, 3019-27 (codified in relevant part at 35 U.S.C. §§ 200-211) (commonly referred to as the Bayh-Dole Act after its legislative sponsors).
152. John Walsh, Ashish Arora & Wesley Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY, *supra* note 10, at 322.
153. *See id.* at 329.

avoided research tool patents by performing research outside the United States.[154]

B. The Walsh, Cho, Cohen Study (2005)

Following the Wash, Cohen, Arora study, some of the same researchers sought to determine what effect *Madey* may have had on practices and on their prior conclusions.[155] They surveyed 414 biomedical researchers in universities, government, and nonprofit institutions to assess their patent and patented technology acquisition practices.[156] By the time of the study, the researchers found little evidence that *Madey* had significantly changed academic patent clearance practices—finding only five percent of respondents regularly checked for patents on knowledge inputs and only two percent had begun checking since *Madey*.[157] Only eight percent of respondents believed their research used information or knowledge covered by a third-party's patent, and there was little effect of such knowledge on scientific research practices—no one reported abandoning research, about one percent changed their research approach, and about one percent were delayed by more than one month. Thus, the researchers concluded that "for the time being, access to patents on knowledge inputs rarely imposes a significant burden on academic biomedical research," noting the difference between the "law on the books" and "law in action."[158]

Nevertheless, the researchers noted (compared to five years earlier) an increase from fifteen to twenty-two percent in institutional notifications to respect intellectual property rights and a slight increase from three to five percent in warning letters from patent holders.[159] The researchers also noted more significant concerns regarding material transfers, identifying more substantial impediments to academic research from lack of physical access. Specifically, they noted that nineteen percent of respondents had their most recent request for a material denied, and that the frequency of such denials was increasing.[160] However, they were unable to conclude "whether patent policy contributes to restricted access to materials, although the commercial activities fostered by patent policy do seem to re-

154. *See* Walsh et al., *Working Through*, *supra* note 140, at 1021.

155. *See* John P. Walsh, Charlene Cho, & Wesley M. Cohen, *View from the Bench: Patents and Material Transfers*, 309 SCIENCE 2002 (2005).

156. *Id.*

157. *Id.*

158. *Id.*

159. *Id.*

160. *Id.* at 2002-03.

strict sharing, as do the burden of producing the materials and scientific competition."[161]

C. The AAAS Study (2006-2007)

In a pilot phase of the AAAS study, the survey was administered in 2005 to 4,017 AAAS members, of which 1,111 responded.[162] Of the forty-six percent of respondents who reported obtaining intellectual property for their scientific discoveries or technologies since 2001, fifty-five percent reported obtaining at least one patent, and of these forty-one percent described their most important patented invention as a research tool.[163]

In contrast, twenty-four percent of respondents had acquired patented technology for use in their research since 2001, with rates of use and sources of acquisition varying by technology and by industrial or academic setting.[164] Similarly, the methods of acquiring patented technologies (including material transfer agreements (MTAs), exclusive and nonexclusive licenses, confidentiality and sponsored research agreements, and informal transfers) and the time required to do so varied significantly among respondents, with significant percentages taking more than six months.[165]

Unlike in the Walsh, Cho, Cohen study, which used a different methodology, the AAAS study reported that forty percent of respondents found that difficulties in obtaining patented technology since 2001 had affected their research.[166] Of those respondents, fifty-eight percent reported delays in research, fifty percent reported changing their research, and twenty-eight percent reported abandoning their research.[167]

The second phase of the AAAS study produced comparable results. The survey was administered in 2006 to scientists in the United States, the United Kingdom, Germany, and Japan.[168] In the United States, the survey

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161. *Id.* at 2003.

162. STEPHEN HANSEN ET AL., THE EFFECTS OF PATENTING IN THE AAAS SCIENTIFIC COMMUNITY 5 (2006).

163. *Id.* at 7.

164. *Id.* at 14-17.

165. *Id.* at 18-20 (explaining that approximately thirty percent of respondents took more than six months in regard to acquisition by exclusive licenses).

166. *Id.* at 21; *see also id.* at 21 n.14 (noting differences in survey methodology between the studies).

167. *Id.* at 22 (reporting abandonment because of overly-complex licensing negotiations (58%), high individual royalties (49%), the patents were not licensable (40%), and licensing breakdowns (36%)).

168. SCI. & INTELLECTUAL PROP. IN THE PUB. INTEREST, AM. ASS'N FOR THE ADVANCEMENT OF SCI., EFFECTS OF INTELLECTUAL PROPERTY PROTECTIONS ON THE CONDUCT OF SCIENTIFIC RESEARCH: RESULTS OF A SURVEY OF U.S. AAAS MEMBERS 2-3 (2007).

was administered to 8,000 AAAS members, of which 2,157 responded.[169] Fifty-two percent of those respondents answering the question had created or contributed significantly to a technology considered eligible for intellectual property protection, with the largest percentage for industry, academic, and government and others acquiring at least one patent.[170] Of those acquiring patents, academics principally patented research tools (forty-five percent), in contrast to industry (twenty-eight percent).

Thirty two percent of those respondents had acquired a technology protected by intellectual property for use in their research since 2002. Of these, fifty-four percent classified their last acquired technology as a research tool.[171] Various methods were used to acquire their last technology, but a low percentage of acquired research tools involved exclusive licenses.[172]

Of those who responded that they had acquired technologies protected by intellectual property, thirty-two percent reported encountering difficulties since 2002.[173] Most research tools were acquired within one month; in contrast, most non-research tool acquisitions took longer than six months.[174] The most common problem reported was overly-complex licensing negotiations, and the most common effect for academics was delay and for industry was changed research; relatively few reported abandoning projects.[175]

D. The Holman Human Gene Patent Litigation Study (2007)

In 2007, one of the authors of this Article (Holman) published the results of a comprehensive survey, which attempted to identify (using various databases) all lawsuits that have been filed asserting infringement of a human gene patent.[176] Although human gene patents represent a relatively small subset of patents covering research tools, they have raised a disproportionate level of concern both in the United States and abroad, which has led to proposals in Congress to codify a broader experimental-use exception for gene sequence patents,[177] to limit the enforceability and reme-

169. *Id.* at 2.
170. *Id.* at 3.
171. *Id.* at 2.
172. *Id.* at 2-3 (reporting 7% for academic and 13% for industrial researchers).
173. *Id.* at 3.
174. *Id.*
175. *Id.*
176. Christopher M. Holman, *The Impact of Human Gene Patents on Innovation and Access: A Survey of Human Gene Patent Litigation*, 76 U. MO.-KAN. CITY L. REV. 295 (2007).
177. *See supra* Section III.4.

dies associated with gene patents, or to ban gene patents outright.[178] Although the Holman study does not directly address social practices or measure the extent to which research activities have been curtailed or modified due to the potential for patent liability, it does provide some objective insight into patent holder and research tool user behaviors. Other commentators have posited a correlation between assertion of a patent in court and patent value,[179] and the Holman study relies on this correlation as a useful indicator of the effects of patents on research and innovation.[180]

Holman identified a total of thirty-one distinct lawsuits involving human gene patents, only seven of which involved an allegation of infringement of a patented human gene in research (i.e., use as patented research tools). In sixteen of the lawsuits, the alleged infringer was a biotechnology company using a patented human gene in the manufacture of a recombinant therapeutic protein. In six of the lawsuits, the alleged infringer was a provider of genetic diagnostic testing services. The remaining two lawsuits involved patented DNA probes useful in forensic identification and paternity testing.[181]

None of the seven lawsuits involving patented research tools resulted in a final judicial decision. In one lawsuit, a lower court found in favor of the patent holder, but the parties settled while the case was on appeal, with the defendant reportedly paying $718,000 for "'licensing fees and other expenses.'"[182] Five of the lawsuits settled before a final ruling by the district court.[183] One lawsuit, which alleged that a nonexclusive licensee had exceeded the scope of its license, was stayed pending the results of an arbitration of the underlying contract dispute.[184]

In five of the lawsuits involving patented research tools, the patent holder was actively using the patented technology in a commercial context at the time of the lawsuit.[185] Two of the lawsuits appear to have involved nonpracticing patent holders, but both of the patent holders demonstrated a willingness to license the technology on a nonexclusive basis.[186] In all of the seven research tool lawsuits, the infringer was alleged either to be sell-

178. *See* Holman, *supra* note 176, at 295, 359.

179. *See generally* John R. Allison et al., *Valuable Patents*, 92 GEO. L. J. 435 (2004).

180. *See* Holman, *supra* note 176, at 303-04.

181. *See id.* at 323-51.

182. *Id.* at 342 (citing to Cistron Biotechnology, Inc., Annual Report (Form 10-K), Notes to Financial Statements, at n.9 (Sept. 28, 1999)).

183. *See id.* at 341-45.

184. *See id.* at 346.

185. *See id.* at 341-45.

186. *See id.*

ing the gene (or the protein encoded by the gene) as a research tool or to be employing the gene in a commercial drug discovery effort specifically targeting the protein encoded by the gene.[187] In some cases, the drug discovery was part of a company's own internal research efforts, although in one case it was conducted on a contract basis.[188]

The Holman study identified no instance in which a lawsuit was filed to address basic, noncommercial research using gene patents. This is consistent with unpublished findings of one of the authors (Holman), who searched for but was unable to identify any instance after *Madey* in which a university researcher was sued for infringement for conducting basic research of a purely noncommercial nature. It is also consistent with the often made observation that a de facto research-use exception exists for noncommercial research.[189] Reasons for the lack of such lawsuits may include the desire to rely on such research to broaden markets for research tools, and the limited damages that may be obtained for such uses relative to the costs of litigation (particularly given the uncertain legal status of reach-through royalties for any products developed from the research uses).[190]

One of the lawsuits identified in the Holman study exemplifies the reluctance of patent holders to use their patents to block noncommercial research. The defendant was engaged in substantial commercial drug development efforts targeting the protein product of the patented gene, and the patent holder was pursuing a research program targeting the same protein. The parties settled at an early stage, before any substantive rulings by the court, with the defendant agreeing to discontinue commercial drug discovery efforts involving the patented gene. However, the settlement agreement explicitly provided that the defendant and others were free to continue using the patented gene in conjunction with basic, noncommercial research activities.[191]

The Holman study also found no evidence from the lawsuits of an anticommons, or patent thicket, problem in regard to gene patents and research. If a researcher were to be sued for using a gene that is only one of multiple genes being studied, this might indicate a patent thicket problem.

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187. *See id.* at 340-42.

188. *See id.*

189. *See, e.g.*, *Hearings*, *supra* note 58 (statement of Dr. Marc Grodman, Chair of the Board & CEO, Bio-Reference Laboratories, Inc.).

190. *See, e.g.*, Bayer AG v. Housey Pharm., Inc., 228 F. Supp. 2d 467, 470-71 (D. Del. 2002) (suggesting that such reach-through royalties as contractual licensing conditions could constitute patent misuse); Holzapfel & Sarnoff, *supra* note 12, at 147 & n.12; Walsh et al., *Working Through*, *supra* note 140, at 1021.

191. Holman, *supra* note 176, at 345.

However, all of the lawsuits identified in the study allege the use of a specifically patented human gene as a central element of a substantial commercial product or research program.[192] Conversely, the Holman study provided evidence of gene patents being designed around (although not in the research tool context), and of a research tool patent being circumvented by off-shoring research activities (to Taiwan) and importing the resulting data back into the United States.[193]

Finally, the Holman study suggests that gene patent holders have generally chosen not to assert their patents against researchers using the patented technologies, choosing instead to tolerate widespread infringement. To illustrate this point, consider the 2004 study by Kyle Jensen and Fiona Murray that identified a total of 4270 human gene patents claiming 4382 human genes (roughly 20% of human genes known at the time).[194] It is reasonable to assume that a significant number of these patented genes are the subject of research in the United States.[195] However, Holman found that these 4270 patents had resulted in only six lawsuits involving eighteen patents with claims reciting thirteen distinct human genes.[196] Most of these lawsuits settled early, and the only lawsuit reaching a substantive decision held that the patent had not been infringed.[197] Furthermore, only one of the lawsuits involved the use of a patented human gene as a research tool.[198] In that case, a genomics company filed a retaliatory infringement lawsuit after being sued by a research tool company for patent infringement. The parties quickly settled under terms granting the research tool company a nonexclusive license under the gene patents.[199]

In summary, it appears that the growing numbers of patents on research tools and the expanded liability for research uses of patented inventions resulting from *Madey* have not yet led to serious problems for the conduct of scientific research in the United States. In large part, this is because there remains a widespread practice of conducting what (in light of the *Madey* decision) can now only be considered infringing research, and

192. *See id.* at 340-47.

193. *See id.* at 336-37, 344.

194. Jensen & Murray, *supra* note 131, at 239-40.

195. *See id.* at 240 (noting that "heavily patented genes tended to have relevance to human health and diseases").

196. Holman, *supra* note 176, at 353-55. Most of the litigated human gene patents found by Holman were not identified in the Jensen & Murray study. *Id.* at 355.

197. *Id.* at 353.

198. *See id.* at 343. Four of the lawsuits were brought against providers of genetic diagnostic testing services, and one against a biotechnology company producing a therapeutic protein. *Id*. at 342-46.

199. *Id.*

because patent holders have continued to restrain themselves from aggressively asserting patents. Nevertheless, the studies demonstrate an increasing trend towards restriction of access and some delays in or changes to research, and the potential exists for patent holders to expand their efforts to enforce their patents (particularly if reach-through damages become available on discoveries made using their patented research tools). Thus, significant concerns remain, particularly regarding the stability of the working solutions that have been employed in the past.

V. RECENT CHANGES TO PATENTING AND LICENSING POLICIES AND PRACTICES

This Part discusses recent licensing policies, particularly with regard to patented research tools, that have been adopted by various governmental, academic, and industrial institutions. These new policies may further affect developing scientific researcher and patent holder practices, potentially disturbing the working solutions currently in place. However, these new policies could potentially provide additional stability to the informal norms of patent infringement and forbearance of patent assertions in noncommercial contexts.

A substantial proportion of research tools patents, particularly those relating to genetics and biomedical research, arise out of government-funded and university research. Thus, one approach to addressing concerns that research tool patents might impede research and innovation is to encourage these institutions to adopt patenting and licensing practices that promote broad and nondiscriminatory access to patented research tools. Government funding agencies, including the NIH, which is the primary source of biomedical research funding in the United States, have implemented internal policies and external funding practices and have published guidelines relating to the patenting of biomedical research tools. These practices and guidelines are aimed at discouraging the patenting of certain inventions and at encouraging licensing practices that promote the dissemination of and access to biomedical research tools. Universities also have adopted patenting and licensing practices aimed at addressing concerns regarding the potential adverse effects of research tool patents.

For example, laboratories funded by the NIH and the U.S. Department of Energy (DOE) have agreed to adhere to the Bermuda Rules,[200] which encourage early and open access to genetic sequence information and dis-

200. *See* Bermuda Sequence Policies: Summary of Principles Agreed at the First International Strategy Meeting on Human Genome Sequencing, http://www.ornl.gov/sci/techresources/Human_Genome/research/bermuda.shtml#1 (last modified Oct. 29, 2003).

courage the patenting of genes by DNA sequencing laboratories.[201] The National Human Genome Research Institute (NHGRI), part of the NIH, has required that major genome sequencing centers (MGSCs) receiving grant funding agree to abide by the Bermuda Rules,[202] and NHGRI strongly encourages all of its grantees to follow these principles. The rapid public release of newly generated sequence information dictated by the Bermuda Rules serves to generate prior art that can block later patent applications. It has been suggested that prevention of DNA patenting was one factor behind the push by publicly-funded gene sequencing labs to encourage rapid entry of genetic sequence information into the public domain.[203] Although the Bermuda Rules are generally not binding on U.S. grant recipients (as most are not MGSCs funded by NHGRI), in practice a failure to abide by the rule would likely jeopardize the grantee's ability to secure future grant funding.[204]

In 1999, the NIH issued a set of principles and guidelines (the Research Tool Guidelines) that encourage grant recipients to adopt practices promoting broad access to research tools developed using NIH funds, in a manner that facilitates further biomedical research.[205] Although the Research Tool Guidelines are only directly applicable to recipients of NIH grant support, NIH expressed its hope that they would be adopted by the wider research community "so that all biomedical research and development can be synergistic and accelerated."[206] These guidelines are not regulations, and therefore are not legally enforceable. At the time they were published, the NIH expressed its view that legally enforceable regulations were not necessary, but warned that at some point in the future it might promulgate legally enforceable regulations if widespread problems continued with respect to access to NIH funded research tools.[207] NIH further noted that, on a case-by-case basis, the expectations set forth in the Re-

201. Eliot Marshall, *Bermuda Rules: Community Spirit, With Teeth*, 291 SCIENCE 1192 (2001).

202. Nat'l Human Genome Research Inst., Policy for Release and Database Depostion of Sequence Data (Dec. 21, 2000), http://www.genome.gov/10000910.

203. Rebecca S. Eisenberg, *Genomics in the Public Domain: Strategy and Policy*, 1 NATURE REVS. GENETICS 72 (2000).

204. *See* Marshall, *supra* note 201, at 1192 (stating that in 1997 U.S. officials made clear that failure to comply with the rules "could be a black mark on future grant reviews.").

205. Principles and Guidelines for Recipients of NIH Research Grants and Contracts on Obtaining and Disseminating Biomedical Research Resources, 64 Fed. Reg. 72,090 (Dec. 23, 1999) (final notice) [hereinafter Research Tool Guidelines].

206. *Id. at* 72,090.

207. *Id.*

search Tool Guidelines might be imposed as specific requirements of NIH funding awards where the grant recipient has failed to demonstrate sufficient progress in implementing the Research Tool Guidelines. "Compliance with those guidelines subsequently became an explicit consideration in the award of NIH grants and contracts.[208] The Research Tool Guidelines are reportedly regarded by at least some university technology transfer officers as de facto federal policy.[209]

The Research Tool Guidelines specifically note that "inappropriate patenting and licensing practices are likely to thwart rather than promote utilization, commercialization and public availability of research tool invention[s]."[210] According to the Guidelines, restrictive licensing practices are generally appropriate only in cases where "further research, development and private investment are needed to realize" the inventions' usefulness as a research tool.[211] In all other cases, dissemination by "publication, deposit in an appropriate databank or repository, or widespread nonexclusive licensing" of the research tool is encouraged.[212] In those instances where an exclusive license is necessary to promote investment in a commercial application of a research tool, the Guidelines state that an exclusive license should ordinarily be limited to the commercial field of use, with the grant recipient retaining rights regarding the invention's use and distribution as a research tool.[213]

The Research Tool Guidelines provide model language to be used in licensing agreements entered into by grant recipients, designed to promote broad dissemination of research tools. For example, the guidelines recommend that recipients reserve in their licenses the right of nonprofit institutions to use the licensed technologies internally.[214]

In 2005, NIH published a final notice of "Best Practices for the Licensing of Genomic Inventions" (Genomic Best Practices).[215] The Genomic Best Practices are generally consistent with the Research Tool Guidelines, although more explicit in clarifying that they represent rec-

208. Lori Pressman et al., *The Licensing of DNA Patents by US Academic Institutions: An Empirical Survey*, 24 NATURE BIOTECHNOLOGY 31, 32 (2006).

209. *Id.*

210. Research Tool Guidelines, *supra* note 205, at 72,093.

211. *Id.*

212. *Id.*

213. *Id.* at 72,095.

214. *Id.*

215. Best Practices for the Licensing of Genomic Inventions: 70 Fed. Reg. 18,413 (Apr. 11, 2005) (final notice).

ommendations of best practices, not legally binding regulations.[216] The Genomic Best Practices specify that:

> [w]henever possible, nonexclusive licensing should be pursued as a best practice. . . . In those cases where exclusive licensing is necessary to encourage research and development by private partners, best practices dictate that exclusive licenses should be appropriately tailored to ensure expeditious development of as many aspects of the technology as possible. Specific indications, fields of use, and territories should be limited to be commensurate with the abilities and commitment of licensees to bring the technology to market expeditiously.[217]

The Genomic Best Practices also recommend that license agreements "be written with development milestones and benchmarks to ensure that the technology is fully developed by the licensee . . . Best practices provide for modification or termination of licenses when progress toward commercialization is inadequate."[218]

In a recent survey of the nineteen U.S. academic institutions that have received the largest number of DNA patents, the researchers found that the institutions' licensing practices were largely in agreement with NIH's Research Tool Guidelines and Genomic Best Practices.[219] For example, universities prefer to enter into nonexclusive licensing arrangements with respect to most research tool DNA patents.[220] Some survey respondents also reported having difficulty determining whether or not an invention constituted a research tool.[221]

A coalition of some the most prestigious U.S. universities have recently published a document identifying and encouraging adoption of technology licensing guidelines designed to promote broad dissemination of and access to research tool inventions. The document, entitled "In the Public Interest: Nine Points to Consider in Licensing University Technology" (Nine Points Paper)[222] arose out of a 2006 meeting at which representa-

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216. *Id.* at 18,414 ("These recommendations are not intended to constitute additional regulations, guidelines, or conditions of award for any contract or grant . . . .").

217. *Id.* at 18,415.

218. *Id.*

219. Pressman, *supra* note 208, at 38-39.

220. *Id*. at 34, 38-39.

221. *Id.* at 34-35.

222. IN THE PUBLIC INTEREST: NINE POINTS TO CONSIDER IN LICENSING UNIVERSITY TECHNOLOGY (2007), *available at* http://news-service.stanford.edu/news/2007/march7/

tives of the universities gathered to discuss "societal, policy, legislative and other issues in university technology transfer."[223] The licensing principles and practices identified are designed to balance the business needs of universities with their broader mandate to serve society and the public interest. The Nine Points Paper states that many of the principles were already being implemented by universities, and encourages all universities and nonprofit research entities to strive to adopt similar policies.[224]

In particular, the Nine Points Paper encourages universities that license patented technologies to reserve rights, in all fields of use, for themselves and for other nonprofit and government organizations to practice inventions for research and educational purposes (including research sponsored by commercial entities), even in cases where the invention is licensed exclusively to a commercial entity.[225] It acknowledges that in some cases the grant of an exclusive license is appropriate, perhaps even necessary, when a significant investment of time and resources in the technology is needed in order to achieve its broad implementation. However, it urges universities to strive to grant only those rights that are necessary to encourage development of the technology.[226]

As an overarching principle, the Nine Points Paper stresses that exclusive licenses should always be structured in a manner that encourages technology development and use.[227] For example, in cases where substantial investment is required to develop a research tool into a commercial product, it might be appropriate for the university to grant an exclusive license for the sale, but not the use, of such products. In doing so, the university ensures its freedom to grant other nonexclusive licenses to use the patented technology.[228] The Nine Points Paper notes that, absent the need for significant investment, broad nonexclusive licensing of tools such as genomic and proteomics inventions can help maximize the benefits derived from those technologies, in part by removing obstacles to further innovation.[229] It also emphasizes that universities are expected to make research tools as broadly available as possible.[230] Finally, the Nine Points Paper recommends that licensing agreements include performance miles-

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gifs/whitepaper.pdf (white paper signed by 11 universities and the Association of American Medical Colleges).

223. *Id*. at 1.
224. *Id*.
225. *Id.* at 2.
226. *Id.*
227. *Id.*
228. *Id.*
229. *Id.* at 3.
230. *Id.* at 5.

tones to promote diligent development and broad dissemination of the licensed technology.[231]

The Wisconsin Alumni Research Foundation (WARF), a technology-licensing affiliate of the University of Wisconsin, has moved to improve access to its patents by researchers. WARF, although university-based, may act like a commercial entity in licensing its patented technologies. On January 23, 2007, WARF announced changes to its licensing policies that improve the terms of access for academic and nonprofit researchers.[232] WARF had been widely criticized for what many have characterized as overly restrictive licensing policies with respect to its broadly claimed human embryonic stem cell patents.[233] Under the new policies, researchers at academic and nonprofit institutions will not need a license to use WARF patented stem cells, even in private company-sponsored research.[234] However, this policy does not extend to any right to "develop and/or use [the human embryonic stem cells] for any therapeutic or commercial purpose, including the right to . . . perform services (including diagnostic services) for consideration, or for the production or manufacture of products for sale or distribution to third parties."[235] Therapeutic or commercial users of the cells are required to seek an additional license from WARF, the terms of which do not appear in WARF's announcement.[236] According to a statement by WARF Managing Director Carl E. Gulbrandsen, "WARF's stem cell policies have evolved over the years, always in favor of increasing access and making it easier for scientists to move the technology forward. These latest changes reflect an ongoing dialogue with researchers and university administrators across the country."[237]

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231. *Id.* at 3.

232. Joyce E. Cutler, *Wisconsin Research Foundation Amends Stem Cell Policies*, 73 PAT. TRADEMARK & COPYRIGHT J. (BNA) 368 (2007) (discussing changes announced in 2007 to ease licensing requirements for academic and nonprofit researchers); Press Release, Wisconsin Alumni Research Foundation [WARF], Wisconsin Alumni Research Foundation Changes Stem Cell Policies to Encourage Greater Academic, Industry Collaboration (Jan. 23, 2007), *available at* http://www.warf.org/news/news.jsp?news_id= 209.

233. *See* Thayer & De Liberty, *supra* note 71.

234. *See* Press Release, WARF, *supra* note 232.

235. WiCell Research Inst., Memorandum of Understanding—ESI Materials (July 2008), *available at* http://www.wicell.org/index.php?option=com_content&task=blogcategory&id=124&Itemid=190 (follow "ESI MOU & SLA (US and Non-US)" hyperlink) (form agreement).

236. WiCell and the National Stem Cell Bank—FAQs for Requesting Stem Cells, http://www.wicell.org/index.php?option=com_content&task=blogcategory&id=124&Itemid=190&limit=1&limitstart=1 (last visited Oct. 22, 2008).

237. Press Release, WARF, *supra* note 232.

Studies of industrial licensing practices in regard to patented research tools are not generally available, but are needed to provide a more complete assessment of the current licensing environment in regard to patents held by commercial entities and used as research tools. In part, such studies may be impeded by commercial desires to keep secret the terms of commercial licenses and the results of licensing negotiations.

The effects of these new patenting and licensing policies have yet to be evaluated. In particular, it remains to be seen how these policies will interact with the changes to the experimental-use and regulatory-approval exceptions and the social practices that have developed in regard thereto. Nevertheless, these policies are likely to ameliorate to some extent restrictions on access to patented technologies used in scientific research that may develop. In turn, implementation of these policies and their effectiveness in assuring access may be affected by broader changes to legal standards within the patent system.

VI. RECENT AND PROPOSED CHANGES TO THE PATENT SYSTEM THAT MAY AFFECT RESEARCH TOOL PATENTS AND USE OF RESEARCH TOOLS

Since the turn of the century, government agencies, nonprofit institutions, bar associations, and academic commentators have expressed concern about the state of the U.S. patent system, and have offered various suggestions for judicial and legislative reform.[238] These concerns have addressed, among other things: the administrative processes and legal standards for granting patents (resulting in patents that arguably should not have been issued and that are subsequently protected by a statutory presumption of validity interpreted to impose a heightened evidentiary burden of proof)[239]; and expansion of patent rights and remedies (resulting in routine grants of injunctions that provide excessive negotiating leverage and excessive damage awards compared to the inventive contribution of the patented invention to the infringing product).[240] These concerns thus have

238. *See, e.g.*, FTC, TO PROMOTE INNOVATION, *supra* note 60; PATENT SYSTEM, *supra* note 64; AIPLA RESPONSE, *supra* note 67; Patent Law Academics' Positions on Patent Law Reform Issues (June 27, 2005) (submitted to the Subcommittee on Courts, the Internet, and Intellectual Property of the House Committee on the Judiciary, on file with author); Mark A. Lemley, Douglas Lichtman & Bhaven N. Sampat, *What to Do About Bad Patents*, REGULATION, Winter 2005, at 10.

239. *See* 35 U.S.C. § 282 (2000 & Supp. II 2002); Am. Hoist & Derrick Co. v. Sowa & Sons, Co., 725 F.2d 1350, 1359-60 (Fed. Cir. 1984).

240. *See, e.g.*, Mark A. Lemley & Philip J. Weiser, *Should Property or Liability Rules Govern Information?*, 85 TEX. L. REV. 783 (2007); Joshua D. Sarnoff, Bilcare,

led to proposals for judicial or legislative reforms of existing patent law doctrines.

Recent decisions and opinions of the Supreme Court, and (to a lesser extent) of the Federal Circuit and the U.S. Patent and Trademark Office (PTO), have responded to these concerns and have significantly changed the patent law landscape in the United States.[241] These decisions may affect the patentability of inventions contemplated for use as research tools and have the potential to significantly reduce concerns regarding access to patented technologies for use in research. Congress also is considering comprehensive legislation to reform the patent statute, and many provisions of the current draft legislation would have similar effects.[242] However, these legal changes also have the potential to induce unanticipated and adverse changes to patent holders' and scientific researchers' behaviors regarding the assertion of and attention to patent rights.

This Part describes specific judicial changes and proposals for legislative reform that the authors believe are most relevant to the issues presented by research tool patents. Some of these changes have raised the standards of patentability for research tools, and others have limited or may limit applicable remedies. These changes may help to reduce concerns over the potential for research tool patents to create barriers to access.[243] However, these changes are quite recent, and it will take some time to determine their full impact, as courts and the PTO apply the deci-

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KSR, *Presumptions of Validity, Preliminary Relief, and Obviousness in Patent Law,* 25 CARDOZO ARTS & ENT. L.J. 995 (2008).

241. *See, e.g.*, KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727 (2007) (altering the obviousness test); Lab. Corp. of Am. Holdings, Inc. v. Metabolite Labs., Inc., 548 U.S. 124, 126 (2006) (Breyer, J., dissenting) (arguing that dismissal was improvidently granted and discussing limits to patentable subject matter); eBay, Inc. v. MercExchange, L.L.C., 547 U.S. 388 (2006) (changing the presumption for injunctions in patent cases); *In re* Bilski, 545 F.3d 943, 954, 958-61 (Fed. Cir. 2008) (restricting patentable inventions to those meeting a "machine-or-transformation" test, finding "inadequate" the "useful, concrete, and tangible result" test, and declining to adopt a "technological arts" test); *In re* Fisher, 421 F.3d 1365, 1369-78 (Fed. Cir. 2005) (addressing the utility requirement); *Ex parte* Lundgren, 76 U.S.P.Q.2d (BNA) 1385, 1388 (B.P.A.I. 2004) (declining to recognize a "technological arts" requirement for patentable subject matter); Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility, 1300 OFF. GAZ. PAT. & TRADEMARK OFFICE 142 (Oct. 26, 2005), *available at* http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/guidelines101_20051026.pdf [hereinafter Interim Guidelines].

242. Patent Reform Act of 2007, H.R. 1908, 110th Cong. (2007); Patent Reform Act of 2007, S. 1145, 110th Cong. (2007).

243. *See, e.g.*, *Hearings*, *supra* note 58, at 10 (statement of Lawrence M. Sung, Law School Professor & Intellectual Property Law Program Director, University of Maryland School of Law).

sions to patents claiming genes and other research tools. Additional future changes to patent law doctrines also may affect patent holders' and scientific researchers' practices in unanticipated ways. Finally, there have been and will likely continue to be changes to patent claim scope and application requirements (e.g., written description and enablement requirements and literal and doctrine of equivalents infringement doctrines) that may affect the scope of such patents and whether any particular research uses infringe issued patents.[244]

A. The Utility Requirement of Section 101

In order to be patentable under section 101, an invention must be "new and useful," with the latter term interpreted to require some identified, practical use.[245] This doctrine, referred to as the utility requirement, has historically served to limit the patenting of at least some research tools, particularly those involving genetic sequences and other biomolecules. This is because the disclosed use to perform further research, which might identify more substantial uses or new materials with such uses, was not considered sufficient to warrant a patent. In order to satisfy the utility requirement, a patent application must show that an invention provides some immediate practical benefit to the public that does not require further research to identify or confirm.[246] The requirement is not satisfied by a showing of utility only discovered after the application was filed.[247]

In response to concerns that patents were being issued that claimed genetic sequences of unknown function or of unknown practical significance—e.g., the controversial patent applications for expressed sequence tags (ESTs), which essentially are fragments of expressed genes, filed by the NIH in the early 1990s—the PTO in 2001 issued revised Utility Examination Guidelines (Utility Guidelines).[248] The Utility Guidelines required patent applicants to articulate for their inventions a "specific and substantial utility that is credible."[249]

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244. *See, e.g.*, Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722 (2002) (applying doctrine of equivalents standards); *In re* Curtis, 354 F.3d 1347, 1355 (Fed. Cir. 2004) (applying enablement standards); Enzo Biochem, Inc. v. Gen-Probe Inc., 323 F.3d 956 (Fed. Cir. 2002) (applying written description standards).

245. 35 U.S.C. § 101 (2000); *see* Brenner v. Manson, 383 U.S. 519 (1966).

246. *See, e.g.*, U.S. PAT. & TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PRACTICE, § 2107.01(I)(C) (8th ed. Rev. 7 2008) (discussing "Research Tools").

247. *See*, e.g., *Fisher,* 421 F.3d at 1371.

248. Utility Examination Guidelines, 66 Fed. Reg. 1092 (Patent & Trademark Office Jan. 5, 2001).

249. *Id.* at 1098.

In 2005, in *In re Fisher*,[250] the Federal Circuit essentially affirmed the Utility Guidelines. The court held that claims directed to ESTs were unpatentable given that the functions of the underlying genes were unknown, that the only asserted uses for the ESTs at that stage were as research intermediates to isolate and experiment on the relevant genes, and that the asserted uses were only possibilities that any EST could achieve but which for these ESTs had not yet been used in the real world.[251] Further, following the Utility Guidelines, the court held that the status of an invention as a research tool is not dispositive; rather, the question is whether the invention has "a specifically identified substantial utility . . . [rather than an] asserted utility [that] requires further research to identify or reasonably confirm."[252]

The utility standard articulated by the PTO and approved in *Fisher* should preclude patents for many of the most criticized patents claiming genes, as well as for other biomedical discoveries lacking an established use beyond that as a pure research tool. In particular, this utility standard should bar patents on gene fragments or genetic sequences of unknown function or significance.

B. The Patentable Subject Matter Requirement of Section 101

The patentable subject matter doctrine, which limits the types of inventions that are patentable, also may be used in the future to restrict patenting of certain genetic and research tool inventions. The statutory language of section 101 defines the scope of inventions that are patentable in the United States as any new and useful "process, machine, manufacture, or composition of matter."[253] While the Supreme Court has interpreted this language broadly to potentially encompass any product or process that is "made by man,"[254] it has also stressed on numerous occasions that it does not extend to "laws of nature, physical phenomena, and abstract ideas."[255] Since 1981, when the Supreme Court last addressed patentable subject matter, the Federal Circuit dramatically altered the standard of patentability to allow protection of a wide range of new technologies and

250. Fisher, 421 F.3d at 1365.

251. *Id.* at 1373.

252. *Id.* at 1372.

253. 35 U.S.C. § 101 (2000).

254. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. Rep. No. 82-1979 at 5 (1952), and H.R. Rep. No. 82-1923 at 6 (1952)).

255. *Id.* (citing Parker v. Flook, 437 U.S. 584 (1978), and O'Reilly v. Morse, 56 U.S. 62, 112-21 (1854)); *see* Diamond v. Diehr, 450 U.S. 175, 185 (1981).

practices.[256] In turn, this change in law required the PTO to grant patents for such inventions, including many new genetic and biomedical inventions used in research.[257] However, the Federal Circuit as a whole recently began to pull back from its earlier, broadest extensions of patentable subject matter in the *In re Bilski* case, which addressed a method for managing commodity sales risks.[258] *Bilski* clearly restricts patents on abstract methods of calculation or electronic transformations of data that are not claimed with regard to particular "physical and tangible objects,"[259] and thus could be used in many kinds of research. *Bilski* also reiterates that "[p]henomena of nature" are themselves unpatentable and that an inventions incorporating such phenomena must involve more than "insignificant post solution activity" to become patentable.[260] This new emphasis could lead to further restrictions on some biotechnology patents, such as isolated and purified genetic sequences and diagnostic methods. It is also foreseeable that the Supreme Court will soon revisit the standards for patentable subject matter.

In 2006, the Supreme Court in *Laboratory Corp. of America Holdings, Inc. v. Metabolite Laboratories, Inc.* originally accepted and later dismissed without an opinion a case that raised significant questions regarding patentable subject matter.[261] The patent claim broadly recited a method for detecting a vitamin deficiency, involving the two steps of: (1) assaying a patient's body fluid for an amino acid; and (2) mentally correlating the knowledge of an elevated level of the amino acid to the existence of the vitamin deficiency.[262] Although the Court as a whole decided not to decide the case (likely because of a failure to plead section 101 and because the issue had not been adequately addressed below), three Justices would have decided the case and would have found the patent invalid under the exclusion for laws of nature, natural phenomena, and abstract ideas.[263] These Justices voiced strong reservations with respect to patents

256. *See, e.g.*, A. Samuel Oddi, *Assault on the Citadel: Judge Rich and Computer Related Inventions*, 39 HOUS. L. REV. 1033, 1040 (2002).

257. *See, e.g.*, Eileen M. Kane, *Splitting the Gene: DNA Patents and the Genetic Code*, 71 TENN. L. REV. 707, 741-47 (2004).

258. *See In re* Bilski, 545 F.3d 943, 949, 954 (Fed. Cir. 2008).

259. *Id.* at 962.

260. *Id.* at 951, 957 (quoting Gottschalk v. Benson, 409 U.S. 63, 67 (1972), and Diamond v. Diehr, 450 U.S. 175, 191-92 (1981)).

261. Lab. Corp. of Am. Holdings, Inc. v. Metabolite Labs., Inc., 548 U.S. 124 (2006).

262. *See, e.g.*, Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings., 370 F.3d 1354, 1358-64 (Fed. Cir. 2004).

263. *See* Lab. Corp. of Am. Holdings, Inc. v. Metabolite Labs., Inc., 548 U.S. at 126 (Breyer, J., dissenting).

broadly claiming biological correlations, and an eagerness to rein in, or even reverse, a trend in the lower courts towards an overly expansive definition of patentable subject matter. Further, they suggested constitutional concerns with such patents, implying that Congress lacks the power to authorize them.[264] If the Court is presented with another case raising patentable subject matter issues and in better condition for appellate review, the Court might decide it in a manner consistent with the views of the dissenting Justices.

If either the Federal Circuit or the Supreme Court further restricts what qualifies as patentable subject matter, the holdings may significantly affect the patentability of some genetic and research tool discoveries. Some genetic technology companies clearly recognized the potential for such a result in *Laboratory Corp.*, filing amicus briefs arguing that a decision could substantially affect genetic inventions, especially those involving "correlations." For example, as amicus Perlegen (a personalized medicine company patenting discoveries regarding genetic disease correlations) argued:

> Virtually every patent claim concerning a diagnostic method is based, explicitly or implicitly, on a correlation between a test result and a disease or medical condition. Thus, the repercussions for biotechnology, particularly diagnostics, if [the Court were to invalidate the claim at issue for encompassing unpatentable subject matter] would be staggering. Hundreds, if not thousands, of patents would at once be called into question.[265]

Similarly, amicus Affymetrix analogized the claim at issue to controversial patents on a breast cancer gene and to patents claiming SNPs, and urged the Court to invalidate the claim in a manner that would bar the patenting of what it characterized as "natural genetic phenomena."[266]

Less than two months after the Supreme Court dismissed *Laboratory Corp.*, a district court in an unreported order held in *Classen Immunotherapies, Inc. v. Biogen IDEC*, that various method claims were invalid for encompassing unpatentable natural phenomena.[267] Specifically, the claims recited methods for determining vaccination protocols, based on compar-

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264. *See id.*

265. Brief for Perlegen Sciences, Inc. & Mohr, Davidow Ventures as Amici Curiae Supporting Respondents, Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 548 U.S. 124 (2006), No. 04-607, 2006 WL 303908.

266. Brief for Affymetrix, Inc. & Professor John H. Barton Amici Curiae Supporting Petitioner, Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 548 U.S. at 126 (2006), No. 04-607, 2005 WL 3597814.

267. Classen Immunotherapies, Inc. v. Biogen IDEC, Memorandum Order, No. 04-2607 (D. Md. Aug. 16, 2006).

ing the incidence of immune disorders between two or more groups of subjects immunized under different schedules. The court characterized the claims as indirect attempts to patent the idea of a correlation between the vaccination schedules and chronic immune-mediated disorders. The decision was affirmed in late 2008 in a one-paragraph, unpublished opinion relying on the *Bilski* decision,[268] which may suggest the invalidity of many such correlation claims and may therefore reduce some of the concerns that have been voiced with regard to biomedical research tool patents.

C. The Nonobviousness Requirement

Section 103 of the U.S. patent statute imposes a patentability requirement of a nonobvious invention (or inventive step), which also might restrict the patenting of many research tool inventions. Specifically, section 103 denies patentability "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."[269] For many years, the Federal Circuit and its predecessor court employed a restrictive approach to proving obviousness, requiring "a teaching, suggestion, or motivation to combine known elements" of the claimed invention that were found in the prior art.[270]

However, the Supreme Court in *KSR International Co. v. Teleflex, Inc.* held that a more flexible approach should be applied to determining obviousness. The Court criticized the Federal Circuit's approach to determining whether there was "an apparent reason to combine" prior art elements of the claimed invention as "rigid,"[271] and noted four specific errors of the Federal Circuit's approach in the case (which addressed a combination of an electronic sensor with an adjustable automotive foot pedal assembly). These were: (1) looking only to the problem that the patentee was trying to solve; (2) assuming the persons having ordinary skill in the art will look only to prior art designed to solve the same problem; (3) concluding that an invention cannot be proved obvious "merely by showing that the combination of elements was 'obvious to try,'" at least when there is a design or market need and limited alternatives; and (4) seeking to prevent hind-

268. Classen Immunotherapies, Inc. v. Biogen IDEC, Nos. 2006-1634, 2006-1649 (Fed. Cir. Dec. 19, 2008), 2008 WL 5273107.

269. 35 USC § 103(a) (2000).

270. KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 1741 (2007) (citing *In re* Bergel, 292 F.2d 955, 956-57 (C.C.P.A. 1961)).

271. *Id.* at 1739, 1741.

sight bias by adopting "[r]igid preventative rules that deny factfinders recourse to common sense."[272]

Based on the *KSR International* decision, the PTO has adopted examination guidelines that provide many potentially expansive rationales for the PTO (and by extension courts) to find a claimed invention obvious.[273] These include:

> (A) Combining prior art elements according to known methods to yield predictable results; (B) Simple substitution of one known element for another to obtain predictable results; (C) Use of known technique to improve similar devices (methods, or products) in the same way; (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (E) "Obvious to try"—choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; [and] (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.[274]

These rationales may have a significant effect on the patenting of research tool inventions, particularly given that a market motivation for creating such tools may exist, there may be limited alternatives, and the need for such tools may make the solution obvious to try.

With specific relevance to gene patents and other biotechnology inventions that can be used as research tools, the Federal Circuit's 1995 decision in *In re Deuel*[275] (relied on by the Federal Circuit in its *KSR International* decision[276]) had been widely interpreted as creating an extremely high bar for the PTO and challengers to prove that claimed inventions are

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272. *Id.* at 1742-43 (quoting Teleflex, Inc. v. KSR International Co., 119 F. App'x. 282, 289 (Fed. Cir. 2005)); *see* Sarnoff, *supra* note 240 12, at 1032.

273. *See* Examination Guidelines for Determining Obviousness Under 35 U.S.C. § 103 in View of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.,* 72 Fed. Reg. 57526 (Patent & Trademark Office Oct. 10, 2007) [hereinafter Examination Guidelines for Determining Obviousness].

274. Examination Guidelines for Determining Obviousness, 72 Fed. Reg. at 57529.

275. 51 F.3d 1552 (Fed. Cir. 1995).

276. *See* Teleflex, Inc., 119 F. App'x. at 289 (quoting *Deuel,* 51 F.3d at 1559).

obvious.[277] The Federal Circuit in *Deuel* had relied on earlier precedent rejecting the "obvious to try" approach to proving obviousness[278] to reverse a PTO determination of obviousness of claimed isolated and purified DNA and complementary DNA sequences relating to human and bovine growth factors.[279] The Federal Circuit had found that the prior art references teaching a method of gene cloning and a partial amino acid sequence of a protein were not sufficient to prove obviousness, as "the PTO has not cited a reference teaching cDNA molecules, but instead has improperly rejected the claims based on the alleged obviousness of a method of making the molecules."[280] A dissenting opinion in *In re Fisher* (discussed above in regard to section 101) later argued that claims to isolated and purified genetic sequences (e.g., the ESTs at issue in *Fisher*) may not be sufficiently inventive to warrant patentability, but the *Deuel* precedent has precluded the PTO from rejecting such claims as obvious under section 103.[281]

The effects of *KSR* have yet to be felt or adequately assessed. However, since *KSR*, the PTO issued a decision in *Ex Parte Kubin*[282] that further calls into question the viability of the *Deuel* precedent. In *Kubin*, the PTO cited *KSR* and the obvious-to-try rationale in affirming a patent examiner's rejection of a claim reciting a genus of novel genetic sequences in light of prior art that was analogous to the prior art at issue in *Deuel*.[283] The decision is on appeal to the Federal Circuit. Depending on how the Federal Circuit decides the case, a post-*KSR/Kubin* obviousness test might preclude the patentability of many genetic inventions that were once considered patentable. In any event, what is obvious to a person skilled in the relevant art changes over time, as does the scope of the prior art, and the *Deuel* precedent may now be obsolete as applied to modern genetic discoveries.

In summary, the standards for utility, patentable subject matter, and nonobviousness have been changing in ways that may make it more difficult to obtain patents for genetic and other inventions that are likely to be used in scientific research. It is possible that such changes may lead to al-

277. *See, e.g.*, Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1178-81 (2002).

278. *In re* Deuel, 51 F.3d 1552, 1559 (citing *In re* O'Farrell, 853 F.2d 894, 903 (Fed. Cir. 1988)).

279. *See id.* at 1555, 1560.

280. *Id.* at 1557.

281. *See Fisher*, 421 F.3d at 1382.

282. *See Ex parte* Kubin, 83 U.S.P.Q.2d (BNA) 1410 (B.P.A.I. 2007).

283. *See id.* at 3-6.

ternative sources of funding to provide incentives for investment, invention, and disclosure of such new technologies. Similarly, as discussed below, changes to patent remedies may also affect the desire to patent and alternatives for funding research tools. If so, there may be corresponding changes to behaviors of the remaining patent holders regarding licensing and assertion of their patents against scientific researchers who use their technologies.

D. Injunctive Relief Under Section 283

The recent Supreme Court decision in *eBay, Inc. v. MercExchange, L.L.C.*,[284] and cases following *eBay* that deny injunctive relief to patent holders,[285] may help to alleviate concerns that patents on research tools will be used to restrict scientific research. Conversely, to the extent that denial of injunctive relief diminishes the commercial exclusivity of patent holders and reduces their revenue or their ability to bargain for higher licensing fees, *eBay* and its progeny may reduce incentives for the creation and patenting of research tools. Further, the denial of injunctive relief and the imposition of prospective compensatory damages in the form of ongoing royalty payments[286] may have a similar effect to the granting of a compulsory license on commercial terms determined by a judge through litigation. Because they directly affect commercial returns to patent holders, these changes to the available remedies for patent infringement also have the potential to change existing practices and working solutions.

Under section 283 of the Patent Act, district courts "may grant injunctions in accordance with the principles of equity."[287] Prior to *eBay*, Federal Circuit precedent essentially mandated that, after finding patents to be valid and infringed, trial courts permanently enjoin future infringements,

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284. 547 U.S. 388 (2006).

285. *See, e.g.*, Andrew Beckerman-Rodau, *The Aftermath of* eBay v. MercExchange, *126 S.Ct. 1837 (2006): A Review of Subsequent Judicial Decisions,* 89 J. PAT. & TRADEMARK OFF. SOC'Y 631 (2007) (discussing the holdings of post-*eBay* decisions on patent law injunctions); Posting of Joseph S. Miller to Fire of Genius, Injunctions, http://www.thefireofgenius.org/injunctions (last updated Dec. 31 2007) (providing a comprehensive list through Dec. 31, 2007 of decisions regarding preliminary and permanent injunctive relief in patent, copyright, and trademark law that apply the *eBay* approach).

286. *See, e.g.*, Paice LLC v. Toyota Motor Corp., 504 F.3d 1293, 1313-16 (Fed. Cir. 2007) (holding that ongoing royalty payments rather than injunctions may be appropriate, but vacating and remanding the ongoing royalty payment at issue).

287. 35 U.S.C. § 283 (2000).

at least absent "exceptional circumstances."[288] The Supreme Court in *eBay* rejected this strong presumption in favor of granting injunctions in patent cases, holding that nothing in the Patent Act suggested that patent law should depart from traditional principles of equity law, and thus a patent holder can only obtain a permanent injunction as a remedy for infringement if he or she can demonstrate: (1) that the patent holder suffered an irreparable injury due to the infringement; (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that irreparable injury; (3) that, considering the balance of hardships between the patent holder and the infringer, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction.[289] However, the two concurring opinions of seven of the Justices reflect very different views about when injunctions are likely to be found appropriate after finding infringement of a valid patent.[290]

Thus, after *eBay*, a trial court has substantially more discretion to deny an injunction—a decision that can only be reversed under the highly deferential "abuse of discretion" standard.[291] Denial of injunctions is more likely to occur in cases where the patented technology makes up a relatively small portion of the infringing product or process, where the patent holder is not practicing the invention, money damages and ongoing royalty payments are sufficient to compensate the patent holder, or an injunction might unduly injure the infringer and/or adversely affect public interests.[292] For example, the Federal Circuit in *Innogenetics N.V. v. Abbott Laboratories*[293] held that a trial court abused its discretion in granting an injunction against an infringer of a gene patent, given that the patent holder had requested and obtained a jury verdict that included or contemplated

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288. *See, e.g.*, Accumed LLC v. Stryker Corp., 483 F.3d 800, 811 (Fed. Cir. 2007) (recognizing that the Supreme Court in *eBay* "struck down" the Federal Circuit's general rule); MercExchange, L.L.C. v. eBay, Inc., 401 F.3d 1323, 1338 (Fed. Cir. 2005) (citing Federal Circuit precedents that established a "general rule . . . that a permanent injunction will issue once infringement and validity have been adjudged").

289. *eBay*, 547 U.S. at 391.

290. *Compare id.* at 394-95 (Roberts, J. concurring), *with id.* at 395 (Kennedy, J., concurring).

291. *Id.* at 391 (majority opinion).

292. *See, e.g.*, Beckerman-Rodau, *supra* note 285*,* at 653-57 (discussing some of these and other factors and noting that direct competition with the patent holder is the most significant predictive factor regarding whether a permanent injunction will issue); Andrew Beckerman-Rodau, *The Supreme Court Engages in Judicial Activism In Interpreting the Patent Law in eBay, Inc. v. MercExchange L.L.C.*, 10 TUL. J. TECH. & INTELL. PROP. 165, 201-02 (2007) (discussing the component product—or "complex invention"—concern) (citing *eBay,* 547 U.S. 388, 396-97 (Kennedy, J., concurring)).

293. 512 F.3d 1363 (Fed. Cir. 2008).

an ongoing royalty for continued use, and thus the patent holder could not be considered irreparably harmed by continued infringement.[294] The court remanded for further assessment of the terms of the ongoing royalty for continued access to the patented technology, which claimed methods of genotyping hepatitis C virus (which depending on the end use could be considered a research tool patent).[295]

In contrast, an injunction is more likely to issue if the patent holder is producing and selling the patented invention and if the infringer competes in the market for such sales. In such cases, courts may consider price erosion, loss of goodwill, potential reductions in workforce, and other factors which are difficult to quantify in terms of damages.[296] Such considerations are less likely to apply to research uses of patented inventions than to sales of inventions intended for use as research tools.

The Federal Circuit has yet to develop a clear understanding of the "public interest" consideration in granting or denying injunctive relief after *eBay*. For example, in the context of affirming a trial court's grant of a preliminary injunction, one panel of Federal Circuit judges recently held that the public interest factor is neutral in regard to the competing public interests in the benefits of lower prices (for printer and facsimile machine toner cartridges) from free competition and in enforcing patent rights.[297] Conversely, a different panel of Federal Circuit judges held that there was no abuse of discretion in a trial court holding that the public interest in acquiring lower cost pharmaceuticals (and potential deaths that would result if consumers did not purchase them) was outweighed by the public's interest in encouraging pharmaceutical research and development by enforcing patent rights.[298]

It is possible that a court would refuse to grant an injunction where a patented invention was used by an infringer as a research tool, particularly if the patent holder was engaged in a pattern of licensing its invention or if the research at issue was particularly important. As the 2004 NAS report suggested, injunctive relief "would rarely be an appropriate remedy in a research infringement case, because from these research uses there would rarely be ongoing commercial losses to the patent holder."[299] Further, as the Supreme Court noted in *eBay,* the trial court had focused on the patent

294. *Id.* at 1380-81.

295. *Id.*

296. *See, e.g.*, Sanofi-Synthelabo v. Apotex, Inc., 470 F.3d 1368, 1381-83 (Fed. Cir. 2006).

297. *See* Canon, Inc. v. GCC Int'l Ltd., 263 F. App'x. 57 (Fed. Cir. 2008).

298. *See Sanofi-Synthelabo*, 470 F.3d at 1383-84.

299. PATENT SYSTEM, *supra* note 64*,* at 116.

holder's willingness to license the technology and its failure to itself practice the invention.[300] However, the Court nevertheless cautioned that no broad, categorical rule could be adopted, and for certain patent holders such as universities a willingness to license might not weigh against issuing the injunction.[301]

In summary, the four-part equitable test is highly sensitive to the facts of each case and to the discretionary judgments of particular judges. This renders the potential for obtaining injunctive relief in regard to research tool uses of patented inventions highly uncertain. Nevertheless, it is clear that the potential to obtain an injunction has been reduced since *eBay*, and consequently that the threat that scientific researchers will be prohibited from continuing to conduct experiments (or forced to negotiate licenses prior to or after litigation at higher rates, given the threat or grant of an injunction) is correspondingly reduced. Additional studies are needed to assess the extent to which these changes will affect incentives to develop and patent research tools, as well as the ability of scientific researchers to acquire and their willingness to use patented technologies as research tools.

E. Potential Legislation Affecting Damages Remedies Under Section 284

The U.S. Congress is considering as part of comprehensive legislation to reform the U.S. Patent Act a provision that would alter the existing rules governing calculation of royalty damages for infringement of patent rights.[302] The proposed change to the law would respond to perceived excesses in jury damage awards that are based on calculating royalty rates with regard to the entire value of the infringing product, even though the patent holder's invention may represent only a fraction of the patented and unpatented technologies included in the infringing product.[303] For example, the proposed changes in the U.S. Senate would: (1) limit reliance on the "entire market value" rule for calculating the royalty base to cases where the patent holder's invention was the predominant basis for the market demand for the infringing product; (2) permit royalties to be based on similar, nonexclusive licenses if enough such licenses indicate that the royalty terms are reasonable; and (3) if neither (1) nor (2) apply, limit the royalty base to the portion of the economic value of the infringing inven-

300. *eBay*, 547 U.S. 388 at 392.

301. *Id.*

302. *See* Patent Reform Act of 2007, H.R. 1908, 110th Cong. (2007); Patent Reform Act of 2007, S. 1145, 110th Cong. (2007).

303. *See, e.g.*, S. Rep. No. 110-259, at 12 (2008).

tion attributable to the patented invention's contribution over the prior art (which for inventions consisting of novel combinations of prior art elements may consist of the additional function or enhanced value of the combination).[304]

Although it is difficult to predict whether such revisions will be enacted into law, they would clearly tend to limit recoverable royalty damages in regard to technologies incorporated into commercial products and to patents that are nonexclusively licensed. Thus, such changes could affect the damages recoverable for competing sales of research tool inventions (or products incorporating those inventions) for scientific research uses. Similarly, such changes could affect royalties recoverable for scientific uses of research tool inventions, as well as potential royalties for new products resulting from the research and incorporating the research tool (which therefore infringe the rights of making and of sale, as well as of use). Further, such changes could affect reach-through royalties that might be recoverable for scientific research uses of patented inventions to develop valuable information, products, or processes that do not infringe the patented invention. As with injunctive relief, reducing the potential scope of damage awards could affect incentives for investment in and invention and patenting of research tools, as well as willingness to use patented technologies in scientific research.

VII. ALTERNATIVES TO EXPERIMENTAL-USE AND REGULATORY-APPROVAL EXCEPTIONS TO INFRINGEMENT

The previous parts of this Article have discussed the historic development of the experimental-use exception and regulatory-approval exception, the effects of these legal developments on the practices of seeking patents on research tools and of using patented technologies for scientific research and commercial development, and responses taken by the government, academic institutions, and industry to assure that patents do not restrict access to the technologies or their use for scientific research and commercial development. This Part addresses existing and proposed legal and practical alternatives to these exceptions, which can help to assure access and continued use of patented technologies in scientific research and commercial development. These alternatives include: (1) compulsory licensing and functional equivalents thereto; (2) government licenses and march-in rights regarding federally funded inventions; (3) reach-through licensing agreements; (4) patent pools; (5) antitrust remedies; and (6) off-

304. *See id.* at 13-14.

shoring of research activities. Additional legal development and studies are needed to determine the extent to which such alternatives can be and will be used to assure access to patented inventions for use in scientific research.

A. Compulsory Licensing

Compulsory licensing provisions were considered for possible incorporation into the 1952 revision of the U.S. patent laws—the most recent comprehensive revision to and codification of U.S. Patent Act. However, these provisions were removed from draft legislation before the final bill was introduced.[305] Since then, "[c]ompulsory licensing of patents often has been proposed, but it has never been enacted on a broad scale."[306] As late as 2005, a bill was introduced in Congress that would have provided for compulsory licensing of certain patented inventions relating to health care emergencies, but the bill never became law.[307] The patent reform bills currently being considered by Congress include no compulsory licensing provisions.[308] As noted in a 2004 report of the NAS on the patent system, there is a prevalent hostility in industry and among patent holders generally to any form of compulsory licensing.[309]

Nevertheless, U.S. law does provide some limited forms of compulsory licensing of patented technologies. For example, the Clean Air Act provides for the compulsory licensing of patents on pollution control devices to those parties who cannot use substitutes to meet pollution control requirements imposed under the statute.[310] The existing compulsory licensing provisions, however, have little if any relevance to the use of patented research tools, particularly those used in the context of biomedical research.

Of greater relevance, use by the U.S. government of any and all patented inventions is fully authorized by statute (and is consistent with the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (the TRIPS Agreement), subject to the payment of adequate remuneration but taking into consideration any anti-

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305. *See* H. COMM. ON THE JUDICIARY, 81ST CONG., PROPOSED REVISION AND AMENDMENT OF THE PATENT LAWS 91 (Comm. Print 1950).

306. Dawson Chem. Co. v. Rohm & Haas Co., 448 U.S. 176, 215 & n.21 (1980).

307. Public Health Emergency Medicines Act, H.R. 4131, 109th Cong. (2005).

308. Patent Reform Act of 2007, H.R. 1908, 110th Cong. (2007); Patent Reform Act of 2007, S. 1145, 110th Cong. (2007).

309. *See* PATENT SYSTEM, supra note 64 at 115.

310. *See* 42 U.S.C. § 7608 (2000).

competitive practices).[311] Under 28 U.S.C. § 1498(a), a patent holder's sole legal remedy for an infringing manufacture, use or sale of a patented invention by the U.S. government—or by any person or entity working under the "authorization and consent" of the U.S. government (i.e., a government contractor)—is a legal claim for "reasonable compensation." This legal claim requires the patent holder to file a lawsuit against the U.S. Government in the U.S. Court of Claims to prove infringement (and where challenged to defend the validity of the patent). However, unlike a normal patent infringement lawsuit, the patent holder cannot obtain injunctive relief to prohibit continuing infringement by the government. (The patent holder may seek to prohibit a third-party's use by filing a lawsuit in a federal district court seeking an injunction, and the third party must prove authorization under section 1498 as an affirmative defense.)[312] Like ongoing royalty damages, section 1498 operates similarly to a compulsory license, particularly as the U.S. government might invoke its authorization on behalf of third parties.[313]

All of the research conducted by, and much of the research conducted for the U.S. government falls under the protection of section 1498(a).[314] The provision is often explicitly invoked on behalf of grantees or contractors to assure access to patented technologies.[315] The authors are unaware of any instance where section 1498(a) has been explicitly invoked to induce voluntary licensing of a patented research tool (although voluntary licensing of such tools may routinely occur given recognition that use without permission of the patent holder may be authorized by section 1498(a)). However, the government has on occasion explicitly threatened to invoke section 1498(a) in order to compel a patent holder to license its patent in rare cases where the patent is perceived to cover the only viable means to address a potential massive public health emergency.

311. *See* Agreement on Trade-Related Aspects of Intellectual Property Rights, art. 31, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, 33 I.L.M. 1197 (1994).

312. *See* Madey v. Duke Univ., 413 F. Supp. 2d 601, 607 (M.D.N.C. 2006).

313. BRIAN T. YEH, CONG. RESEARCH SERV., CRS REPORT NO. RL33159, INFLUENZA ANTIVIRAL DRUGS AND PATENT LAW ISSUES (2005).

314. As discussed below, use by the government and its contractors also may be authorized by a statutory license arising from the use of federal funds in the development of the invention, and the existence of such a license and its scope in regard to infringing activity may only be resolved in a suit seeking compensation under section 1498. *See Madey*, 413 F. Supp. 2d at 608. Conversely, use by state governments is immunized from compensatory liability by the 11th Amendment to the U.S. Constitution, but injunctive relief may still be available. *See* U.S. CONST., amend. XI; Fla. Prepaid Postsecondary Educ. Expense Bd. v. College Sav. Bank, 527 U.S. 627, 633-635 (1999).

315. *See Madey,* 413 F. Supp. 2d at 607-08.

Notable recent examples involved Roche's Tamiflu and Bayer's Ciprofloxacin, thought to be critical in responding to fears of an avian flu pandemic and an anthrax bioterrorism attack, respectively.[316] In both cases, the government was reportedly able to use the threat to gain significant concessions from patent holders without actually authorizing third-party production under section 1498(a).[317]

Given that legislative enactment of a broad experimental-use exception might not occur, the 2004 NAS report on the patent system recommended that the federal government consider assuming liability under the "authorization and consent" provision of section 1498(a) for the infringement of research tool patents by investigators whose work it supports under contracts, grants, and cooperative agreements.[318] However, the report noted that authorization under section 1498(a) has not often been extended to federal grantees in this context, and has never been formally extended by the NIH (although reportedly the DOE has exercised this option).[319] One member of the NAS committee issuing the 2004 report recommended that the government consider providing authorization under section 1498(a) for scientific research uses of patented inventions only in cases where access to research tool technologies is not resolved in the marketplace by licensing on reasonable terms, and predicted that in all likelihood the threat of its use would lead to a negotiated solution.[320] The report itself recommended that federal agencies include explicit authorization and consent "as a reasonable step that addresses the need to maintain research tool access."[321]

Similarly, an ongoing royalty damage award (which may be considered a compulsory license[322]) can be achieved in instances where a court declines to enter an injunction against a party found liable for infringing a research tool patent. As noted above, *eBay* has significantly expanded the

316. YEH, *supra* note 313; JOHN R. THOMAS, CONG. RESEARCH SERV., CRS REPORT RL32051, INTELLECTUAL PROPERTY ISSUES IN HOMELAND SECURITY (2007).

317. James P. Love, KNOWLEDGE ECOLOGY INT'L, *Recent Examples of the Use of Compulsory Licensing of Patents* (2007), *available at* http://www.keionline.org/ miscdocs/recent_cls.pdf.

318. *See* PATENT SYSTEM, supra note 64 at 115.

319. *Id.*

320. *Id.* at 117.

321. *Id*.

322. *Compare* Paice LLC v. Toyota Motor Corp., 504 F.3d 1293, 1313 n.13 (Fed. Cir. 2007) (distinguishing the two because there is no authorization for third party use other than by the parties to the lawsuit), *with id.* at 1316 (Rader, J., concurring) ("[C]alling a compulsory license an 'ongoing royalty' does not make it any less a compulsory license.").

courts' discretion to deny injunctions, and courts may in the future do so for research uses of patented inventions. In Genomic Best Practices, the NRC recommended that "[c]ourts should continue to decline to enjoin patent infringement in those extraordinary situations in which the restricted availability of genomic or proteomic inventions threatens the public health or sound medical practice."[323]

Given that compulsory licensing, and its functional equivalents of governmental authorization under section 1498(a) and refusals to enjoin continued infringement, can assure research uses of patented inventions, a number of academic commentators have proposed that the U.S. institute some form of compulsory licensing (or codify an experimental-use exception either providing for compensation to patent holders or specifically targeting certain types of research uses) so as to promote access to patented research tools in certain situations. For example, Rebecca Eisenberg has proposed a compulsory licensing regime that would deny "patent holders an injunctive remedy to prevent subsequent researchers from using their inventions to make further advances in the same field," but would allow the patent holder a reasonable royalty.[324]

In contrast, Katherine Strandburg has proposed that the research tool inventor be granted an initial period of a few years of complete exclusivity, after which the technology would be subject to compulsory licensing.[325] This proposal is designed to provide adequate compensation for the inventor while ensuring that the research tool is not withheld from other researchers for the entire length of the patent term.[326] Strandburg has predicted that the compulsory license provision would rarely be invoked, but would incentivize the patent holder to negotiate a voluntary license during the initial period of complete exclusivity.[327]

Janice Mueller has proposed a "liability rule" model that permits the non-consensual "development use" of research tools not readily available for licensing or purchase, while providing an ex post royalty payment to the patent owner that would be correlated to the commercial value of the new product developed from the non-consensual use.[328] This reach-through royalty approach seeks to approximate the true worth of the research tool to its user. According to Mueller, her proposal would ensure a

323. REAPING THE BENEFITS, *supra* note 69, at 146-47.

324. Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1075-77 (1989).

325. Strandburg, *supra* note 78, at 143-44.

326. *Id.* at 143-45.

327. *Id*. at 141-42.

328. Mueller, *supra* note 8, at 58.

royalty award of sufficient amount to maintain incentives for the development and patenting of new research tools, yet alleviate the access restrictions and up-front costs currently associated with acquisition and use of many proprietary research tools.

Rochelle Dreyfuss has proposed a plan pursuant to which a university or other nonprofit research institution that wanted to use patented material and cannot obtain a license from the patentee on reasonable terms could use the technology without permission if it were willing to sign a waiver of potential patent rights.[329] The waiver would require the institution to promptly publish the results of work conducted with the patented technology and to refrain from patenting discoveries made in the course of that work.[330] Richard Nelson has proposed a modification of the Dreyfuss waiver plan, which would allow the researchers to patent their work but would require them to agree to license on a nonexclusive basis for reasonable royalties.[331]

Jordan Karp has proposed a

> modified experimental use exception whereby an inventor is paid a "reasonable royalty" by those who experiment on her patented innovation. This type of scheme treats experimental use as a type of limited compulsory licensing. . . . Under this paradigm, the royalty payment required from the experimenter could be tied to the commercial success of any innovation resulting from the experimental activity on the patented invention. An experimenter would only have to compensate the patentee when the experimental activity actually resulted in a benefit to the experimenter (thus, allowing "pure" scientific research to continue unhindered).[332]

This proposal would effectively impose reach-through royalty licensing for research tool uses, which is a controversial approach.

David Parker has suggested that a statutory research exemption could undermine the value of patents covering basic research tools by rendering them essentially incapable of infringement.[333] Thus, Parker has proposed

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329. Rochelle C. Dreyfuss, *Protecting the Public Domain of Science: Has the Time for an Experimental Use Defense Arrived*, 46 ARIZ. L. REV. 457, 471-72 (2004).

330. *Id*. at 471.

331. Richard R. Nelson, *The Market Economy, and the Scientific Commons*, 33 RES. POL'Y 455, 467 (2004).

332. Jordan P. Karp, Note, *Experimental Use as Patent Infringement: The Impropriety of a Broad Exception*, 100 YALE L.J. 2169, 2188 (1991).

333. David L. Parker, *Patent Infringement Exemptions for Life Science Research*, 16 HOUS. J. INT'L L. 615, 659 (1994).

that "[i]f an exception for 'commercial' research and development is warranted," the approach should be

> based upon the concept of allowing the commercial use of a patented invention in research and development and only making this commercial research activity subject to infringement once a decision has been made to commercialize the fruits of that endeavor. Of course, if the activity results in a product or process within the scope of the patented technology, the end product or process itself would be actionable without regard to the underlying technology used in its development. In short, only the research activities would receive the 'limited- time' protection, not the end result of that research.[334]

At a recent Congressional hearing relating to the patenting of human genes, Lawrence Sung proposed that the U.S. establish a research use exception limited to basic, noncommercial research.[335] Under his proposal, academic researchers and institutions would be exempt from infringement liability for noncommercial research activities, with the caveat that the researchers and institutions must provide actual notice to the patent holder of the open and notorious use of the patented technology for basic research uses, and agree to dedicate the results of the research to the public.[336]

B. Government Rights to Inventions Patented Under the Bayh-Dole Act

As summarized in a 1998 report by the NIH Working Group on Research Tools:

> The Bayh-Dole Act ["Bayh-Dole"] provides the statutory basis and framework for federal technology transfer activities, including the patenting and licensing of federally funded inventions by recipient organizations. The Act permits recipients of federal grants and contracts to elect title to patentable "subject inventions" that arise with the use of federal funds. If recipients elect title, the Act requires them to file patent applications, seek commercialization opportunities, and report back to the funding agency on efforts to obtain utilization of their inventions. *The*

334. *Id*. at 659-60.

335. *Hearings*, *supra* note 58, at 10 (statement of Lawrence M. Sung, Law School Professor & Intellectual Property Law Program Director, University of Maryland School of Law).

336. *Id*. at 13-14.

> *Act also retains for the funding agency certain residual rights in subject invention.*[337]

Bayh-Dole has led to dramatic changes in the economic structure of research and norms of open science, as well as to increased patenting of basic research discoveries by federally funded academic research institutions.[338]

Under Bayh-Dole, for all inventions made in the course of federally funded research, the federal government retains "a non-exclusive, non-transferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world."[339] However, the NIH Working Group noted that while

> [t]his license gives the NIH, and any other agency of the Federal Government, the right to use any patented research tool arising in the course of federally-sponsored research without liability for patent infringement[, it] is not clear whether NIH's retained license [] allows NIH to authorize use of subject inventions by other recipients of NIH grants. Some agencies take the position that the activities of grantees are covered by the exemption, but NIH has considered it an open question.[340]

Bayh-Dole also provides that a federal agency engaged in research funding, such as NIH, can "march-in" and grant licenses to patented inventions arising out of funded research under certain specified circumstances, including when the agency determines that such action is necessary because the grantee has "not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention in such field of use," or when such "action is necessary to alleviate health or safety needs which are not reasonably satisfied by the" grantee.[341]

The NIH Working Group suggested that NIH might exercise the march-in right "on a case by case basis to improve access to particular research tools." However, the Working Group noted that "[i]n order to exercise march-in rights, the funding agency must comply with a lengthy ad-

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337. REPORT OF THE NATIONAL INSTITUTES OF HEALTH (NIH) WORKING GROUP ON RESEARCH TOOLS, App. D, http://www.nih.gov/news/researchtools/appendd.htm [hereinafter NIH RESEARCH TOOLS REPORT] (emphasis added).

338. *See generally* Arti K. Rai & Rebecca S. Eisenberg, *Bayh-Dole Reform and the Progress of Biomedicine,* 66 L. & CONTEMP. PROBS. 289 (2003).

339. 35 U.S.C. § 202(c)(4) (2000 & Supp. II 2002). .

340. NIH RESEARCH TOOLS REPORT, *supra* note 337.

341. 35 U.S.C. § 203(a) (2000 & Supp. II 2002).

ministrative process," and that "[e]ach particular case can be expected to be lengthy and uncertain." The NIH Working Group also noted that, because of this administrative burden the mechanism "does not lend itself to routine use."

The NIH has never asserted its march-in rights in the nearly twenty-eight (28) years since the Act was enacted. It has denied at least three (3) formal requests to exercise the right (none of which was brought with respect to a patented research tool), concluding that the patented technologies were being made reasonably available under the patent.[342] In denying the requests, NIH noted that it was concerned that exercising its march-in rights would act as a disincentive for investment in the development of commercial products based on inventions patented under Bayh-Dole. It has also stated that the march-in right is not intended to be used to compel patent holders to make patented technology available at lower prices, and that "manufacture, practice, and operation . . .[by the patent holder providing for] availability and use by the public" is sufficient to meet the standard.[343]

Absent a sharp departure from past practice or a legislative change, it seems unlikely that the NIH or other federal agencies will exercise their march-in rights with respect to a research tool patent absent some showing that the restrictive practices of the patent holders are precluding all access to the technology or substantially impairing the "health or safety needs" of the U.S. public. This would likely be a difficult showing to make. However, a witness at a recent Congressional hearing on gene patents strongly urged Congress to consider legislation that would encourage more active use of the march-in provision to promote accessibility to genetic diagnostic testing services. If Congress acts on this proposal it could perhaps open the door to the use of march-in rights more broadly with respect to patented research tools.

C. Reach Through Licensing Agreements

Under a reach-through licensing agreement ("RTLA"), the licensor receives a share of the profits generated by the ultimate commercial prod-

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342. *See, e.g.*, In the Case of Norvir® Manufactured by Abbott Laboratories, Inc. (Nat'l Insts. Health July 2, 2004), *available at* http://www.ott.nih.gov/policy/March-In-Norvir.pdf [hereinafter Norvir®]; In the Case of Xalatan® Manufactured by Pfizer, Inc. (Nat'l Insts. Health September 17, 2004), *available at* http://ott.od.nih.gov/policy/March-in-xalatan.pdf; DETERMINATION In the Case of PETITION OF CELLPRO, INC. (Nat'l Insts. Health August 1, 1997), *available at* http://www.nih.gov/news/pr/aug97/nihb-01.htm.

343. Norvir®, *supra* note 342, at 5; *see id.* at 5-6.

uct if and only if the research tool is used in the development of such a product.[344] However, RTLAs are controversial because they raise potential antitrust and patent misuse issues, given that the patent holder may require as a condition of use of the patented invention that the licensee provide compensation (at least in part) for uses or sales of unpatented aspects of the products developed with the patented invention.[345] The legal resolution may depend in part on the market power of the patent holder and the specific form of the licensing offer in conditioning access to the patented technology.[346] According to the 2003 FTC report on the patent system, some representatives of the biotechnology industry reported that RTLAs have been successfully employed to provide commercial researcher with access to patented research tools.[347] These representatives expressed the view that RTLAs can promote access to a wide range of research tools at low up-front cost, and facilitate risk-sharing between licensor and licensee. However, other panelists interviewed for the FTC report argued that RTLAs create anticommons problems, and might violate antitrust and patent misuse laws.[348]

D. Patent Pools

Patent pools involve "patents [from multiple patentees being] licensed in a package, either by one of the patent holders or by a new entity established for this purpose, usually to anyone willing to pay the associated royalties."[349] The Biotechnology Industry Organization (BIO), a leading trade association representing biotechnology companies, has stated that voluntary patent pools are "one of the most important potential solutions to concerns regarding overlapping patents."[350] Similarly, the PTO has released a report entitled "Patent Pools: A Solution to the Problem of Access and Biotechnology Patents?" which discusses the use of patent pools as a

344. *See, e.g.*, Thomas J. Kowalski & Christian M. Smolizza, *Reach-Through Licensing; a US Perspective, 6* J. COMMERCIAL BIOTECH. 349.

345. *See, e.g.*, *id.* at 349 n.1; Research Tool Guidelines, *supra* note 205 ("[I]mposing reach-through royalty terms as a condition of use of a research tool is inconsistent with this principle [of ensuring appropriate distribution of NIH-funded tools].").

346. *See, e.g.*, Zenith Radio Corp. v. Hazeltine Research, Inc., 395 U.S. 100, 139 (1969) ("While a licensee must pay if he uses the patent . . . he may insist upon paying only for use, and not on the basis of total sales"); Bayer AG v. Housey Pharms., Inc., 228 F. Supp. 2d 467, 470-71 (D. Del. 2002) (rejecting allegation that reach through licensing agreement constituted patent misuse where the licensee voluntarily agreed to the royalty provision).

347. FTC, TO PROMOTE INNOVATION, *supra* note 60, ch. 3, at 26-28.

348. *Id.*

349. Carl Shapiro, *supra* note 131, at 119-150.

350. FTC, TO PROMOTE INNOVATION, *supra* note 60, ch. 3, at 27.

means of fostering access to patented research tools.[351] The 2003 FTC report on the patent system notes that the "centralized management that the patent pools entails may help in avoiding the royalty stacking/complements problem that economists have suggested may develop when multiple patents are needed for follow-on activities, and each patentee independently determines its own royalty rates."[352]

Nevertheless, some have questioned whether high transaction costs might substantially limit the ability to form and the use of patent pools in the context of genetic inventions.[353] It has been noted that these technologies are fundamentally different from the electronics sector, in which patent pools are used more frequently because of the importance of standards and interoperability.[354] Further, the greater unpredictability of biotechnological inventions that may result in wider differences in valuation of patented technologies, and the potentially greater reliance of biotechnology companies on maximizing licensing revenues may reduce incentives for particular patent holders to join or to agree to standard licensing terms of patent pools.[355]

Nevertheless, various proposals have been put forward for creating specific research tool patent pools. For example, Affymetrix, a leading DNA microarray company, has been an outspoken advocate for the creation of gene patent pools.[356] A group of European scholars has published a series of articles discussing the potential use of patent pools to facilitate access to genetic technologies for use in diagnostic testing.[357] Merrill

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351. JEANNE CLARK ET AL., PATENT & TRADEMARK OFFICE, U.S. PATENT AND TRADEMARK OFFICE, PATENT POOLS: A SOLUTION TO THE PROBLEM OF ACCESS IN BIOTECHNOLOGY PATENTS? (2000), *available at* http://www.uspto.gov/web/offices/pac/dapp/opla/patentpool.pdf.

352. FTC, TO PROMOTE INNOVATION, *supra* note 60, ch. 3, at 42.

353. *See id.* ch. 3, at 28.

354. *Id*.

355. *Cf.* Ted J. Ebersole et al., *Patent Pools as a Solution to the Licensing Problems of Diagnostic Genetics*, 17 INTELL. PROP. & TECH. L.J. 6, 10 (2005) (discussing differences among the genomics industry that make it difficult to identify "essential patents").

356. Barbara Caulfield, Executive V.P. & Gen. Counsel, Affymetrix, Inc., Presentation at Personalized Medicine and Molecular Diagnostics Conference at Arizona State University (March 2, 2007), *available at* http://www.law.asu.edu/files/Centers_and_Programs/LST/Conferences_&_Events/caulfield.pdf (slide presentation).

357. Geetrui Van Overwalle et al., *Models for Facilitating Access to Patents on Genetic Inventions*, 7 NATURE REVIEWS: GENETICS 143 (2006); Brigit Verbeure et al., *Patent Pools and Diagnostic Testing*, 24 TRENDS IN BIOTECHNOLOGY 3 (2006) [hereinafter Verbeure, *Patent Pools*]; Brigit Verbeure et al., *Analyzing DNA Patents in Relation with Diagnostic Genetic Testing*, 14 EUR. J. HUM. GENETICS 1, 26-33 (2006); Esther van Zimmeren et al., *A Clearing House for Diagnostic Testing: The Solution to Ensure*

Goozner of the Center for Science in the Public Interest has proposed a patent pool for the California Institute of Regenerative Medicine and other funders of stem cell research.[358] Similar approaches could prove useful for biomedical research tools. However, to date patent pooling has not played a significant role in the biotechnology sector. The best known example of a biotechnology patent pool is probably the collection of patent rights cobbled together to provide freedom of operation to produce "Golden Rice" (a genetically engineered rice that produces β-carotene, the precursor to vitamin A, which give the rice grains a yellow hue).[359] Golden Rice is not considered a commercially relevant crop, and licenses under the pool were granted free of charge, essentially for humanitarian reasons.[360] There has also been an attempt to create a pool of patents relating to SARS research, but so far there appears to have been no report that this attempt has been consummated.[361]

E. Antitrust approaches

Some commentators, including Rochelle Dreyfuss, have argued that competition law should be invoked in certain circumstances to compel patent holders to make patented research tools available, particularly where the patent holder is effectively blocking downstream research on a biologic target of significant clinical importance, e.g., the BRCA breast cancer genes.[362] There is a long history in the United States of judicially imposed compulsory licenses to remedy antitrust violations or concerns, where patent holders exercise or seek to acquire monopoly market power or engage in other prohibited practices. There are also compulsory licenses imposed or agreed to in regard to administrative reviews (in the context of merger and acquisition reviews by the Federal Trade Commission, the U.S. agency that formulates and enforces much of the U.S. antitrust law and policy).[363]

Access to and Use of Patented Genetic Inventions?, 84 BULL. WORLD HEALTH ORG. 5, 337 (2006).

358. *See* Merill Goozner, *Innovation in Biomedicine: Can Stem Cell Research Lead the Way to Affordability?,* 3 PLOS MED. 126, 612 (2006).

359. Verbeure, *Patent Pools*, *supra* note 357.

360. *Id*.

361. *Id*.

362. Rochelle C. Dreyfuss, *Unique Works/Unique Challenges at the Intellectual Property/Competition Law Interface* (N.Y.U. L. & Econ. Research Paper Series, Working Paper No. 05-13, 2005), *available at* http://ssrn.com/abstract=763688.

363. JEROME H. REICHMAN, COMPULSORY LICENSING OF PATENTED INVENTIONS: COMPARING UNITED STATES LAW AND PRACTICE WITH OPTIONS UNDER THE TRIPS AGREEMENT (May 14, 2006), *available at* http://www.aals.org/documents/2006intprop/JeromeReichmanOutline.pdf (presented at AALS Mid-Year Workshop on Intellectual

The FTC (along with the U.S. Department of Justice (DOJ)) recently indicated that they are unlikely to impose compulsory licenses. Their view is that although unilateral refusals to license are permissible, conditional refusals will be reviewed for antitrust violations under a "rule of reason" analysis.[364] Nevertheless, the FTC and DOJ have shown some willingness in the merger context to require licensing of patented research tool technology in cases where the merger has the potential to decrease the number of firms researching in a particular area.[365] For example, when the large biotechnology companies Amgen and Immunex merged, the FTC required them to agree to license out some of their patented research tools relating to the development of drugs targeting interleukin-1.[366]

However, U.S. courts, while willing to impose compulsory licenses to remedy antitrust violations, have shown little if any inclination to apply the antitrust laws to compel access to research tools. For example, in *Digene Corporation v. Third Wave Technologies Inc.*,[367] a district court recently rejected allegations that a patent infringement plaintiff violated the Sherman Act[368] by monopolizing the market for human papilloma virus (HPV) testing.[369]

Federal Circuit and Supreme Court precedents effectively preclude using antitrust and misuse law to address unilateral refusals to license, as well as conditional refusals to license, so long as the conditions are within the scope of patent rights. This is true even when the patent holder is not actively exploiting the technology, or is even suppressing it. For example,

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Property, Vancouver, Canada, June 14-16, 2006); *see generally* JEROME H. REICHMAN & CATHERINE HASENZAHL, NON-VOLUNTARY LICENSING OF PATENTED INVENTIONS: HISTORICAL PERSPECTIVE, LEGAL FRAMEWORK UNDER TRIPS, AND AN OVERVIEW OF THE PRACTICE IN CANADA AND THE USA (2003), http://ictsd.net/downloads/2008/06/cs_reichman_hasenzahl.pdf.

364. *See* DOJ & FTC, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 15-32 (2007) (citing, *inter alia,* Image Technical Servs., Inc. v. Eastman Kodak Co., 125 F.3d 1195 (9th Cir. 1997), and *In re* Indep. Serv. Org. Antitrust Litig., 203 F.3d 1322 (Fed. Cir. 2000)).

365. *See* Dreyfuss, *supra* note 362, at 12.

366. Press Release, FTC, Resolving Anticompetitive Concerns, FTC Clears $16 Billion Acquisition of Immunex Corp. by Amgen Inc. (July 12, 2002), *available at* http://www.ftc.gov/opa/2002/07/amgen.shtm (reporting consent agreement requiring Amgen and Immunex to license intellectual property rights relating to IL-1 inhibitors in view of the potential therapeutic relevance of these drugs).

367. Digene Corp. v. Third Wave Techs., Inc., No. 07-0022, 2008 WL 450467 (W.D. Wis. 2008).

368. 15 U.S.C. § 2 (2000 & Supp. IV 2004).

369. *Digene,* 2008 WL 450467 at *8-*10.

in *Rite-Hite Corp. v. Kelley Co*.,[370] an en banc panel of the Federal Circuit held that "[t]here is no requirement in this country that a patentee make, use or sell its patented invention."[371] The *Rite-Hite* Court did suggest, however, the court might in some circumstances refuse to enjoin patent infringement in cases of non-use, in effect creating a compulsory license: "If a patentee's failure to practice a patented invention frustrates an important public need for the invention, a court need not enjoin infringement."[372] After *eBay*, courts have more discretion to act upon this suggestion.

The Federal Circuit held in *Monsanto Co. v. McFarling*[373] that its earlier decision in *Mallinkrodt, Inc. v. Medipart, Inc.*[374] established that in "the cases in which the [conditional licensing] restriction is reasonably within the patent grant, the patent misuse defense can never succeed," because such conditions cannot extend the patent right beyond the patent's scope.[375] Similarly, in *Virginia Panel Corp. v. Mac Panel Co.*[376] the Federal Circuit held that violation of the antitrust laws "requires more exacting proof than suffices to demonstrate patent misuse."[377] However, the continuing validity of any rule relying on *Mallinkrodt* and its progeny was recently called into question by the Supreme Court's decision in *Quanta Computer Inc. v. LG Electronics, Inc*.,[378] which arguably effectively overruled *Mallinkrodt*.[379] Finally, the Supreme Court recently held in *Verizon Communications Inc. v. Law Offices of Curtis v. Trinko, LLP*[380] that the right to refuse to deal is not unqualified, but that it has "been very cautious in recognizing [abuse of dominant position, essential facilities, or other] exceptions, because of the uncertain virtue of forced sharing and the difficulty of identifying and remedying anticompetitive conduct by a single firm."[381] This is in contrast with the European Union, where doctrines

370. 56 F.3d 1538 (Fed. Cir. 1995) (en banc).

371. *Id*. at 1547 (citing Cont'l Paper Bag Co. v. E. Paper Bag Co., 210 U.S. 405, 424-30 (1908)); *see also, e.g.,* Cygnus Therapeutics Sys. v. ALZA Corp, 92 F.3d 1153 (Fed. Cir. 1996).

372. *Rite-Hite*, 56 F.3d at 1547.

373. 363 F.3d 1336 (Fed. Cir. 2004).

374. 976 F.2d 700, 708 (Fed. Cir. 1992).

375. *Monsanto*, 363 F.3d at 1341.

376. 133 F.3d 860 (Fed. Cir. 1997).

377. *Id.* at 872.

378. 128 S.Ct. 2109, 2121-22 (2008); *see also* Transcript of Oral Argument, Quanta Computer, Inc. v. LG Elecs., Inc., 128 S.Ct. 2109 (2008) (No. 06-937), *available at* http://www.supremecourtus.gov/oral_ arguments/argument_transcripts/06-937.pdf.

379. *Cf.* LG Elec., Inc. v. Bizcom Elec., Inc., 453 F.3d 1364 (Fed. Cir. 2006).

380. 540 U.S. 398 (2004).

381. *Id.* at 408.

such as essential facilities and abuse of dominant position tend to hold greater sway.[382]

Absent a substantial shift in U.S. policy, it seems unlikely that antitrust law will play a significant role in compelling research tool patent holders to expand access to the patented technology. To the contrary, some have expressed the concern that antitrust laws could restrict the availability of certain private ordering approaches to deal with the effect of research tool patents, such as patent pools or licensing arrangements.[383]

F. Off-shoring Research

One commentator has argued that "current U.S. jurisprudence is forcing U.S. drug companies to outsource their early stage drug research" to other countries.[384] Indeed, U.S. patent law would allow many research tool patents to be avoided by off-shoring certain uses of research tools to other countries where the tool is not patented, where patent enforcement is more difficult, or where use of the research tool would be more likely to fall under an experimental or research use exception. In general, U.S. patent law only reaches activities performed within the United States, and the Supreme Court recently expressed its view that U.S. patent law should generally be interpreted in a manner that minimizes the impact of U.S. law on extra-territorial activities.[385] However, U.S. patent law does include certain exceptions to this general principle, some of which could be relevant with respect to the susceptibility of U.S. patents to avoidance by off-shoring of research activities.

For example, section 271(g) of the Patent Act[386] provides that, under certain circumstances, a party can be held liable for infringement based on the importation into the U.S., or use or sale in the U.S., of a product produced outside the country by a process covered by a U.S. patent. Thus, in some cases the extraterritorial use of patented research tool process could result in liability for infringement under section 271(g) if a physical product of the process is imported into the United States. An example might be a cell line created outside the United States by a process patented in the United States. However, a 2003 decision by the Federal Circuit makes clear that section 271(g) only applies to physical products, and does not apply to information generated by a patented process.[387] Thus, a U.S.

382. *Dreyfuss, supra* note 362 at 13.
383. FTC, TO PROMOTE INNOVATION, *supra* note 60, ch. 3, at 26-28.
384. Helm, *supra* note 93.
385. Microsoft Corp. v. AT&T Corp., 127 S.Ct. 1746, 1751 (2007).
386. 35 U.S.C. § 271(g) (2000).
387. Bayer AG v. Housey Pharms., 340 F.3d 1367 (Fed. Cir. 2003).

company should be free to off-shore certain research activities to avoid a U.S. patent, and then bring the resulting data and insights back into the United States for subsequent drug development activities.

Conversely, a U.S. firm might be liable for patent infringement under section 271(f)[388] for exporting a component of a patented research tool that is subsequently incorporated into the patented research tool extraterritorially. For example, export of a noninfringing DNA vector which is subsequently used to create a cell line that would infringe a U.S. patent might, under certain circumstances as limited by the language of the statute, be the basis for a finding of infringement under section 271(f). However, a recent Supreme Court decision, *Microsoft v. AT&T*, indicates that the export of information, or software, which is later incorporated extraterritorially into a research tool covered by a U.S. patent will not infringe under section 271(f), which requires at least the export of tangible embodiments of the information that are capable of being used in a claimed process or product.[389] In Microsoft, the Supreme Court held that section 271(f) was not applicable where computer software was first sent from the United States to a foreign computer manufacturer on a master disk, or by electronic transmission, and then copied by the foreign recipient for installation on computers made and sold abroad, since the copies, as "components" installed on the foreign made computers, were not supplied from the United States.[390]

In summary, to the extent that the failure to provide a broad experimental-use or regulatory-approval exception provides incentives for off-shoring of research using patented technologies, current law does not meaningfully restrict the ability to develop and import into the U.S. new products or processes that do not themselves infringe the claims of the patent. There is no current consensus on whether broader exceptions are desirable to prevent such off-shoring of research.

VIII. CONCLUSIONS

The law regarding the experimental-use and regulatory-approval exceptions to patent infringement has changed over time. In recent years, the Federal Circuit has narrowly construed the scope of the experimental-use exception in ways that largely preclude its application to patented research tools used in academic or commercial scientific research. In contrast, the Supreme Court and the Federal Circuit have construed the regulatory-

388. 35 U.S.C. § 271(f) (2000).
389. *See Microsoft*, 127 S.Ct. at 1746.
390. *Id*. at 1755-59.

approval exception broadly, and district courts have determined that the exception applies to at least some research tools and may soon determine that it applies to sales for research tool uses.

These legal developments have led to varied practical responses by academic and commercial scientists. Although the effects of the developments on access to patented technologies and on scientific research and development are uncertain, large-scale adverse effects have to date been avoided by adoption of working solutions to restrictions on access. These solutions include perceived widespread infringing activity and consequent forbearance from assertion of patents by patent holders. Nevertheless, the discontinuity between the law on the books and the law in practice continues to pose concerns that more serious problems of access may develop.

Further, the stability of the existing working solutions is uncertain, particularly in light of significant changes that are occurring to various patent law doctrines and to governmental, academic, and industrial licensing practices. The sensitivity of existing practices to these changes also is uncertain. Consequently, it is difficult to predict whether these changes, and possible consequential or extrinsic changes to patenting behaviors, funding for innovation, and patent holders' licensing behaviors, will alleviate or further exacerbate access problems regarding research uses of patented inventions. What is certain is that the issues of the scope of experimental-use and regulatory-approval exceptions, their application to research tools, practical responses and the social consequences of the rules and practices, and alternative legal and practical means for assuring access to patented inventions for research uses will remain a focus of concern and will continue to warrant careful scrutiny and empirical and theoretical analysis.